Příloha 1:

Porod a pánevní dno

MUDr. Zdeněk Rušavý

GPK FN Plzeň a Lékařská fakulta v Plzni, UK v Praze

Cílem výukového textu je seznámit studenty pregraduálního i postgraduálního studia s aktuálním pohledem na vliv porodu na statiku a integritu pánevního dna. První část dokumentu seznamuje s moderní funkční anatomií pánevního dna a patofyziologií sestupu pánevních orgánů. Následně je probírán vliv porodu ve smyslu poranění či poškození jednotlivých struktur a jsou nastíněny možnosti prevence porodního poranění pánevního dna.

1. Úvod

U naprosté většiny žen dojde při porodu k poranění struktur pánevního dna. Takové poranění může mít krátkodobé, ale i dlouhodobé následky. Bolesti v oblasti hráze či poruchy hojení poranění mohou bránit v řádné péči o nově narozené dítě a mít určité psychické následky. Dyspareunie, inkontinence moči či stolice a sestup pánevních orgánů mohou dotyčnou až vyřadit ze společenského života. Všechny tyto komplikace po porodu mají většinou společného jmenovatele; poranění pánevního dna.

Na první pohled patrné a zároveň také nejlépe poznatelné je poranění hráze. Poranění análního svěrače je v některých případech již hůře poznatelné, jeho ošetření je komplikovanější a následky závažnější. Poranění svalů pánevního dna, tedy komplexu musculus levator ani po porodu je naopak velmi obtížně poznatelné a prakticky neošetřitelné. U zhruba jedné poloviny žen dojde k významnému poškození funkce m. puborectalis, mediální součásti m. levator ani [1]. Svaly pánevního dna, zejména m. puborectalis, které utváří urogenitální hiátus mají stěžejní význam pro podporu pánevních orgánů a zabezpečení močové a anální kontinence. Integrita musculus levator ani má velký význam v patogenezi prolapsu a úspěšnosti jeho konzervativní i operační léčby [2].

Musculus levator ani je evolučně přeměněný kývač ocasu zvířat, jenž v souvislosti se vzpřímeným postavením člověka dostal velice obtížnou úlohu. Na jedné straně musí udržet břišní a pánevní orgány v břišní dutině navzdory gravitaci a rozdílu v intraabdominálním a atmosférickém tlaku. Na druhé straně musí umožnit kontrolované vyprazdňování tekutých i tuhých odpadních produktů z těla. Aby toho nebylo málo, musí ještě umožnit reprodukci, tj. pohlavní styk a porod. Porod je opravdovou výzvou pro pánevní dno vzhledem k velikosti hlavičky a v některých případech má trvalé následky. Tato práce si klade za cíl přehledně popsat vliv porodu na pánevní dno, zejména s ohledem na patogenezi prolapsu pánevních orgánů.

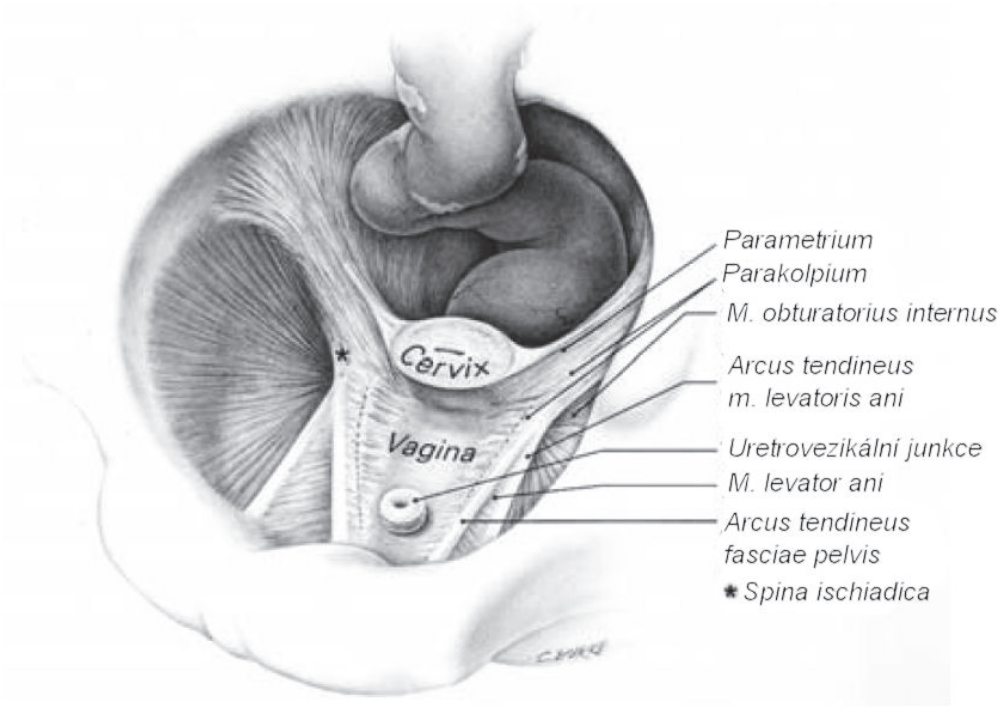
2. Základy funkční anatomie pánevního dna

Pánevní dno je soubor struktur mezi pánevním peritoneem a kůží vulvy, které uzavírají břišní dutinu. Podporu pro tyto struktury poskytuje jejich spojení ke kostěné pánvi vazy a svaly, které jsou uspořádané ve dvou vrstvách, tedy pánevní svaly (diaphragma pelvis) a perineální membrána (diaphragma urogenitale).

2.1. Endopelvická fascie - vazivová komponenta

Endopelvická vascie, která spojuje pánevní orgány s pánevní stěnou, tvoří horní vrstvu pánevního dna. Jedná se o soubor vazivových struktur, na které jsou pánevní orgány zavěšeny (Obrázek 1). Je tvořena parametrii od uterinní arterie distálně (uterosakrálními a kardinálními ligamenty) a parakolpiem horní třetiny pochvy.

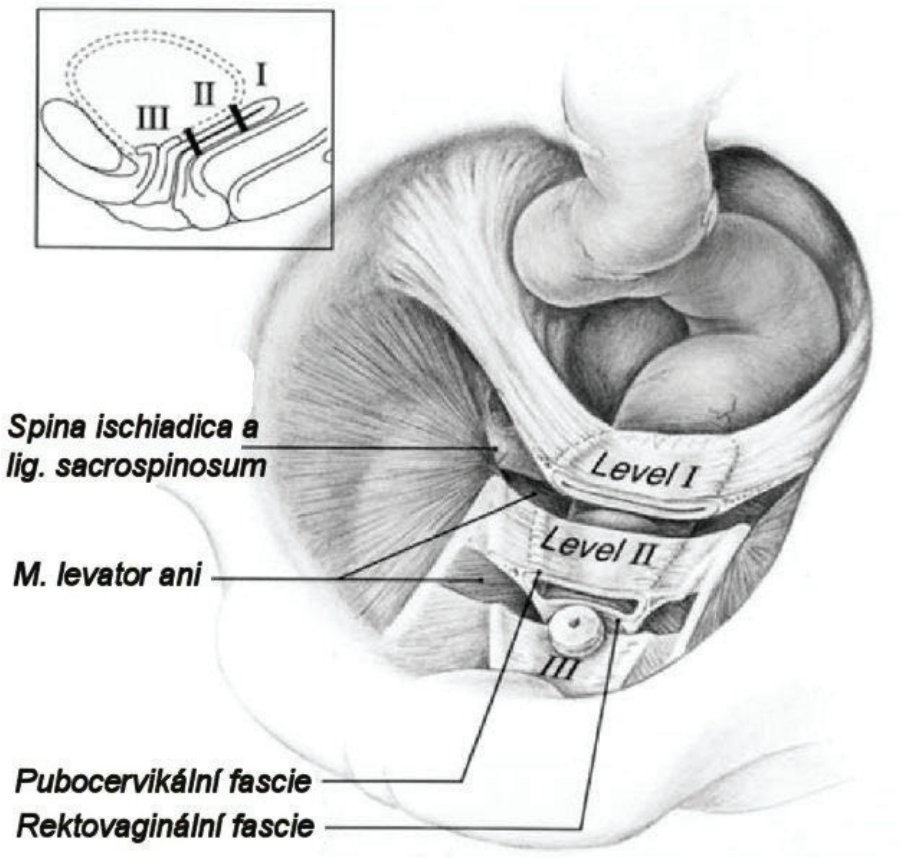
Obrázek 1: Endopelvická fascie: *[3] se svolením*



Kardinální ligamenta nejsou vazy v pravém smyslu, v této struktuře k děloze přistupují cévy, nervy a pojivová tkáň. Histopatologické studie uterosakrálních a kardinálních ligament u žen bez prolapsu pánevních orgánů ukázaly, že jsou složením srovnatelné s viscerálním mezenteriem [4]. Uterosakrální ligamenta vytvářejí typický hřeben ohraničující cavum Douglasi a jejich vzhled je zcela odlišný v případě prolapsu dělohy, což však demonstruje

jejich podpůrnou roli. Přestože tradičně byla těmto vazům připisována klíčová role v podpoře všech pánevních orgánů, DeLancey prokázal, že poloha a funkce orgánů malé pánve je udržována rovněž kotvícími a podpůrnými strukturami v parakolpiu organizovanými na třech úrovních [3] (Obrázek 2).

Obrázek 2: Tři úrovně závěsu pochvy [3] se svolením



2.1.1 Level I.

První úroveň je tvořena vazivovými vlákny z endopelvické fascie, tedy zčásti distálními parametrii a ligamenty zmíněnými výše a zčásti vazivovými vlákny na kterých je zavěšena horní třetina pochvy. Defekty vznikající na této úrovni vedou k sestupu dělohy, nebo vrcholu poševního pahýlu.

2.1.2. Level II.

Druhá třetina pochvy je přichycena k pubocervikální a rektovaginální fascii. Tyto fascie jsou připojené po stranách k arcus tendineus fasciae pelvis a udržují pochvu na svém místě. Fascie brání sestupům poševních stěn a s tím spojené poruše vyprazdňování močového

měchýře a konečníku. Arcus tendineus fasciae pelvis je pruh vazivové tkáně který inzeruje v dolní šestině os pubis přibližně jeden centimetr laterálně od střední čáry a upíná se na os ischium právě nad spinu ossis ischii. V případě defektu v druhé etáži podpory pochvy dochází k sestupu či prolapsu předního (cystokéla), či zadního kompartmentu (rektokéla, enterokéla).

2.1.3 Level III.

V distální třetině pochva přímo splývá s okolními strukturami bez přítomnosti parakolpia. Anteriorně splývá s uretrou, posteriorně s hrází a laterálně s musculi levator ani. Pochva je v této části imobilní, její zakotvení a svaly perineální membrány uzavírají její vchod. Defekt třetí etáže predisponuje k vaginální everzi.

2.2 Diaphragma pelvis - svalová komponenta

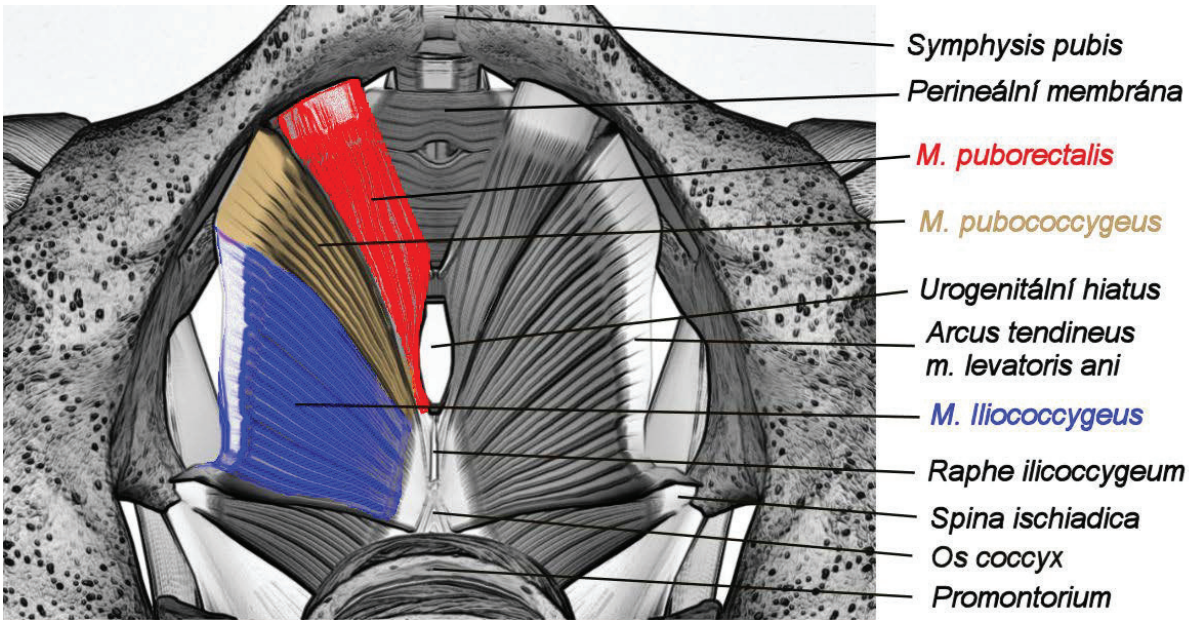
Z pozorování pohyblivosti kloubů tanečníků, nebo protahování šlach běžců je patrné, že pokud je pojivová tkáň vystavována pravidelně, či konstantně napětí, dojde k jejímu protažení. Vzhledem k tomu, že je pánevní dno trvale vystaveno nitrobřišnímu tlaku, kdyby bylo tvořeno pouze vazy, došlo by k jejich protažení a poruše jejich funkce pánevního dna. K protažení vazů nedochází díky pánevním svalům, které nesou tíhu břišních a pánevních orgánů. Svaly tedy ulevují vazům, které nejsou v trvalém tahu. Diaphragma pelvis je tvořena komplexem musculus levator ani a fascia musculi levatoris ani superior a fascia musculi levatoris inferior. Vzhledem k mnohým neshodám v anatomii diaphragma pelvis byla vypracována mezinárodní standardizovaná terminologie rozdělení, začátků a úponů svalů komplexu musculus levator ani [5]. Musculus levator ani sestává z 3 hlavních komponent:

1/ musculus ileococcygeus, horizontálně uložený plochý sval, který překlenuje mezeru mezi pánevními stěnami a vytváří "polici", na které mohou orgány malé pánve ležet. Začíná v arcus tendineus musculi levatoris ani a upíná se do raphe iliococcygeum, který je připojen ke kostrči a kosti křížové.

2/ Musculus pubococcygeus (také zvaný m. pubovisceralis) je silný sval tvaru U, který přitahuje pánevní orgány k pubické kosti.

3/ Musculus puborectalis je uložen laterálně od m. pubococcygeus, zažíná z horního okraje perineální membrány a vytváří smyčku za rektem hned nad externím análním sfinkterem.

Obrázek 3: Diaphragma pelvis



Otvor ohraničený m. levator ani se nazývá urogenitální hiatus. Normální tonus komplexu svalů musculus levator ani udržuje hiátus uzavřený, přitlačuje pochvu, uretru i konečník k pubické kosti a zdvihá pánevní orgány kraniálně. Konstantní tonus pánevních svalů utváří pevnou horizontálně uloženou plotnu, která brání pánevním orgánům v jejich sestupu a zajišťuje jejich správnou funkci. Dělohu je tedy možné si představit jako "plující orgán" [6] a funkční anatomické vztahy pochvy bývají připodobňovány k lodi v doku (viz podkapitola 3.2)

2.3 Inervace pánevního dna

Pro správnou funkci diaphragma pelvis je nutné, aby byly tyto svaly trvale tonizovány, tedy inervovány. Za inervaci pánevního dna ve vztahu k prolapsu pánevních orgánů jsou zodpovědné zejména dva nervy. Nervus musculi levatoris ani, který odstupuje ze sakrálního plexu na úrovni míšních kořenů S3-S5, běží po ventrální straně diaphragma pelvis a inervuje všechny svaly z komplexu m. levator ani [7,8] Nervus pudendus, který vychází ze sakrálního plexu na úrovni míšních kořenů S2-S4 a běží v Alcockově kanálu kaudálně od musculus levator ani, inervuje svěrače uretry a rekta svaly hráze. Svaly m. levator ani mají často dvojí somatickou inervaci od obou těchto nervů [7].

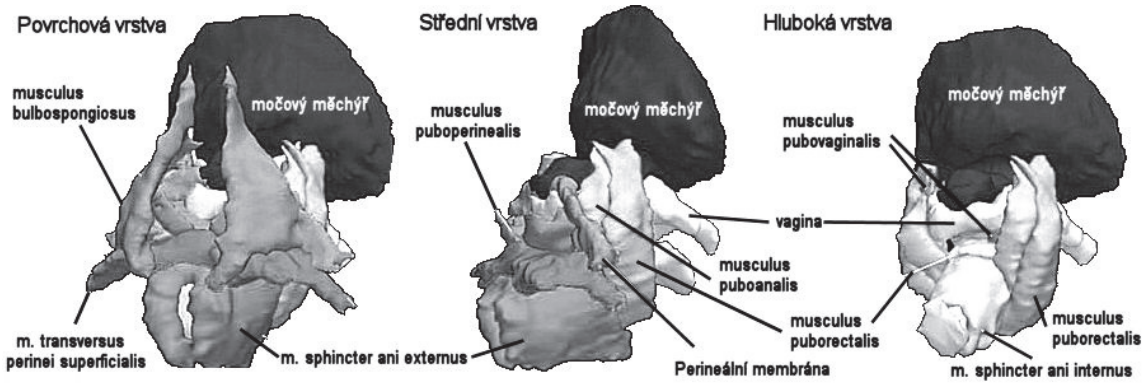
2.4 Perineální membrána

Přední část pánevního východu je přepažena pevnou trojúhelníkovou membránou s centrálním otvorem, která se nazývá perineální membrána. Tato struktura leží na úrovni hymen a připojuje uretru pochvu a centrum perineale k dolnímu raménku os pubis. Ventrálně od ní se nachází musculus sphincter urethrae, musculus compressor urethrae, musculus sphincter urethrovaginalis a musculus tranversus perinei profundus. Termín perineální membrána nahradil termín diaphragma urogenitale, vzhledem k tomu, že se nejedná o svalovou plotnu ohraničenou vazivem, ale spíše pojivovou tkáň s variabilně rozmístěnými svalovými vlákny [9]. Spojení vláken perineální membrány s centrum perineale vytváří vrstvu, která brání sestupu rekta. Perineální membrána je dále retropubicky spojena s endopelvickou fascií.

2.5 Svaly hráze

Jednotlivá svalová vlákna v perineu někdy tvoří svalové snopce, které se sbíhají do středu perinea - centrum perineale (perineal body). Anatomie svalů hráze je velice komplikovaná, nejednotná a nekonstantní. Studiem ultratenkých řezů magnetické rezonance bylo zjištěno, že jsou tyto svaly jsou uspořádané do 3 vrstev; povrchové, střední a hluboké [10] (Obrázek 4). Povrchová vrstva na úrovni bulbus vestibuli je tvořena svaly musculus bulbospongiosus, který zde inzeruje do laterálních okrajů perineálního centra, musculus transversus perinei superficialis a musculus sphincter ani externus, které procházení napříč centrum perineale. Ve střední vrstvě, při horním okraji musculus transversus perinei superficialis, přistupuje k laterálním okrajům centrum perineale musculus puboperinealis (součást musculus pubococcygeus, tedy komplexu m. levator ani), u některých jedinců jeho snopce překračují střední čáru. V této vrstvě se rovněž nachází distální část vnitřního análního svěrače a musculus puboanalis, který inzeruje mezi vnitřní a zevní anální svěrač. Hluboká vrstva perinea je na úrovni středního průběhu uretry a musculus puborectalis. Do této vrstvy ještě zasahují musculus puboanalis a musculus sphincter ani internus. Musculus pubovaginalis zde splývá se stěnou pochvy a podél ní vysílá vlákna dorzálně k centrum perineale. Musculus puborectalis (část diaphragma pelvis) utváří smyčku za rektem, ale není spojen žádnými vlákny s centrum perineale [10].

Obrázek 4. Jednotlivé vrstvy svalů hráze dle [10]



3. Prolaps pánevních orgánů

Prolaps pánevních orgánů představuje častý problém žen s významným dopadem na kvalitu života. Jedná se o sestup dělohy, stěn pochvy, či poševního pahýlu ve směru porodního kanálu. Symptomy jako boule v pochvě, výhřez pochvy, tlak v pánvi, dysfunkce močového měchýře, střev, či sexuální problémy jsou často s prolapsem spojeny a mohou způsobit až vyřazení ženy ze společenského života. Je všeobecně uznáváno, že přestože u 50% žen se vyvine sestup, jen 10-20% z nich přijde k vyšetření. Prevalence prolapsu je udávána ve velice širokém rozmezí. Sestup pánevních orgánů nižšího stadia je velice často asymptomatický. Výhřez předního kompartmentu je nečastější, dvakrát častější než zadního a třikrát častější než středního kompartmentu [11]. Nejvyšší incidence prolapsu je mezi 70 a 79 lety, byť incidence je relativně vysoká i u mladších žen. Vzácně se může prolaps vyvinout i u mladších nerodivších žen, nejspíše vlivem zhoršené kvality kolagenu, či jinou vrozenou poruchou podpůrných tkání. Kazuistiky rovněž popisují vznik prolapsu pánevních orgánů u novorozených dívek a v průběhu těhotenství.

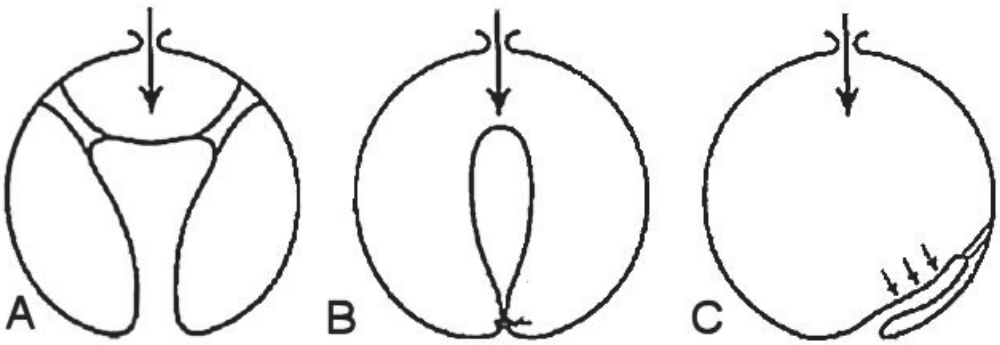
Z etiologického hlediska je prolaps pánevních orgánů nejčastěji výsledkem selhání svalové a vazivové podpory malé pánve. K tomuto selhání může dojít dvěma různými způsoby; degenerativními a destruktivními procesy. Vlivem degenerativních procesů jsou s věkem svalová vlákna postupně nahrazována za vazivové. Menopauza s deficitem estrogenů ještě potencuje oslabení podpůrných tkání. Závěsný aparát dělohy a pochvy a celé pánevní dno může být také destruováno vlivem porodního poranění či operace. Po hysterektomii dojde k prolapsu poševního pahýlu u 6-12% žen. Rovněž chronické namáhání pánevního dna,

například chronická zácpa, či časté tlačením na stolici při zácpě má negativní vliv na správnou funkci pánevního dna. Byť je etiologie prolapsu pánevních orgánů multifaktoriální, mezi nejvýznamnější rizikové faktory patří těhotenství a porod.

3.1 Patofyziologie prolapsu pánevních orgánů

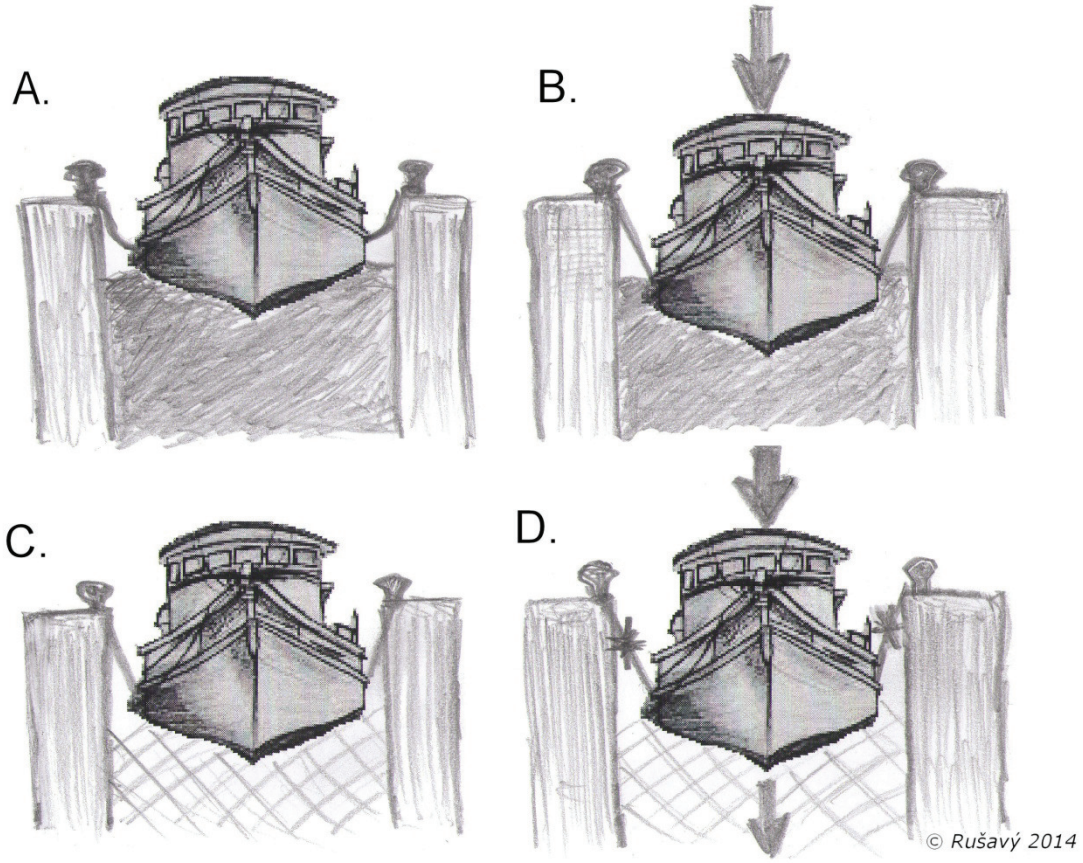
Pro patofyziologii prolapsu má největší význam nitrobřišní tlak, respektive rozdíl mezi okolním atmosférickým a nitrobřišním tlakem. Byly popsány tři mechanizmy, které zajišťují, aby u zdravé ženy zvýšení nitrobřišního tlaku nevedlo k everzi pochvy a výhřezu pánevních orgánů: A. Děloha a pochva jsou zavěšeny k pánevní stěně cestou endopelvické fascie. B. Svaly pánevního dna uzavírají prostor skrz který by mohlo k výhřezu dojít. C. Třetí mechanismus, tzv. mechanismus "klapky", vyplývá z předchozích dvou. Pochva je tak zavěšena, že spočívá na pánevním dně. Vzestup v nitrobřišním tlaku způsobí přitlačení pochvy k pánevní stěně a ještě upevní její pozici [12] (Obrázek 5).

Obrázek 5: Mechanismy bránící výhřezu pánevních orgánů: dle [12]



Z výše uvedeného je tedy patrné, že pro správnou polohu orgánů v malé pánvi je důležitá souhra mezi svalovou a vazivovou složkou pánevního dna. Přestože endopelvická fascie udrží krátkodobě orgány malé pánve na svém místě, při dlouhodobém namáhání dojde k nevratnému protažení pojivové tkáně, což vede k prolapsu pánevních orgánů. Podpora pochvy a pánevních orgány byla připodobněna k lodi v doku, plující po hladině a přivázána volně na obou stranách lany ke břehu [6,13] (Obrázek 6).

Obrázek 6. Kotvící loď a prolaps pánevních orgánů



Lana (ligamenta) udržují loď (pánevní orgány a pochvu) ve správné pozici, zatímco celá její váha spočívá na vodě (svaly pánevního dna) (Obrázek 6 - A). Vazy nepřistupují k děloze pod tahem, proto v případě zvýšení nitrobřišního tlaku jsou ligamenta napnuta, ale nejsou extrémně protažena a nedojde k jejich poškození (Obrázek 6 - B). Poškození svalové složky pánevního dna je možné přirovnat k poklesu hladiny či poklesu hustoty vody. Kdyby hladina vody poklesla do takové míry, že by lana musely nést celou váhu lodě, všechna by popraskala. Podobně jsou vystavena ligamenta extrémním silám, které vedou k jejich nevratnému poškození a při zvýšení nitrobřišního tlaku k prolapsu dělohy (Obrázek 6 - C, D)

Síla svalů pánevního dna určuje velikost urogenitálního hiátu, což je vůbec nejvýznamnější faktor zodpovědný za vznik a progresi prolapsu pánevních orgánů. Při uzavřeném urogenitálním hiátu jsou tlaky v předním a zadním kompartmentu vyrovnané. Pokud je ale hiatus rozšířený či otevřený, rovnováha je porušena. Rozdíl nitrobřišního a atmosferického

tlaku v pochvě působí tahem na pánevní orgány. Při svém sestupu je pochva vystavena atmosferickému tlaku. Exponovaná pochva a rozdíl tlaků vede k tahu za dělohu směrem dolů, který je přenášen na vazy endopelvické fascie. Bylo změřeno, že čím více pochvy je exponováno tím je větší tah za kardinální a sakrouterinní ligamenta [14]. Velikost urogenitálního hiátu je navíc přímo úměrná velikosti plochy exponované pochvy [15]. Tedy čím více je musculus levator ani oslaben, tím větší je plocha urogenitálního hiatu. Čím je větší plocha urogenitálního hiatu, tím více pochvy je exponováno atmosférickému tlaku a čím více pochvy je vystaveno atmosférickému tlaku tím větší síly jsou generovány při změně nitrobřišního tlaku. Tedy tím větší tah je vyvíjen na vazy endopelvické fascie při změnách nitrobřišního tlaku.

4. Porod a pánevní dno

Byť je etiologie prolapsu pánevních orgánů multifaktoriální, mezi nejvýznamnější rizikové faktory patří těhotenství a porod. Největší riziko poranění pánevního dna je spojováno s protrahovaným a obtížným, popř. operativním, porodem. Po prvním vaginálním porodu stoupá riziko prolapsu čtyřnásobně a po více než 4 porodech je riziko sestupu pánevních orgánů 11násobné [16]. Dle švédského registru je prevalence symptomatického sestupu 20 let po vaginálním porodu více než dvojnásobná oproti porodu císařským řezem (14,6 vs. 6,3%). Ženy, které porodily vaginálně, měly více než trojnásobné riziko kombinace symptomatického sestupu a močové inkontinence [17]. Porod způsobuje sestup pánevních orgánů dvěma mechanismy; jednak mechanickým postižením, poraněním, či přetržením podpůrných struktur a jednak postižením nervových struktur, které v konečném důsledku vede rovněž k oslabení svalstva pánevního dna.

4.1 Postižení podpůrných struktur

Jak již bylo popsáno dříve, vazivové struktury, které přistupují k děloze, dělohu rigidně nefixují, ale spíše ji volně orientují do správné pozice. Vztah mezi svalovou a vazivovou složkou je daný; čím více je musculus levator ani oslaben, tím více pochvy je exponováno atmosférickému tlaku a tím větší tah za ligamenta endopelvické fascie je generován při změně nitrobřišního tlaku. K jejich natažení, či poranění dojde při dlouhodobé či značné

zátěži po selhání svalové složky pánevního dna. Byť endopelvická fascie je důležitá pro správné uložení orgánů malé pánve, poranění svalové složky pánevního dna je hlavním faktorem určujícím vliv porodu na pánevní dno.

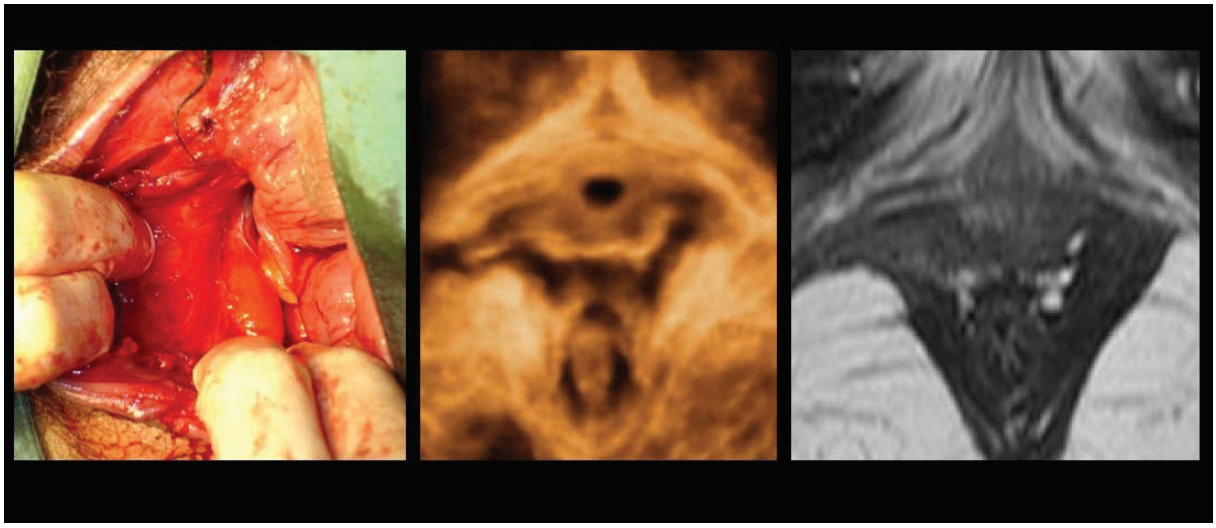
Musculus levator ani při porodu nepochybně patří mezi nejvíce namáhané struktury, protože z měkkých tkání obklopujících porodní kanál klade největší odpor. Velikost rozměru urogenitálního hiátu je značně variabilní a pohybuje se od 6 do 36 cm^2 při Valsalva (zatlačení výdechem přes uzavřené hlasivky) [18]. Obsah největšího procházejícího obvodu průměrné hlavičky je 70-100cm^2. Tato disproporce vyžaduje výrazné protažení a deformaci komplexu m. levator ani. Pomocí počítačového modelu vytvořeného na základě MRI snímků bylo prokázáno, že nejkaudálnější a nejmediálnější část levátorového komplexu, tedy musculus puborectalis, je v průběhu porodu natažen 3,26x při prořezávání hlavičky (hlavička po průchodu kostěnou pánví, sevřena strukturami perinea) [19]. Přihlédneme-li k faktu, že sval neumožní své protažení o více než dvojnásobek, aniž by došlo k jeho přetržení, je s podivem, že asi u jedné poloviny žen po porodu není patrné žádné morfologické, ani funkční postižení musculus levator ani. Toto je způsobeno hormonálními vlivy spojenými s těhotenstvím. Pružnější svaly jsou nejen méně náchylné k poranění, ale umožňují rychlejší průběh porodu [20]. S postupujícím věkem zřejmě dochází ke snížení schopnosti svalů zvýšit svoji pružnost v těhotenství, a tak se riziko odtržení musculus levator ani od dolního raménka kosti stydké (tedy avulze levátoru) s věkem výrazně zvyšuje. Zatímco riziko avulze u 20ti leté prvorodičky je menší než 15%, 40leté prvorodičky mají více než 50% riziko avulze levátoru [21]. Incidence poranění levátoru ani hodnocené dle magnetické rezonance prokázala poranění u 6-10% po spontánním porodu, 17-33% po porodu vakumextrakcí a 67-71% po klešťovém porodu [22]. Česká studie s využitím magnetické rezonance prokázala poranění levátoru ani u 64% žen po klešťovém porodu [23].

Přibližně u poloviny žen je vaginální porod spojen se vznikem významných morfologických abnormalit a vede k nenávratnému zvětšení plochy urogenitálního hiátu, jevu nazývaného „ballooning“. Ballooning byl definován jako plocha urogenitálního hiátu >25cm^2 při Valsalva [24]. K tomuto jevu dochází buď odtržením (makrotrauma) nebo roztažením (mikrotrauma) m. levator ani. K avulznímu poranění levátoru, tj. přerušení úponu svalu na dolní raménko kosti stydké a pánevní stěnu, dochází v 15-30% případů [25-27]. Při porovnání žen, které rodily císařským řezem a vaginálně bylo zjištěno zvýšení plochy urogenitálního hiátu o 18% u

žen bez avulze levátoru a o 33% u žen s avulzním poraněním levátoru [28]. Riziko poranění levátoru narůstá s věkem, váhou novorozence, délkou druhé doby porodní a je zvýšené u porodů per forcipem [20]. Ať už je ballooning způsoben porodem, nebo je vrozený, vždy je spojen s prolapsem pánevních orgánů, který často recidivuje při konvenčních operačních řešeních.

Hodnocení poranění pánevního dna, zejména avulze lavátoru lze provádět palpačně [25], sonograficky [26], či pomocí MRI [27] (Obrázek 7). Ačkoliv je palpační vyšetření nejméně náročné na vybavení, je obtížně naučitelné, do jisté míry subjektivní a obtížně opakovatelné [29]. Díky pokrokům v sonografické zobrazovací technice v posledních letech je nyní možné zobrazit hlavní abnormality anatomie levátoru pomocí 3D translabiálního ultrazvuku. Renderované axiální řezy umožňují dobrou vizualizaci úponů komplexu svalů m. levator ani k dolnímu raménku spony stydké a pánevní stěně. Je možné spolehlivě změřit oba rozměry urogenitálního hiátu a identifikovat avulzní poranění levátoru [20].

Obrázek 7: Pravostranná avulze levátoru vyšetřená na porodním sále, pomocí 3D USG a MRI
Dietz IUGA 2014 - Pelvic floor ultrasound workshop.



Traumatické oddělení levátoru od dolního raménka spony stydké a pánevní stěny má významné následky. Nejen, že způsobuje rozšíření urogenitálního hiatu, ale zároveň způsobí významné oslabení kontraktility svalů pánevního dna. Následky avulze levátoru zahrnují prolaps pánevních orgánů, močovou a fekální inkontinenci a potíže v sexuální oblasti. Avulze

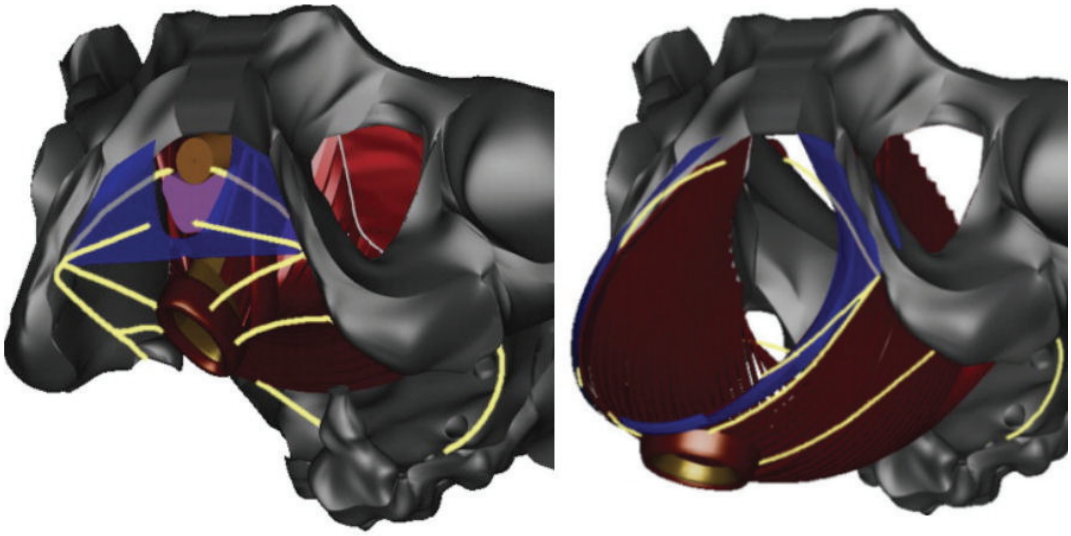
levátoru je spojována zejména se sestupem předního (močový měchýř a přední stěna poševní) a středního (děloha a pochva) kompartmentu. Zadní kompartment je postižen méně.

Pravděpodobnost sestupu stoupá s velikostí defektu, nicméně je nutno poznamenat, že mnoho žen s prolapsem pánevních orgánů neutrpělo avulzní poranění levátoru při porodu. U takových žen může hrát roli oslabení pánevního dna při denervačních poraněních, nebo kongenitální příčiny vzniku prolapsu pánevních orgánů. Mezi čtyřmi páry jednovaječných dvojčat ve věku 52-56 let, z nichž jedno dvojče rodilo spontánně a druhé nerodilo, nebyly shledány výrazné rozdíly ve stupni prolapsu či močové inkontinence. Byť se jedná o velmi malý soubor pacientek, ukazuje na význam genetické predispozice [30].

4.2 Postižení nervových struktur

Poranění nervů a nervových pletení, které inervují pánevní orgány a svaly pánevního dna je častým následkem porodu. Prostupující hlavička porodním kanálem způsobuje útlak a protažení nejen svalů pánevního dna, ale i nervů, které tyto svaly inervují, a jejich zakončení. Proto mezi hlavní rizikové faktory porodního poranění nervů patří délka druhé doby porodní a makrosomie plodu [31]. Nejčastěji postiženým nervem při porodu je nervus pudendus. Pomocí 3D modelu pánevního dna založeném na snímcích magnetické rezonance bylo prokázáno, že při porodu jednotlivé větve pudendálního nervu prodělávají značné prodloužení: ramus rectalis inferior je prodloužen o 35%, perineální větve přistupující k análnímu svěrači o 33% a větev inervující musculus sphincter urethrae o 13-15% [32] (Obrázek 8). Přitom experimentální studie prokázaly, že protažení nervu o více než 15-20% u pokusného zvířete vede k jeho trvalému poškození [33,34]. K postižení nervu čistou kompresí při porodu nejspíše nedochází vzhledem k tomu, že nervové struktury, jako větve sakrálního plexu a nervus obturatorius, které jsou při porodu komprimovány, ale nejsou protaženy, jsou při porodu postiženy jen velmi vzácně. Postižení nervu protažením je naopak zhoršeno jeho kompresí [34].

Obrázek 8: Protažení větví pudendálního nervu *dle [32] se svolením*



Z výše uvedeného vyplývá, při porodu že je nutné počítat s poškozením nervus pudendus a jím inervovaných svalů pánevního dna a orgánů malé pánve. Významná pudendální neuropatie po porodu byla prokázána u 80% žen [31]. Hodnocením funkce zevního análního sfinkteru pomocí elektromyografie pánevního dna bylo prokázáno, že ženy 2-3 dny po vaginálním porodu mají významné prodloužení akčního potenciálu motorické jednotky pudendálního nervu. Samo těhotenství na tento akční potenciál vliv nemělo a přibližně u 80% žen s prokázanou latencí motorické jednotky došlo k normalizaci nálezu za dva měsíce [35]. Po porodu tedy dochází k reverzibilní částečné denervaci pánevního dna, která snižuje sílu kontrakce svalů pánevního dna a přispívá k rozvoji prolapsu pánevních orgánů a jiných přechodných funkčních potíží po porodu (inkontinence moči a stolice).

4.3 Poranění hráze

V průběhu vaginálního porodu nejsou deformovány pouze svaly komplexu musculus levator ani a orgány malé pánve, ale dochází také ke značným deformacím v oblasti hráze při průchodu hlavičky jejími strukturami. Tyto deformace mohou vést k poranění hráze různého rozsahu až po poranění análního svěrače. Více než dvě třetiny žen utrpí poranění hráze nějakého rozsahu v průběhu vaginálního porodu. Experimentální studie prokázaly, že k největší deformaci na hrázi při průchodu hlavičky dochází v oblasti zadní komisury a že napětí na hrázi je více než 4x vyšší v příčném než v předozadním směru [36]. Poranění je klasifikováno do 4 stupňů:

Klasifikace ruptur perinea:

1. stupeň: Postiženy pouze vaginální sliznice a kůže perinea
2. stupeň: Poraněny svaly perinea ale ne análním svěrač
3. stupeň: Poranění komplexu análního svěrač
   3a méně než 50% síly zevního análního svěrače
   3b více než 50% síly zevního análního svěrače
   3c ruptura vnitřního análního svěrače
4. stupeň: Ruptura celého komplexu análního svěrače a mukózy rekta

Poranění hráze může vést k řadě funkčních problémů v budoucnosti. Mezi ně patří zejména bolesti, dyspareunie a jiné potíže v sexuální oblasti a anální inkontinence. Na rozdíl od poranění svalů pánevního dna, které se většinou projeví s odstupem od porodu a jeho ošetření bezprostředně po porodu není možné, nebo nemá žádný efekt, poranění hráze je většinou po porodu ihned patrné a jeho správné rozpoznání a ošetření je klíčem ke snížení závažnosti jeho komplikací a následků v budoucnosti.

5. Prevence

5.1 Prevence poranění musculus levator ani

Poranění svalů musculus levator ani je velice obtížně preventabilní. Techniky, které by mohly zvýšit pružnost svalů pánevního dna a tím snížit incidenci poranění jsou stále ve vývoji [37]. Císařský řez by bezpochyby představoval možnost prevence poranění komplexu musculus levator ani. Jeho provedení u všech rodiček by však bylo medicínsky i ekonomicky neúnosné i pro tu nejbohatší zemi. Císařský řez s sebou přináší četné komplikace a nevýhody pro matku a dítě, které přesahují rámec tohoto textu. Objevují se však snahy vyselektovat skupinu rodiček, kde je riziko avulze levátoru a rozvoje dysfunkce pánevního dna tak vysoké, že převáží rizika a nevýhody spojené s císařským řezem. Analýza švédského registru ukázala, že ženy menší než 160cm, které porodily dítě s porodní váhou vyšší než 4000g měly dvojnásobnou prevalenci symptomatického sestupu pánevních orgánů dvacet let po porodu. Dle dat z této studie je zapotřebí provést 12 císařských řezů aby bylo předejito jednomu

symptomatickému sestupu [17]. Stejná skupina vypracovala skórovací systém UR-CHOICE (Tabulka 1), který zohledňuje několik parametrů, podle nichž by bylo možné provést rozhodnutí, která by maximalizovala šance na bezproblémový porod a zabránila zbytečně vysoké incidenci inkontinence moči, stolice a prolapsu pánevních orgánů, která by v budoucnu vyžadovala operační řešení [38]. Tento systém je zatím ve fázi validace.

Tabulka 1: UR-CHOICE skórovací systém

UR-CHOICE		
U	UI before pregnancy	inkontinence moči před otěhotněním
R	Race/ethnicity	rasa/etnikum
C	Child bearing started at what age?	věk při prvním porodu
H	Height (mother's height)	výška matky
O	Overweight (weight of mother, BMI)	nadváha matky
I	Inheritance (family history)	rodinná anamnéza
C	Children (number of children desired)	počet chtěných dětí
E	Estimated fetal weight	odhadnutá porodní váha

5.2 Prevence poranění hráze

Výčet a popis všech preventivních opatření a technik pro snížení rozsahu a incidence poranění hráze zdaleka přesahuje rozsah toto textu. Existují 4 potenciální způsoby jak snížit rozsah poranění hráze; 1/ snížením třecích sil (porodnický gel), 2/ zvýšením elasticity hráze (masáž hráze před porodem), 3/ zmenšením prostupujícího obvodu hlavičky (deflexní techniky), 4/ rozložením napětí po zadní komisuře (chránění hráze). Porodnické praktiky zaměřené na minimalizaci poranění pánevního dna při porodu se výrazně odlišují nejen na mezinárodní úrovni, ale i na úrovni jednotlivých pracovišť. Praxe často odráží kulturu daného národa, či zvyky pracoviště. Obliba i způsob užití některých metod (episiotomie, Ritgenův manévr, masáž hráze) prodělává v čase výrazné změny.

6. Závěr:

Vaginální porod má významný dopad na statiku pánevního dna. Již samo těhotenství vlivem zvýšených hladin hormonů vede k poruchám pánevního dna. Hlavička procházející porodním kanálem způsobuje protažení a utlačuje svaly a nervy pánevního dna i orgány malé pánve. Toto protažení, či útlak může vést k nevratným změnám a dlouhodobým následkům vaginálního porodu.

V rámci pánevního dna má největší význam svalová složka, která utváří podporu po orgán malé pánve. Dokud jsou svaly schopny si udržet konstantní tonus, je urogenitální hiátus uzavřený a ligamenta volná, bez jakéhokoliv napětí a fungují jako pružiny při změnách nitrobřišního tlaku. Pokud ale dojde k poškození svalů, hiátus se otevře, pánevní dno se propadne a orgány malé pánve jsou vytlačovány. Jakmile se dostanou pod úroveň hymen je exponována pochva a podpora svaly pánevního dna nulová. Čím více pochvy je exponováno atmosférickému tlaku, tím větší je tah za ligamenta. Namáhaná vazivová složka postupně selže a tím i celá statika pánevního dna.

Detekce avulzního poranění levátoru se dostala do popředí v rámci diagnostiky a vyšetření prolapsu pánevních orgánů. Její rozpoznání má velký klinický význam pro indikaci správného ošetření a stanovení prognózy. V současnosti je v popředí výzkumu hledání metod prevence poranění pánevního dna. Některé následky, jako prolaps pánevních orgánů, se projeví s větším odstupem od porodu. Vzhledem k tomu, že populace celosvětově stárne a délka života se prodlužuje lze očekávat, poranění pánevního dna při porodu bude nabývat na významu. Porody budou v budoucnu budou možná potom vedeny s ohledem na minimalizaci poranění pánevního dna.

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Příloha 2:

37 Porodní poranění análního sfinkteru

Kališ V., Rušavý Z.

Závažné porodní poranění perinea a análního sfinkteru je relativně často spojeno s následnou mateřskou morbiditou, a proto vždy vyžaduje pečlivé ošetření.

Incidence poranění análního svěrače se výrazně liší podle jednotlivých prací a osciluje mezi 0,1 a 24,5 % všech vaginálních porodů.[1–3] Neadekvátně ošetřené závažné poranění perinea a análního sfinkteru je spojeno s výrazným nárůstem tzv. dlouhodobé mateřské morbidity, zejména je to:

- **anální inkontinence**, což je nedobrovolný únik plynů, řídké nebo i tuhé stolice a/nebo urgentní inkontinence, která negativně ovlivňuje kvalitu života ženy;
- **zhoršení kvality sexuálního života** ženy (dyspareunie, strach z poranění, anální inkontinence při pohlavním styku);
- **chronická perineální bolest**.

Prevence poranění perinea a svalstva konečníku

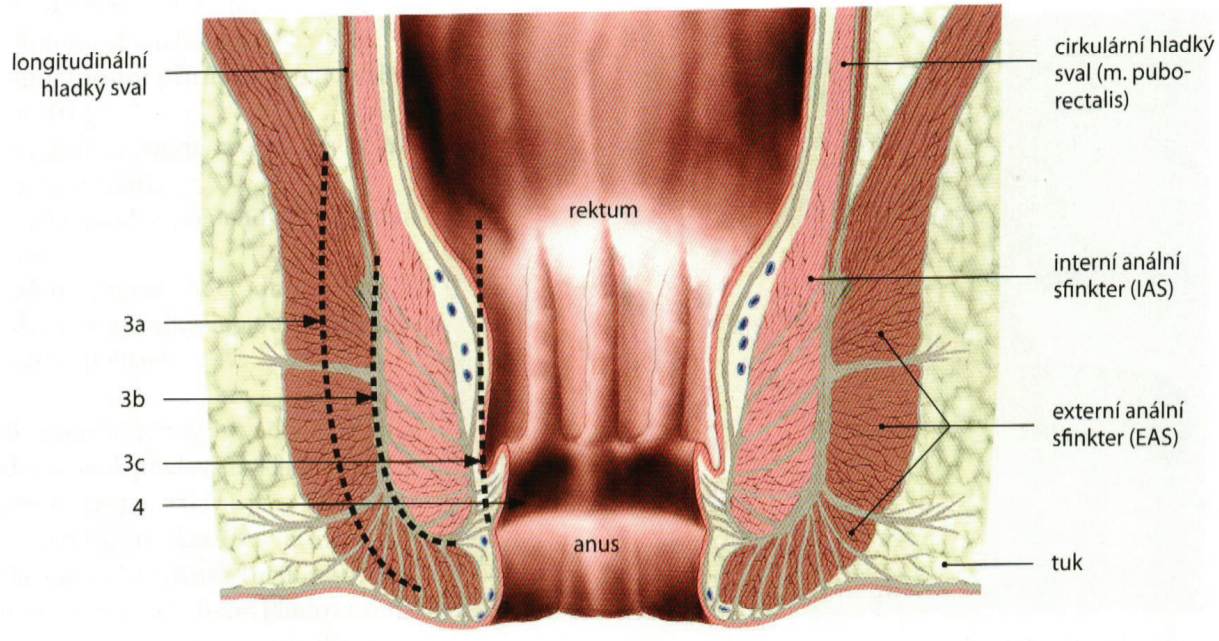
Úkolem lékaře řešícího porodní poranění perinea je zajistit primární, sekundární a částečně i terciární prevenci. **Primární prevencí** je míněna identifikace všech rizikových faktorů a jejich vyhodnocení, zvolení vhodného postupu a minimalizace vlivu těchto faktorů na vlastní průběh a výsledek porodu. Přes jisté odlišnosti v jednotlivých studiích jsou nejčastěji uváděny tyto rizikové faktory porodního poranění análního sfinkteru: vaginální porod prvorodičky, zadní postavení, resp. okcipitoposteriorní naléhání hlavičky plodu, klešťový porod a mediální episiotomie. Příkladem primární prevence je náhrada klešťového porodu vakuumextrakcí či vyhýbání se použití mediální episiotomie. Předmětem **sekundární prevence** je správná diagnostika poranění, zvolení správného operačního postupu a operačních podmínek a adekvátní ošetření. **Terciární prevencí** je míněna následná centralizace těchto pacientek ve specializovaných ambulancích, jejich důkladné pooperační sledování, diagnostika možných komplikací, jejich řešení a spolupráce s dalšími odborníky (kolorektálním chirurgem, fyzioterapeutem, radiodiagnostikem apod.).

Anatomie análního sfinkteru

Anální sfinkter (dále AS) se skládá z interního a externího análního sfinkteru. Interní anální sfinkter (dále IAS) odvozený od vnitřní cirkulární svaloviny rekta je hladký sval makroskopicky výrazně bledší v kontrastu s externím análním sfinkterem a jeho dolní okraj končí o něco výše než externí anální sfinkter. Externí anální sfinkter (dále EAS) se strukturálně dělí na tři komponenty: hlubokou, povrchovou a podkožní. Jednotlivé komponenty jsou jen obtížně odlišitelné v klinické praxi, a proto se k němu přistupuje jako k jediné struktuře (obr. 37-1). U žen je EAS zkrácen ve své anteriorní části.

Patogeneze anální inkontinence

Patogeneze anální inkontinence vychází z typu a rozsahu poranění jednotlivých struktur zabezpečujících



Obr. 37-1. Anatomie análního sfinkteru a klasifikace jeho poranění (podle A. H. Sultana a Ch. Kettleové)

udržení stolice. Zatímco oba anální sfinktery (IAS i EAS) zodpovídají za udržení plynu a tekuté stolice, m. puborectalis a anorektální úhel jsou zodpovědné za základní fekální kontinenci (udržení tuhé stolice). Zabezpečení anální kontinence zajišťuje tzv. automatický kontinenční mechanismus. Tento mechanismus tvoří klidový tonus IAS a kontrakční tonus EAS, kdy se EAS a m. puborectalis kontrahují vědomě a reflexně zároveň, aby zabránily úniku stolice. Maximální kontrakce EAS je možné dosáhnout jen na dobu 40–60 sekund vzhledem k existenci svalové únavy.[4] IAS je zodpovědný za 50–85 % klidového tonu, EAS za 25–30 %,[5] zbývajících 15 % zajišťují expanze vaskulárních análních pletení.[6] Dostatečně vysoký tonus IAS je tedy nezbytný k minimalizaci vědomé pozornosti k análnímu sfinkteru.

IAS je ve stavu permanentní maximální kontrakce a brání tak nedobrovolnému odchodu stolice. Tato permanentní kontrakce je výsledkem jak vnitřních (svalových), tak vnějších (autonomních neurogenních) vlastností. EAS a svalstvo pánevního dna na rozdíl od jiných příčně pruhovaných svalů udržují permanentní nevědomý klidový tonus v reflexním oblouku na úrovni cauda equina pomocí vláken typu I, které zajišťují tonickou kontraktilní aktivitu.

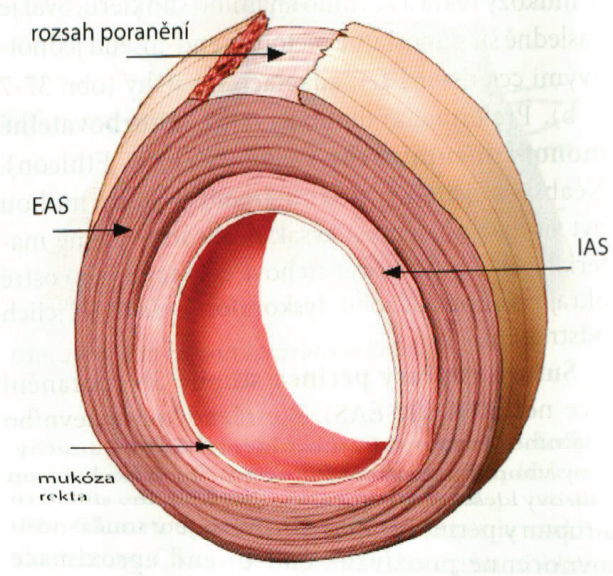
Diagnostika

Při podezření na poranění análního sfinkteru je nutné digitální vyšetření. Ukazovák ruky je zaveden do rekta a palcem ruky je palpačně zhodnocen a popř. vizualizován stav análního svěrače. Při podezření na jeho poranění by měl být přivolán zkušený odborník.

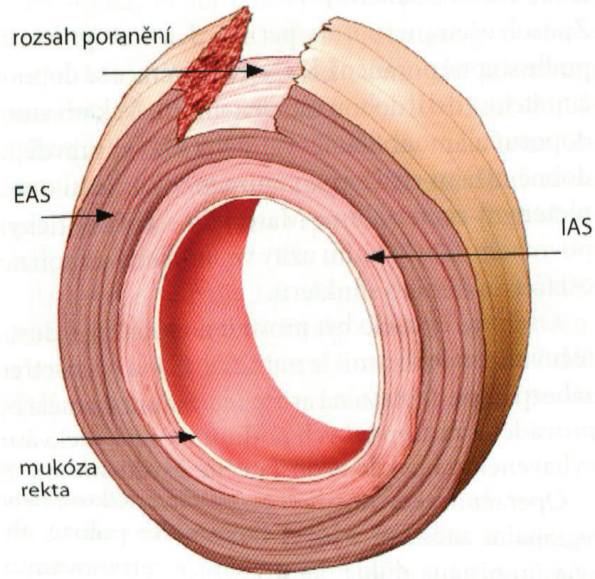
Od roku 1996, kdy byla vydána 9. revize Mezinárodní klasifikace nemocí, je používána v mezinárodní literatuře čtyřstupňová klasifikace ruptur perinea, kde 4. stupeň odpovídá kompletní ruptuře 3. stupně.[7] Od roku 2001 byla ve Velké Británii navržena a Royal College of Obstetricians and Gynaecologists (dále RCOG) schválena nová přehledná klasifikace porodního perineálního poranění, která odstraňuje nedostatky předešlých klasifikací (insuficientního popisu postižených anatomických struktur).[8] Tato klasifikace současně určuje pravděpodobnost vzniku anální inkontinence a zároveň navrhuje metodu operační korekce. Pravděpodobnost vzniku anální inkontinence při dřívějším způsobu ošetření ruptury perinea (sutura end-to-end) činila u stupně 3a kolem 20 %, u 3b cca 30 % a u 3c dokonce nad 60 %. Vzhledem k faktu, že ošetření i prognóza jednotlivých stupňů poranění podle klasifikace RCOG se výrazně liší, je doporučeno přijetí této klasifikace i v České republice.

Klasifikace ruptur perinea podle RCOG (Guideline No 29 – 2007):[8]

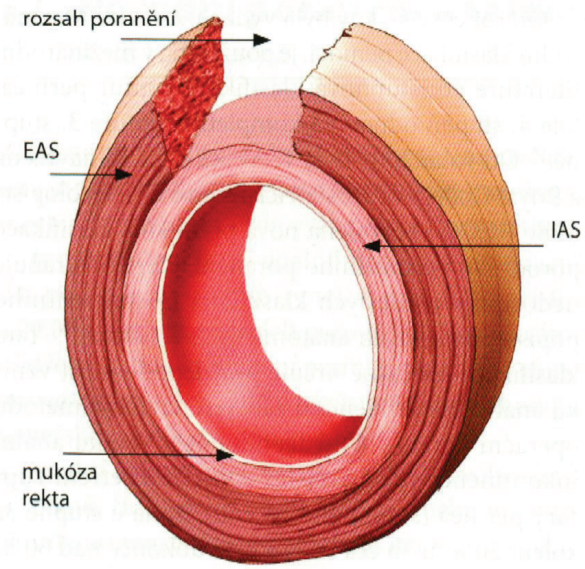
- 1. stupeň: postižení pouze vaginální sliznice a kůže perinea
- 2. stupeň: poranění zahrnující svaly perinea, ale ne anální sfinkter
- 3. stupeň: poranění komplexu análního sfinkteru
  - 3a: méně než 50 % síly EAS (obr. 37-2)
  - 3b: více než 50 % síly EAS (obr. 37-3, 37-4)
  - 3c: ruptura EAS a IAS (obr. 37-5)
- 4. stupeň: ruptura EAS a IAS a mukózy rekta (obr. 37-6)



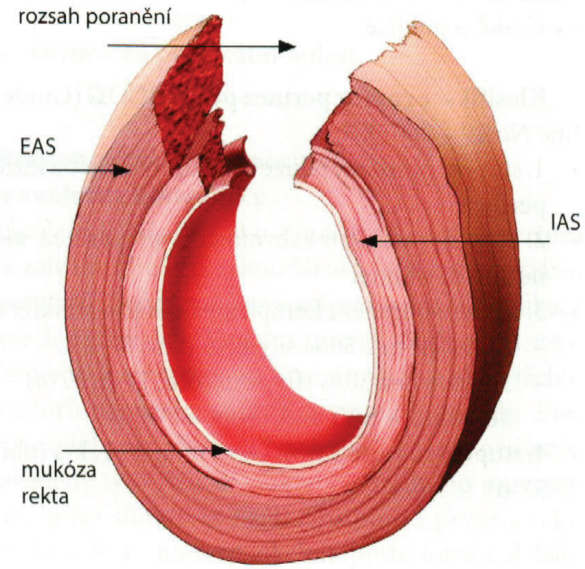
Obr. 37-2. Ruptura perinea stupně 3a podle RCOG



Obr. 37-3. Ruptura perinea stupně 3b podle RCOG



Obr. 37-4. Ruptura perinea stupně 3b podle RCOG



Obr. 37-6. Ruptura perinea 4. stupně podle RCOG

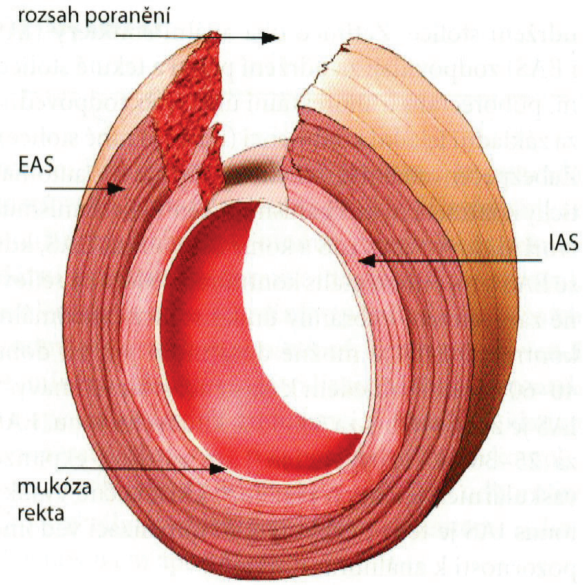
Ošetření poranění análního sfinkteru

Operační podmínky

Způsob ošetření ruptury perinea 3. a 4. stupně se liší podle stupně poranění. K ošetření svěrače se doporučují stehy s delší dobou vstřebatelnosti. Někteří autoři doporučují monofilamentní steh (PDS) s pravděpodobně nižším rizikem kolonizace bakteriemi oproti pleteným materiálům. Materiály s antiseptickým povrchem nebyly zatím užity ve studiích hodnotících ošetření análního sfinkteru.

Ošetření by mělo být provedeno lékařem s dostatečnými zkušenostmi. Je nutné, aby byla při ošetření zabezpečena dostatečná asistence. Sutura by měla být prováděna za aseptických podmínek a na adekvátně vybaveném sále, kde je dostatečné osvětlení.

Operační výkon musí být prováděn v celkové nebo regionální anestezii, vždy v litotomické poloze, aby byla umožněna důkladná preparace retrahovaných konců análního sfinkteru. Přetržené konce análního



Obr. 37-5. Ruptura perinea stupně 3c podle RCOG

svěrače se retrahují do své fascie, pro jejich ozřejmění a zachycení je proto svalová relaxace nezbytná.

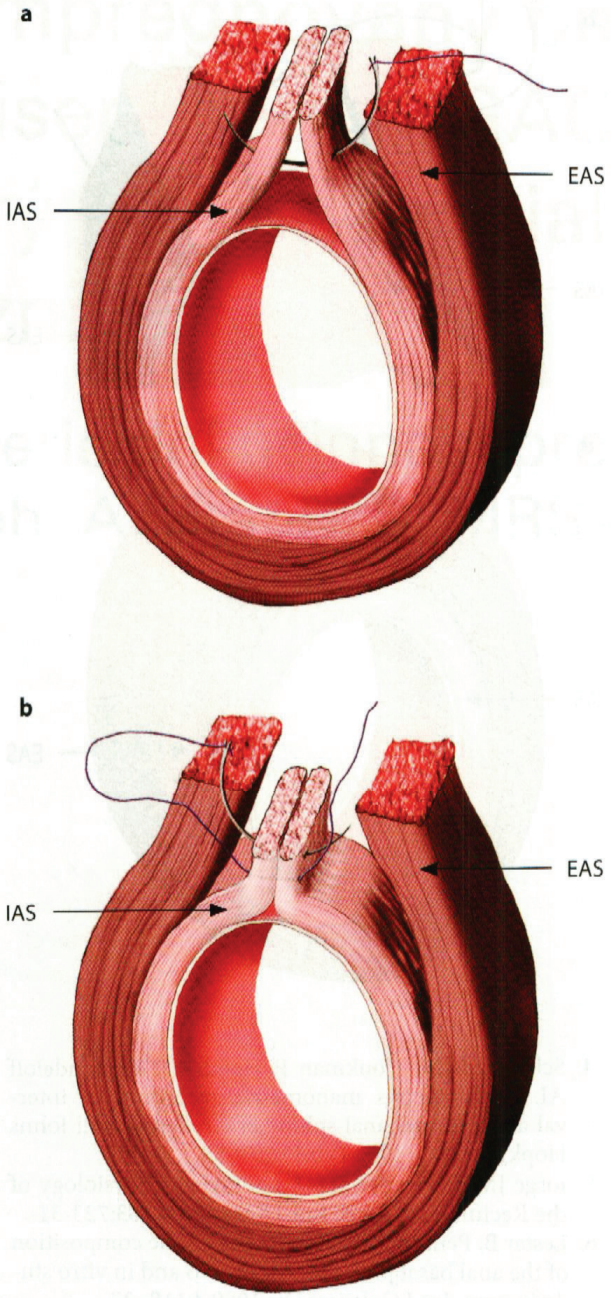
Byla prokázána výhoda jednorázového pooperačního podání cefalosporinu 2. generace.[9] Výhoda delšího podání nebo kombinace antibiotik nebyla ve studiích zkoumána. Některé práce doporučují dlouhodobé podání kombinace intravenózních antibiotik, tj. metronidazol 500 mg a cefalosporiny 3. generace – např. cefuroxim 1,5 g po dobu 5–10 dní, nicméně pouze na základě osobních zkušeností.[6]

Provedení operace

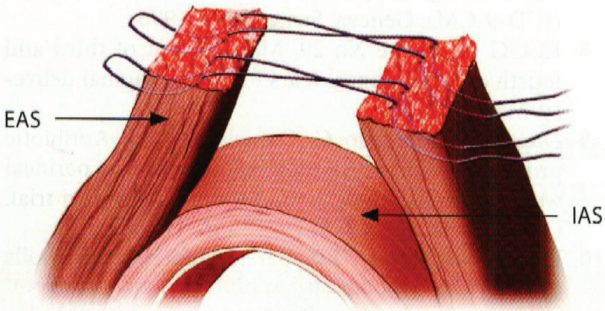
Sutura ruptury perinea 4. stupně (ruptura EAS a IAS a mukózy rekta). Sliznice rekta je sešita jednotlivými stehy absorbovatelného pleteného vlákna (např. 3-0 Vicryl, Ethicon) s uzly vázanými v análním lumen či pokračovacím submukózním stehem.

Sutura ruptury perinea stupně 3c (ruptura IAS). Vnitřní análí sfinkter je bez ohledu na typ sutury zevního sfinkteru vždy uvolněn od okolních struktur, tj. mukózy rekta a zevního análního sfinkteru. Sval je následně šit samostatně metodou end-to-end jednotlivými cca dvěma tzv. adaptačními stehy (obr. 37-7 a, b). Preferujeme dlouhotrvající **absorbovatelné monofilamentní stehy** (např. 3-0 PDS, Ethicon). Neabsorbovatelné monofilamentní stehy mohou být sice stejně účinné, avšak neabsorbovatelný materiál může způsobovat stehové abscesy a jeho ostré okraje mohou způsobit dyskomfort vyžadující jejich odstranění.

Sutura ruptury perinea stupně 3b (poranění více než 50 % síly EAS). Přetržené konce zevního análního sfinkteru musí být identifikovány a zachyceny vhodným operačním nástrojem. Vhodné jsou Allisovy kleště. Pro suturu zevního análního sfinkteru u ruptury perinea stupně 3b a větší je v současnosti rovnocenně používána end-to-end aproximace i overlapping sfinkteroplastika.



Obr. 37-7. Sutura IAS



Obr. 37-8. End-to-end aproximace EAS

End-to-end aproximace. Principem metody je přiblížení konců přetrženého svalu bez napětí k sobě (end-to-end). V jednotlivých studiích je užíváno několik metod aproximace, jejich popis je však nedostatečný. Okraje zevního sfinkteru jsou přibliženy v každém kvadrantu jedním stehem (u čísla 3, 6, 9 a 12). Další možností je použití stehů ve tvaru čísla „8" (obr. 37-8), matracové stehy apod.

Overlapping sfinkteroplastika. Podmínkou této metody je, že je sval mobilizován tak, aby mohl být jeden konec přetažen přes druhý (overlap – obr. 37-9). Pro rozlišení zevního análního svěrače od jiných svalů pánevního dna je vhodné zatáhnout za zachycený konec svalu a vizuálně i palpačně ověřit, který sval se pohybuje. Jako šicí materiál je vhodné použít dlouhotrvající absorbovatelný monofilamentní materiál.

Sutura ruptury perinea stupně 3a (poranění méně než 50 % síly EAS). Sutura stupně 3a se vždy provádí metodou end-to-end. Dvěma stehy jsou zachycena roztržená vlákna zevního svěrače a aproximována.

Vybavení pro suturu ruptury perinea 3. a 4. stupně

Pro suturu ruptury perinea 3. a 4. stupně je potřebné následující **vybavení:** 2 páry sterilních rukavic, dezinfekce, jehelec, pinzeta, preparační nůžky, 2 ks Allisových kleští, doporučen je vaginální retraktor.

Doporučený šicí materiál:

- krátkodobě či střednědobě vstřebatelný 3-0 polyglactin 910 (Vicryl rapide či Coated Vicryl) či ekvivalentní materiál pro suturu mukózy rekta;
- 2 ks 3-0 PDS či ekvivalentní dlouhodobě vstřebatelný materiál pro suturu IAS, EAS;
- střednědobě vstřebatelný 2-0 polyglactin 910 (Coated Vicryl) či ekvivalentní materiál pro suturu svalů perinea;
- krátkodobě vstřebatelný 2-0 polyglactin 910 (Vicryl rapide) či ekvivalentní materiál pro suturu stěny pochvy a kůže.

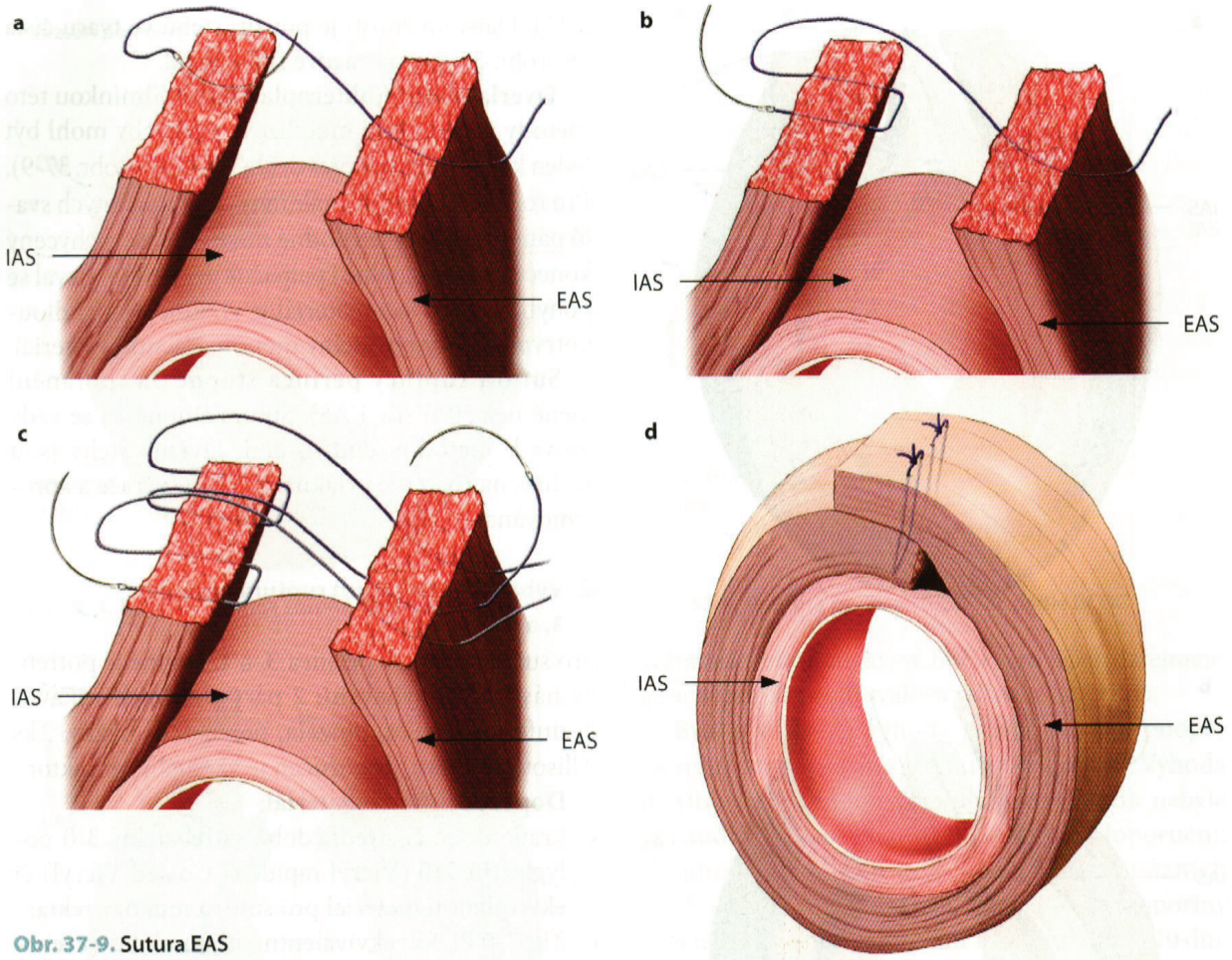
Následná péče

Všechny nedělky po ošetření závažného poranění hráze a análního sfinkteru by měly užívat změkčovadla stolice, neboť tlak vyvolaný při obtížné defekaci tuhé stolice může způsobit disrupci provedené sutury. Vhodné je například osmotické laxativum Lactulosa (Lactulosa Infusia sir., 10–15 ml denně až do dávky 60 ml denně). Léčba by měla trvat cca 10–14 dní do zhojení sutury. V literatuře je zcela ojediněle doporučována i speciální dieta (bezezbytková, kašovitá).[10]

Pacientka by měla být detailně poučena nejdéle následující den o této komplikaci a upozorněna na existenci rizika zhoršené kontinence. Musí dále vědět, na koho se obrátit v případě, že se objeví potíže.

Follow-up

Je doporučena následná kontrola zkušeným lékařem. Za 2 týdny od ošetření je možné hodnotit zejména stav hojení. V čase 2–3 měsíce po porodu je vhodná kontrola na posouzení funkčnosti svěrače a vyloučení



Obr. 37-9. Sutura EAS

přítomnosti jiných poporodních potíží spojených se závažným poraněním perinea. Tyto možné potíže kromě análního inkontinence zahrnují močovou inkontinenci, dyspareunii či jiné defekační potíže, jako jsou zácpa nebo bolestivá defekace.

Hojení poporodních poranění tkání měkkých porodních cest zrychluje podávání systémové enzymoterapie (Wobenzym).

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POZNÁMKY

Příloha 3:

Ritgenův manévr a jeho modifikace

Ritgen maneuver and its modifications

Rušavý Z., Karbanová J., Bednářová B., Kališ V.

Gynekologicko-porodnická klinika LF UK a FN, Plzeň, přednosta doc. MUDr. Z. Novotný, CSc.

ABSTRACT

Objective: To present the Ritgen maneuver, its original description as well as its most common modifications and to demonstrate the heterogenity of descriptions of the maneuver regarding its performance, purpose and published results.
Design: A review article.
Setting: Department of Gynecology and Obstetrics, Medical Faculty and University Hospital Pilsen, Charles University in Prague.
Methods: A review article demonstrating the heterogeneity of Ritgen maneuver descriptions based on analysis of present and past obstetrical textbooks and journal articles.
Conclusion: At present there is a pursuit of finding and analysis of methods for obstetric perineal injury prevention, which could considerably improve quality of life of women after delivery. One of the possible mechanisms of perineal trauma reduction is to ensure that the fetal head passes with its smallest head circumference through the perineal structures. Already in the middle of the 19th century, von Ritgen devised a method allowing to facilitate and control the extension of the fetal head in the end of the second stage of labor. His method quickly spread all over the world, however, the description changed considerably. The Ritgen maneuver today means a variety often very different interventions. This review points out to the need of clarification of terminology, i.e. definition and classification of methods facilitating extension of the fetal head in the end of the second stage of labor.

KEYWORDS

Ritgen maneuver – vaginal delivery – perineal trauma – prevention

SOUHRN

Cíl studie: Představit Ritgenův manévr v jeho originálním znění a jeho nejčastější modifikace. Na základě analýzy popisů této intervence v domácí i světové literatuře poukázat na rozdíly v popisu provedení, jeho účelu i publikovaných výsledcích.
Typ studie: Přehledový článek.
Název a sídlo pracoviště: Gynekologicko-porodnická klinika LF UK a FN v Plzni.
Metodika: Souhrnná práce poukazující na různorodost popisu Ritgenova manévru založená na analýze současné i historické porodnické literatury.
Závěr: V současnosti trvá potřeba nalezení a analýzy metod, které by byly schopny předejít, nebo alespoň snížit stupeň porodního poranění, a přispět tak ke zlepšení kvality života žen po porodu. Jednou z možností minimalizace porodního poranění je zajistit, aby hlavička plodu procházela perineálními strukturami svým nejmenším, subokcipitobregmatickým obvodem. Již v polovině 19. století navrhl von Ritgen metodu, která umožňuje napomáhat a řídit deflexi hlavičky. Jeho metoda se rychle rozšířila po celém světě, nicméně dnes se za pojmem Ritgenův manévr skrývá mnoho mnohdy odlišných intervencí. Tato práce ukazuje na nutnost upřesnění terminologie, tedy definování a klasifikaci různých technik napomáhání deflexe hlavičky na konci druhé doby porodní.

KLÍČOVÁ SLOVA

Ritgenův manévr – vaginální porod – poranění hráze – prevence

Čes. Gynek., 2014, 79, č. 1, s. 64–67

ÚVOD

Hlavním úkolem porodníka či porodní asistentky, vedle zajištění bezpečného průběhu porodu pro plod, je minimalizace či eliminace porodního poranění a s ním spojených komplikací a následků porodu. Porodní poranění hráze je častou komplikací spontánního vaginálního porodu, pro jejíž prevenci ještě nebyla jednoznačně definována evidence-based opatření kromě omezení provádění epiziotomie a nahrazení porodu per forcipem vakuumextrakcí [2]. V průběhu vaginálního porodu dochází k velkým deformacím tkání v oblasti pánevního dna, což může být doprovázeno různým rozsahem poranění perinea, popř. i análního sfinkteru. Podle britské recentní prospektivní observační studie na 3000 rodičkách pouze 9,6 % prvorodiček a 31,2 % vícerodiček porodí s intaktní hrází [19]. Podle dřívějších odhadů z Velké Británie kolem 85 % žen utrpí při vaginálním porodu určitý stupeň poranění hráze, přičemž 60–70 % z nich vyžaduje suturu [13]. Tato poranění významně přispívají k poporodní bolesti a morbiditě, která ztěžuje běžné aktivity, jako chůzi, sed, kojení i nošení novorozence, a významně zasahuje do sexuálního života pacientky. Bolesti v oblasti hráze se vyskytují až u 42 % nedělek, v 10 % přetrvávají jeden a půl roku po porodu [2]. Přítomnost jakéhokoli stupně močové inkontinence po porodu byla odhadnuta na 31 % [21]. Velká švédská prospektivní studie prokázala, že 8 % žen nemělo pohlavní styk do šesti měsíců po porodu, přičemž tento poměr byl výraznější ve skupině žen s poraněním análního sfinkteru (13,6 %) [16]. Stupeň poporodní morbidity je přímo úměrný rozsahu a komplexitě porodního poranění [1]. Minimalizace porodního poranění má tedy velký význam pro zlepšení kvality života žen po porodu.

Vzhledem k tomu, že incidence porodních poranění má spíše vzestupný trend, trvá potřeba nalezení a analýzy metod, které by byly schopny předejít nebo alespoň snížit stupeň porodního poranění. Od počátků lékařsky vedeného porodu byly navrhovány různé postupy zaměřené na minimalizaci porodního poranění. Z principů mechaniky vyplývá, že snížení rozsahu a četnosti porodního poranění může být dosaženo čtyřmi způsoby; snížením třecích sil, zvýšením elasticity hráze, rozložením bodového napětí na zadní komisuru na větší plochu hráze, či zmenšením prostupujícího obvodu hlavičky perineálními strukturami [26]. V roce 1855 Ferdinand August Marie Franz von Ritgen navrhl metodu, jejímž smyslem je napomáhání deflexe hlavičky plodu na konci druhé doby porodní a docílení vedení porodu hlavičky skrze perineální struktury jejím nejmenším, tj. subokcipitobregmatickým obvodem [18]. Od prvního popisu vzniklo mnoho modifikací Ritgenova manévru s různými klinickými výsledky.

V současné době dochází k odklonu zájmu porodnických učebnic, včetně českých, od přesného popisu technik určených k snížení rozsahu a četnosti porodních poranění. Klinická praxe se významně liší nejen mezi jednotlivými porodnicemi, ale i mezi jednotlivými lékaři a porodními asistentkami. Využívané postupy se odvíjejí zejména od zkušeností pracoviště a tradice. Studie v této oblasti jsou vzhledem ke složitosti problému a nemožnosti studia jednotlivých současně prováděných technik odděleně metodologicky obtížně proveditelné. Skutečnost, že závěry publikovaných studií neposkytují jednoznačná doporučení, vyplývá z faktu, že popis jednotlivých intervencí není standardizovaný a terminologie se významně liší.

Ritgenův manévr je příkladem intervence s velmi různorodým popisem provedení i navrhovaným účelem. Jako metoda určená ke snížení porodního poranění je v českých učebnicích popisován zřídka, jeho interpretace v zahraničních učebnicích je často zavádějící, nebo je použito některé modifikace, která může měnit jeho navržený protektivní efekt.

Naše pracoviště v současnosti pracuje na standardizaci terminologie týkající se metod napomáhání deflexi hlavičky na konci druhé doby porodní. Jejich klasifikace umožní porovnání a reprodukování budoucích studií zabývajících se touto porodnickou intervencí. **Cílem této práce** je představit Ritgenův manévr a poukázat na rozdíly v jeho popisu a publikovaných výsledcích.

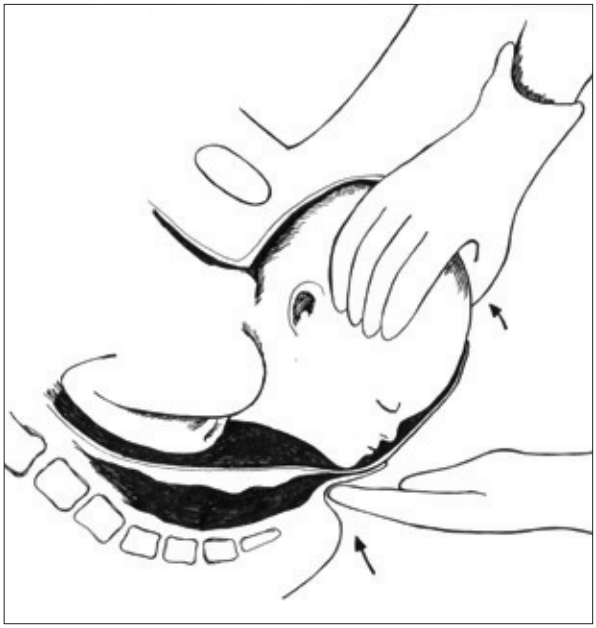
RITGENŮV MANÉVR

Byla provedena analýza dostupné porodnické literatury ve spolupráci s univerzitní knihovnou v porodnických učebnicích, v databázi PubMed/Medline a specializovaných vyhledávacích serverech, jako Google scholar search engine. Mezi klíčová slova pro vyhledávání patřil:

Ritgen maneuver, extension, manual protection, hands on, hands-on, perineal support a věty, které by mohly identifikovat pasáže z učebnic popisující Ritgenův manévr nebo jinou podobnou techniku usnadňující deflexi hlavičky na konci druhé doby porodní.

METODIKA

Ritgen svůj manévr původně popsal jako „protlačení“ hlavičky skrze struktury hráze v období mimo kontrakci. Doporučil vyvíjet špičkami 4 prstů tlak dovnitř a dopředu na bradičku plodu přes zadní hráz, tedy oblast mezi análním otvorem a kostrčí, a současně druhou rukou regulovat rychlost prostupu hlavičky a navést hlavičku tak, aby



Obr. Ritgenův manévr: V čase mimo kontrakci dominantní ruka špičkami čtyř prstů vyvíjí tlak dovnitř a dopředu přes zadní hráz na bradičku plodu. Druhá ruka současně reguluje rychlost prostupu hlavičky a navádí ji tak, aby prošla skrze perineální struktury svým nejmenším obvodem.

prošla skrze perineální struktury svým nejmenším obvodem (obr. 1). Doporučoval ještě tlačit mimo střední čáru tak, aby vrcholy temenních kostí neprořezávaly současně. V průběhu kontrakce měly ruce stát nehnutě, dokud kontrakce neskončí [28].

Díky Ritgenovým uznávaným úspěchům stran menší četnosti a rozsahu poranění se jeho metoda rychle rozšířila z Německa do celého světa. Od svého popisu byl manévr doporučován a hodnocen v mnoha učebnicích a publikacích, ale jeho popis prodělal výrazné změny. Přestože Ritgen manévr popsal jako tlak na oblast mezi análním otvorem a konečníkem, už v 19. století byl manévr popisován jako vytlačování hlavičky prsty zavedenými skrz rektum [5, 11]. Dodnes tak je některými porodníky chápán. Ritgenův manévr rovněž prodělal výrazné změny v popisu časování manévru. Tato změna je dobře pozorovatelná na jednotlivých vydáních jedné ze základních amerických učebnic porodnictví Williams Obstetrics. První vydání (1903) udává velmi zjednodušený, nicméně relativně věrný popis: „...v čase mezi bolestmi (...) dva prsty jsou přiloženy hned za anální otvor a je vyvíjen tlak dopředu a nahoru na čelo plodu přes hráz ...“ [25]. Od 15. vydání Williams Obstetrics je provádění Ritgenova manévru popisováno jen za kontrakce a označuje se jako modifikovaný Ritgenův manévr. Poslední 23. vydání této učebnice poskytuje podrobný popis, nicméně časováním manévru se vůbec nezabývá [3].

V českém písemnictví není Ritgenův hmat příliš probírán, výjimku tvoří pouze 3 klasické učebnice. V Traplově učebnici praktického porodnictví je podrobný popis, nicméně bez udání časování [22]. Dlhoš popisuje metodu jako alternativu k vakuumextrakci pro domácí porody a doporučuje ji provádět za kontrakce [6]. V Porodnictví od Zwingera a kol. má být manévr prováděn skrz rektum, rovněž bez udání časování [27]. Podobný trend lze sledovat i v anglosaských učebnicích. Popis manévru, jeho časování, ale i účel se poměrně významně liší mezi jednotlivými učebnicemi. Ritgenův manévr je často zmiňován v souvislosti s možností urychlení porodu za cenu většího poranění, což je přesný opak toho, jak byl původně von Ritgenem popsán [7, 8, 17, 23, 24]. Ve skandinávských učebnicích a publikacích je popisován podobný manévr prováděný pokrčeným prostředníkem současně při chránění hráze ukazovákem a palcem [15, 20]. Zavedení tohoto manévru v Norsku vedlo ke snížení incidence ruptury análního svěrače z 4,03 % v roce 2002 na 1,17 % v roce 2007 [12]. Zajímavá je nabízená možnost dokončení klešťového porodu Ritgenovým manévrem po sejmutí kleští před prořezáním hlavičky za účelem snížení traumatu hráze při porodu per forcipem [3, 4, 9].

Zajímavé je, že zatímco starší učebnice Ritgenův manévr doporučují jako výkon vhodný ke snížení porodního poranění, moderní učebnice udávají, že narušuje mechanismus porodu, zvyšuje porodní poranění, a od jeho užívání odrazují. Tento zásadní obrat ve vnímání této intervence vychází z několika recentních studií. Jönsson a kol. ve své randomizované multicentrické kontrolované studii na více než 1600 porodech prokázali, že Ritgenův manévr prováděný za kontrakce nesnižuje riziko poranění análního sfinkteru [10]. Autoři však spekulují, že von Ritgen prováděl svůj manévr mimo kontrakci a k efektu původního manévru se nemohou vyjádřit. Přesto tato práce významně změnila náhled na tuto intervenci. Některé učebnice rovněž citují úvahu, že Ritgenův manévr způsobí nepřirozenou nadměrnou deflexi hlavičky a perineálními strukturami pak prořezává větší, okcipitofrontální obvod, což způsobuje výraznější poranění [14]. Původní Ritgenův manévr ale popisuje práci levé ruky při navádění hlavičky tak, aby procházela nejmenším obvodem a krček plodu se opřel o dolní okraj spony. Ostatní vědecké práce, které byly o Ritgenově manévru napsány, se výrazně liší ve svých závěrech o jeho prospěšnosti. To je způsobeno zejména výraznými odlišnostmi v metodice, zejména výrazně nesourodém popisu této intervence. V současné době je připravována standardizace, popřípadě i klasifikace deflexních technik, která by měla umožnit zhodnocení vzta-

hu mezi Ritgenovým manévrem, eventuálně jeho konkrétní modifikací a porodním poraněním.

ZÁVĚR

Od svého vzniku doznal Ritgenův manévr mnoha modifikací, které významně změnily jeho efekt a nakonec i indikaci k jeho provedení. Vzhledem k tomu, že je tlak na zadní komisuru mimo kontrakci rodičkou vnímán bolestivě, je v současnosti užíván zejména modifikovaný Ritgenův manévr, tedy za kontrakce. Poslední práce ukazují, že je-li proveden pouze v tomto provedení, nesnižuje riziko poranění análního svěrače, nicméně urychluje finální fázi druhé doby porodní. Kvalitní práce, které by hodnotily vztah originálního Ritgenova manévru a porodního poranění neexistují. Vzhledem k tomu, že za pojmem Ritgenův manévr se skrývá mnoho často odlišných intervencí, je v současné době snaha o upřesnění terminologie, tedy definování a klasifikaci různých deflexních technik.

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MUDr. Zdeněk Rušavý
Gynekologicko-porodnická klinika
LF UK a FN Plzeň
Alej Svobody 80
304 60 Plzeň
e-mail: rusavyz@fnplzen.cz

Příloha 4:

Episiotomy

6

Vladimir Kalis, Zdenek Rusavy, and Matija Prka

Abstract

Episiotomy is a surgical incision to the perineum made during the last part of labour to facilitate delivery. It should always be defined by the location of the beginning, direction, length, and timing. Seven episiotomy types have been identified. However, only three (midline, mediolateral, and lateral) are routinely used. Exact placement of episiotomy incision is significant regarding perineal trauma. Lateralisation of episiotomies significantly decreased OASIS incidence. While midline episiotomy increases the risk of OASIS, the protective role of mediolateral episiotomy depends on the correct identification of the risk group and correct incision. A protective effect of lateral episiotomy on primiparous women has been consistently demonstrated. Mediolateral episiotomy at an angle of at least 60° from the midline or lateral episiotomy are recommended. A restrictive policy regarding episiotomy is recommended: <30 % in total, <50 % for primiparas, <10 % in multiparas. Episiotomy is clearly indicated for fetal compromise, and, consensually, instrumental deliveries. Perineal mapping is helpful in deciding whether episiotomy might be useful. A qualified approach to the protection of the perineum should be applied to all deliveries including those with episiotomy. A continuous non-locking suturing technique for all layers using fast-absorbing synthetic material is currently the recommended standard for episiotomy repair.

V. Kalis, MD, PhD (✉) • Z. Rusavy, MD
Department of Gynecology and Obstetrics, University Hospital and Faculty of Medicine, Charles University, Alej Svobody, Pilsen 304 60, Czech Republic
e-mail: kalisv@fnplzen.cz

M. Prka, MD
Department of Obstetrics and Gynecology, Zagreb University School of Medicine, Clinical Hospital "Sveti Duh", Zagreb, Croatia

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Keywords
Episiotomy • Definition • Classification • Midline episiotomy • Mediolateral episiotomy • Lateral episiotomy • Perineal trauma • Healing • Pain • Sexuality • Dyspareunia • Incontinence • Anal incontinence

Historical Landmarks

Episiotomy is globally the second most common surgical procedure after umbilical cord ligation (also obstetrical) [1]. It was first described more than 270 years ago [2]. During the eighteenth and nineteenth centuries this procedure was rarely applied [3] until 1921 when De Lee advised using mediolateral episiotomy during forceps deliveries [4]. The labour was seen to be a disease producing, and therefore, "decidedly pathologic process." Historically, physicians were trained to intervene in to a disease process, including protecting the mother from the morbidity of childbirth [5]. Coincidently, at that time, a movement from home to hospital delivery was taking place, with a significant increase in all obstetrical operations. As a result of these factors, an increase in the use of episiotomy was registered over the following years. Another turning point occurred in 1982 when Banta and Thacker contested the well-established opinion that routinely performed episiotomy reduces maternal and neonatal morbidity [6, 7]. Their findings had a great impact on the global scientific community. This can clearly be seen in the continuous growth in the number of articles published annually from 1983 until the present day, by searching for the key word "episiotomy" in the PubMed database [8] (Fig. 6.1). The result was the overthrow of routine episiotomy and the introduction of a more restrictive use of episiotomy in everyday obstetric practice.

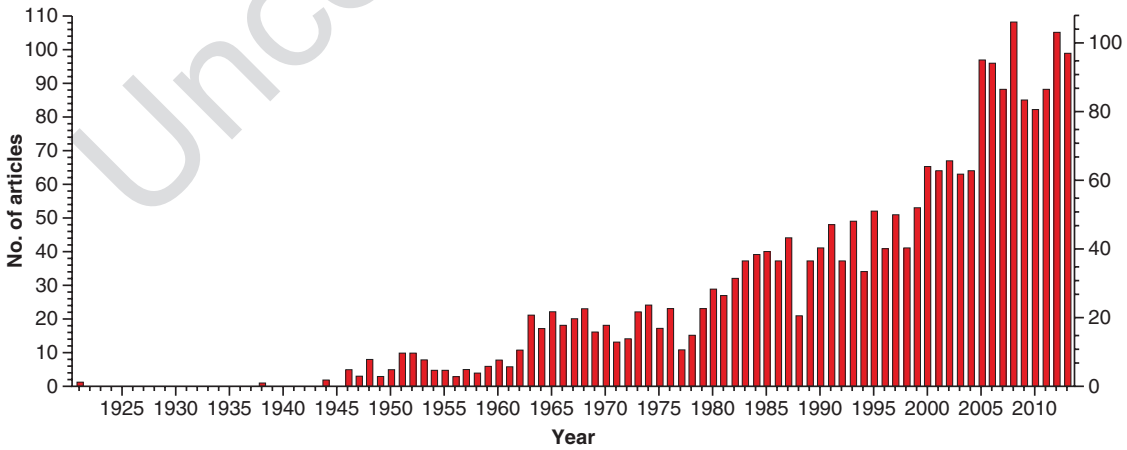

Fig. 6.1 Number of published articles per year (1921–2013) searching for the keyword *episiotomy* in the PubMed database [7]

Definition, Classification, Types of Episiotomy

Episiotomy is a surgical enlargement of the vaginal orifice by an incision to the perineum during the last part of the second stage of labor or delivery [7, 9]. It should always be defined by the following combination of parameters; the location of the beginning of the incision, the direction, the length, and the exact timing of the procedure. A recent analysis [10] revealed that the standard research texts usually describe only two main types of episiotomy (midline and mediolateral) [9, 11–13]. The term lateral episiotomy has only lately started to be re-used [14–19]. Therefore, a classification system of episiotomies [10] is important in order to improve the quality of methodology in future research and to facilitate the comparison of different studies.

A thorough analysis of the literature [10] revealed seven main types of episiotomy: midline, modified median, J-shaped, mediolateral, lateral, radical lateral, and anterior (Fig. 6.2).

Midline (median, medial) **episiotomy** begins at the fourchette and extends to a half of the length of the perineal body [10, 11, 20].

Modified median episiotomy differs from the previous type by two transverse cuts in opposite directions slightly anteriorly of the expected margins of the external anal sphincter (EAS) [21]. Transversely, only subcutaneous tissues, not the skin, may be incised.

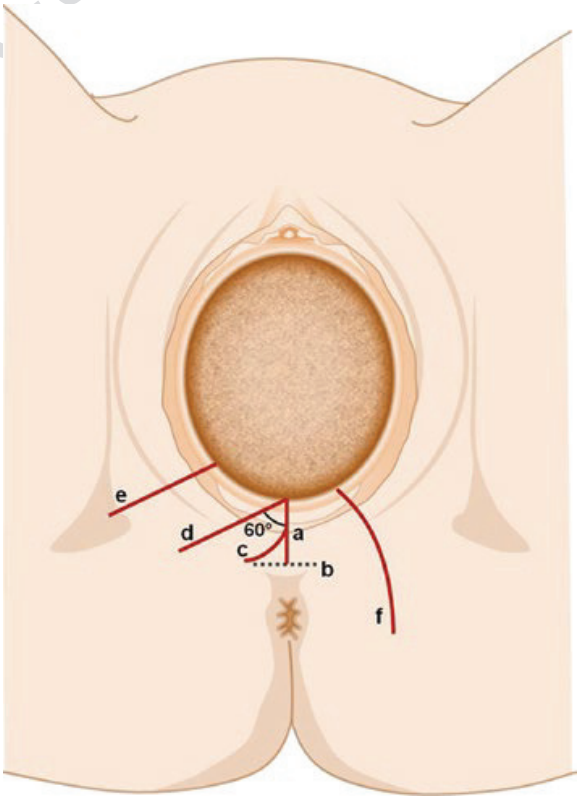

Fig. 6.2 Types of episiotomy. Key: *a* midline episiotomy; *b* modified median episiotomy; *c* J-shaped episiotomy; *d* mediolateral episiotomy; *e* lateral episiotomy; f radical lateral (Schuchardt incision) (Illustration adapted from Hakan Soken, MD, Eskisehir Military Hospital, Turkey, hsoken@hotmail.com)

"J-shaped" episiotomy runs initially as a midline incision and then at approximately 2.5 cm from the anus is curved to avoid the anal sphincter [10, 22, 23]. The latter part of episiotomy is directed towards the ischial tuberosity [24].

Mediolateral episiotomy is a compromise between midline and lateral episiotomy. The results of recent research clearly demonstrate that the definition of mediolateral episiotomy has thus far been unsatisfactory [27–30]. A wide variety in the clinical performance of mediolateral episiotomy has been observed between countries and institutions [29] as well as between individual doctors and midwives [27, 28]. Based on studies by Tincello et al. [27], Eogan et al. [32], and Kalis et al. [30, 33] evaluating the placement of episiotomy, an angle of episiotomy of 60° has been proposed as part of the definition [10]. Therefore, mediolateral episiotomy is defined as an incision starting at the posterior fourchette in the midline and directed at an angle of at least 60° towards the ischial tuberosity [10, 33].

Lateral episiotomy begins in the vaginal introitus 1–2 cm laterally from the midline and is directed towards the ischial tuberosity [24, 34–37]. This type has been reported in only one RCT [19]. The Cochrane review [9] suggests that: "*There is a pressing need to evaluate which episiotomy technique (mediolateral or midline) provides the best outcome*" thus not taking lateral episiotomy into account [9]. Also, a review analyzing seven commonly sold general textbooks [39] evaluates whether *"both methods of performing episiotomy (median/mediolateral)"* are discussed in the texts, so again no other type of episiotomy is mentioned. However, it has been found that lateral episiotomy has in fact been used, albeit unintentionally by wider medical community, in Europe [28, 29]. In both Finland and Greece this type of episiotomy is used routinely [14, 40, 41].

Radical lateral (Schuchardt incision) is an original non-obstetrical episiotomy performed at the beginning of radical vaginal hysterectomy or trachelectomy [42–44], starting as lateral episiotomy but passing around the rectum in a downward, lateral curve [45]. Only rarely it is recommended as an aid to childbirth during complicated deliveries [35, 37, 45].

Anterior episiotomy (deinfibulation – opening the scar associated with female genital mutilation). A potential choice for labour and also antenatally [20, 46], the anterior scar tissue is incised in the midline up to the urethra [47]. Due to the possibility of tissue stretching at the end of delivery, it may be deemed necessary to employ an alternative type of episiotomy.

To improve the methodological quality of studies evaluating episiotomy, the authors present the following proposal for a detailed classification of episiotomies, Table 6.1.

Significance of the Placement of Episiotomy

An evaluation of studies and reviews, where the majority focussed on mediolateral episiotomy, has found that the methodology is very often poorly organised [57]. Four main problems were defined: diagnostics and classification of the perineal trauma, and the definition and practical implementation of mediolateral or lateral

Table 6.1 Types and characteristics of episiotomies [10]

Type of episiotomy	Location of the initial incision	Direction of the cut
Midline	within 3 mm of the posterior fourchette (midline)	between 0 and 25° of the midline
Modified median	within 3 mm of the posterior fourchette (midline)	between 0 and 25° of the midline
"J shaped"	within 3 mm of the posterior fourchette (midline)	At first midline, then "J" is directed towards the ischial tuberosity
Mediolateral	within 3 mm of the posterior fourchette (midline)	Directed laterally at an angle of at least 60° towards the ischial tuberosity
Lateral	1–2 cm from the midline	Towards the ischial tuberosity
Radical lateral (Schuchardt incision)	1–2 cm from the midline	Towards the ischial tuberosity and around the rectum
Anterior	Midline	Midline, directed towards the pubis

episiotomy [57]. Evaluating the methodology of studies included in the Cochrane review [9], only two studies looked at median episiotomy [58, 59], and none of the others described the positioning of mediolateral episiotomy sufficiently [25, 60–64], suggesting that the methodology did not fulfill current requirements and no clear conclusions may be drawn, especially with regards to severe perineal trauma.

There is growing evidence that the exact placement of episiotomy plays an important role in the degree of perineal trauma [14, 15, 32, 65–67]. At crowning, the perineal body is particularly exposed to a high degree of deformation. After delivery, the strain on the perineal tissues and edema recedes, and subsequently the deformation disappears. The significant alterations in the geometry of the perineal region result in a difference between the observed episiotomy locations: at the time of incision, after repair, and later postpartum [68]. Based on perineo-anthropometric studies [30, 32, 33] three new terms have been introduced: incision angle, suture angle and scar angle of episiotomy [33]. It has been shown that a mean incision angle of 40° falls to 20° after suture [30] while that of 60° falls to 45° [33]. Analysis showed a 50 % relative reduction in the risk of obstetric anal sphincter injuries (OASIS) for every 6.3° that the episiotomy scar lies away from the perineal midline [32]. This finding was later supported by Stedenfeldt who also found that episiotomy cut too short and at too wide an angle also carried a higher risk of OASIS [65].

In many retrospective studies [69–72] as well as in a recent RCT [59] midline episiotomy was associated with an increased risk of OASIS and consequent functional damage. A significantly higher incidence of OASIS was also found for midline episiotomy in comparison to the mediolateral type [26, 73–76]. Mediolateral episiotomy has consistently been found to be protective in instrumental vaginal deliveries [77–79] whereas midline episiotomy has been associated with a significant increase in OASIS [80]. Lateralisation of episiotomies as a part of a set of obstetric interventions contributed to an immediate significant decrease in OASIS

in Norway [66, 67, 81]. Lateral episiotomies have consistently been found to be protective in primiparous women [16, 17], the effect of mediolateral episiotomies has differed between studies [82–86], and midline episiotomy has never been found protective [7, 9, 87, 88]. A recent RCT evaluating properly performed mediolateral and lateral episiotomies has shown a low incidence of OASIS amongst primiparous women [89]. Two procedures that appear to be among those that best divert principal perineal tissue strain away from the midline appear to be appropriately executed mediolateral episiotomy as well as properly performed executed lateral episiotomy [89].

Conclusion

The exact placement of incision of episiotomy has a significant role in the subsequent severity of perineal trauma. Lateralisation of episiotomies has significantly decreased the incidence of OASIS. Either mediolateral episiotomy at an angle of at least 60° from the midline or lateral episiotomy are recommended if indicated. If in a study design the type of episiotomy differs from internationally recognized mediolateral or lateral episiotomy, then specific details of the episiotomy characteristics are required.

Episiotomy Goals and Indications

The performance of episiotomy to expedite delivery in cases of non-reassuring fetal status by shortening the second stage of labour is currently a generally accepted approach. There does however remain a lack of professional consensus regarding other specific episiotomy indications. The commonly argued goals and indications include:

1. Prevention of OASIS and of pelvic floor dysfunction either in general, or in the following cases: short perineum, instrumental delivery *(*see the section "Episiotomy and instrumental deliveries"), fetal macrosomia, prolonged second stage of labor, imminent perineal tear, history of episiotomy or OASIS in previous delivery.
2. Providing space for the facilitation of difficult deliveries (i.e., shoulder dystocia, persistent occiput posterior presentation, breech delivery),
3. Lack of self-control or cooperation of the mother.

The Role of Episiotomy in Prevention of OASIS

The protective effect of episiotomy against OASIS is a matter of controversy and largely depends on the type of episiotomy. The estimated risk of OASIS in women undergoing midline episiotomy is six times higher than in the case of mediolateral episiotomy [64], while women giving birth without a mediolateral episiotomy were

1.4 times more likely to experience OASIS [75]. In spite of the fact that mediolateral episiotomy was occasionally identified as an independent risk factor for OASIS [76], a large Dutch retrospective study demonstrated its protective effect [73]. Interestingly, no difference was observed in the prevalence of OASIS when comparing maternity units with either a restrictive or routine approach to episiotomy [73]. While midline episiotomy increases the risk of OASIS, the role of mediolateral episiotomy in OASIS prevention depends upon the correct identification of the risk group of patients and upon its correct execution. A protective effect of lateral episiotomy was consistently demonstrated [81].

The Role of Episiotomy in Prevention of Pelvic Floor Dysfunction

Episiotomy has not been found to confer benefits with respect to preserving continence or pelvic floor muscle function within a period of months or years after birth [82]. Mediolateral episiotomy was, in some studies, associated with a lowered strength of the pelvic floor muscles in comparison with spontaneous perineal lacerations [83]. On the other hand, a recent prospective cohort study suggested that while women with perineal lacerations in two or more deliveries were at a significantly higher risk of prolapse 5–10 years after the first delivery, women with a history of even multiple episiotomies showed no increase in the risk of suffering a prolapse [84]. Nevertheless, although well established in clinical practice, the prevention of pelvic floor dysfunction alone, as an indication for episiotomy, is hardly justifiable at present.

Short Perineum

The association between short perineal body length and the risk of OASIS is controversial. A perineum shorter than 4 cm in the first stage of labor was associated with traumatic vaginal delivery [85]. However, the mean perineal length ranges from 3.6 to 4 cm [86]. The phenomenon of perineal second-stage stretching is to be considered. Second-stage perineal stretching >150 % was found to be predictive of perineal damage and assessment of perineal stretching was suggested to avoid unnecessary episiotomies [87]. However, the stretching did not correlate with the degree of trauma among multiparous women [86]. No data exist suggesting any benefit of performing episiotomy in cases of a short perineum or low perineal stretching. Apart from a short perineum, the range of anal dilation in the final phase of labour may contribute to the degree of perineal trauma [88].

Fetal Macrosomia

It is generally acknowledged that fetal macrosomia is an important risk factor of OASIS. Prevalence estimates of OASIS based on published odds ratios have demonstrated no preventive effect of episiotomy in the delivery of a macrosomic fetus.

However, the type of episiotomy used was not provided in these studies and could possibly have been midline [89–91]. The type of episiotomy certainly plays an important role; however, there is no data evaluating the benefits of different types of episiotomy in deliveries of macrosomic infants.

Imminent Perineal Tear

A German RCT demonstrated benefit of avoiding episiotomy in cases of impending perineal tear. This practice was associated with an increased frequency of intact perineum or minor trauma, reduction of postpartum perineal pain, and with no increase in maternal or neonatal morbidity [51]. A follow-up of this study proved that episiotomy at the time of impending perineal tear is not beneficial for the preservation of pelvic floor function [92].

History of Episiotomy or Severe Perineal Trauma in a Previous Delivery

Episiotomy performed at a first vaginal delivery is a significant independent risk factor of repeated episiotomy and spontaneous perineal tears in a subsequent delivery [93]. Episiotomy at first delivery was associated with more than a four-fold risk of perineal laceration in subsequent childbirth [94]. The data encouraged further restrictions in episiotomy use. There are no data supporting routine episiotomy in a childbirth with previous OASIS.

Space for Necessary Interventions or Maneuvers in Difficult Deliveries

Preventive episiotomy is commonly performed to facilitate maneuvers in difficult deliveries such as malpresentations or anticipated shoulder dystocia. In spite of historical recommendations that episiotomy should be performed for brachial plexus injury prevention when shoulder dystocia is encountered, recent evidence has demonstrated no neonatal benefit of this practice [95]. Performing fetal manipulations without midline episiotomy in severe shoulder dystocia leads to a reduction in the risk of OASIS without incurring a greater risk of brachial plexus injury [96]. Moreover, use of mediolateral episiotomy in instrumental delivery did not reduce the risk of shoulder dystocia [97]. Therefore, episiotomy in cases of shoulder dystocia should be reserved for cases where maneuvers to effect delivery cannot be reasonably achieved without episiotomy [95].

There is not enough evidence regarding the relationship between persistent occiput posterior position, episiotomy and perineal trauma. A French cohort retrospective study found that mediolateral episiotomy is not protective against OASIS in cases of persistent occiput posterior positions [98].

Likewise, there is not enough data regarding the relationship between episiotomy and breech delivery. Although episiotomy is quite common for breech delivery in clinical practice, a restrictive approach can also be employed. Based on a Dutch perinatal register, mean episiotomy rate in term breech delivery was 72 % in 1990, with a wide variation among hospitals (19–100 %) [99].

Self-Control of the Woman

The risk of laceration is increased in a patient, who is not capable of good self-control (i.e. unable to respond to directions) and some accoucheurs prefer to cut an episiotomy. Nevertheless, no data exist regarding the benefits of this practice.

Conclusion

Analysis of episiotomy indications is an important step in the identification of patients, who could really benefit from this obstetric intervention. This approach leads to a reduction in the frequency of episiotomy while preserving, or even improving the standard of care. Apart from a clear indication for episiotomy, i.e., shortening of the second stage of labour in case of suspected fetal compromise, there are many other indications of episiotomy. While the existing evidence suggests that most of these indications are not justified per se, there are circumstances in which a prudent clinical judgment necessitates an episiotomy. In these cases, mediolateral or lateral episiotomy should be preferred.

Episiotomy and Instrumental Deliveries

Traditionally, episiotomy has been a routine component of instrumental delivery, the primary aim being to avoid OASIS. However, the use of instrumental delivery in combination with midline episiotomy was associated with a significant increase in the risk of OASIS in both primiparous and multiparous women [71]. Time trends support a reduction in OASIS by restricting the liberal use of the two modifiable variables: midline episiotomy and forceps delivery [100].

Routine use of mediolateral episiotomy in instrumental delivery is recommended by the National Institute for Health and Care Excellence (NICE) [101]. National surveys in the UK and Ireland revealed that two-thirds of obstetricians held the view that routine use of episiotomy decreases the likelihood of OASIS for a forceps delivery while having a divided view as to vacuum extraction [102]. In the only RCT comparing routine versus restrictive use of episiotomy for instrumental delivery, routine use of episiotomy was not associated with a statistically significant difference in the incidence of OASIS (8.1 % vs. 10.9 %) [103]. However, subsequently and with regards to the same population, Macleod et al. [104] found that restrictive use of episiotomy for instrumental delivery may increase immediate

postpartum morbidity, in particular the incidence of perineal pain and stress urinary incontinence. The type of episiotomy or its precise placement were not recorded and neither were the complete spectrum of other obstetric interventions [103, 104].

Two large retrospective population-based register studies from the Netherlands suggested that mediolateral episiotomy reduces the risk of OASIS in instrumental delivery [68, 69]. De Leeuw et al. demonstrated that mediolateral episiotomy significantly protected against OASIS in both vacuum extraction and forceps [68]. Twelve mediolateral episiotomies were needed to prevent one case of OASIS concerning vacuum extraction, whereas five mediolateral episiotomies could prevent one case of OASIS with regards to forceps. Another Dutch group found a sixfold decrease in the risk of OASIS when mediolateral episiotomy was performed in women undergoing instrumental deliveries [69]. According to this study, the known adverse effects of mediolateral episiotomy (e.g., short-term perineal pain, dyspareunia) cause less morbidity compared with the known adverse effects of OASIS (e.g., fecal incontinence).

In a similar Finnish study evaluating vacuum extraction, lateral episiotomy decreased the incidence of OASIS by 46 % in primiparous but not in multiparous women [17].

Conclusion

The significant risk-reducing effect of mediolateral or lateral episiotomy warrants their use in all instrumental deliveries at least with regards to primiparous women, as opposed to the use of midline episiotomy which carries a considerable risk of the occurrence of OASIS in instrumental deliveries.

Episiotomy Rate

Although there is a growing general consensus about restricting the use of episiotomy, no such agreement has emerged as to what constitutes an appropriate episiotomy rate [105]. Carroli and Belizán have established that a restrictive episiotomy rate above 30 % is not clinically justified [25]. Episiotomy rates around the world range from as low as 9.7 % in Sweden to 100 % in Taiwan, while half of all countries exceeded the recommended rate of 30 % [40, 105, 106]. Moreover, episiotomy rates vary with regards to parity. Results from large epidemiologic studies from restrictive episiotomy settings where total episotomy rate remained under 30 % showed an episiotomy rate of 55–65 % in primiparous women [107, 108].

When defining the lower limit for “safe” episiotomy rate, it is important to take into account the type of episiotomy being used and the quality indicator for determining the success of the restrictive approach. The quality indicator commonly used is the OASIS rate.

In the USA, a restrictive approach to midline episiotomy in spontaneous deliveries resulted in a reduction in the OASIS rate from 5 to 3.5 % [109]. In Australia a significant correlation was registered between increasing mediolateral episiotomy use, from 12.6 to 20.1 %, and a reduction in the OASIS rate, from 4.4 to 2.1 % [110]. Both lateral

(in Finland and Norway) and mediolateral episiotomy (in Sweden, Denmark and Norway) are used in Nordic countries. Within the last 10 years a falling trend in the use of episiotomy was registered in Denmark (10 % vs. 5 %) and Sweden (9 % vs. 6 %) while the rate remained unchanged in Norway (20 % vs. 19 %) and stayed higher in Finland (42 % vs. 24 %). However, OASIS incidence in Finland has been notably lower (0.7–1 %) than in the other Nordic countries (2.3–4.2 %). A significant and constant reduction in OASIS incidence has only been observed in Norway (from 4.1 to 2.3 %, $p<0.001$) [111, 112]. This reduction occurred simultaneously with the introduction of a national intervention program of improved delivery techniques aiming at reducing the incidence of OASIS [57, 112].

Conclusion

Nowadays, taking into account different episiotomy types (midline, mediolateral, lateral), it is necessary to find a balance between the lowest reported (total: 5 %, primiparas: 10 %, multiparas: <5 %) and the optimal (total: <30 %, primiparas: 50 %, multiparas: <10 %) episiotomy rates for both spontaneous and instrumental deliveries with regards to the OASIS rate of between 1 % and 5 % depending on the strengths of the restrictive approach and the type of episiotomy applied.

Timing of Episiotomy

The optimal time for performing an episiotomy is unclear and depends largely on the indication. In cases where prophylactic episiotomy is performed, i.e. to facilitate a forceps delivery or to expedite delivery, it is recommended to perform episiotomy when the head is visible during a contraction to a diameter of 3–4 cm [20]. However, with restrictive approach to episiotomy, the indication often arises during the crowning. It is important to bear in mind the significant difference in the change of the angle of mediolateral episiotomy between time of cut and after repair depending on the timing of the episiotomy [30]. Performing episiotomy early before crowning of the fetal head is associated with increased blood loss [113]. Some authors have argued that performing episiotomy too late compromises the protection of the maternal perineum. According to their opinion, at the time of crowning, the fetal head has already torn the perineal muscles and the damage of the supporting structures has already occurred [24, 114, 115]. However, no valid studies have been performed to support this expert opinion.

Episiotomy Repair

Reduction of maternal discomfort during episiotomy repair and short- and long-term maternal morbidity following this procedure can be achieved with the use of an appropriate type of analgesia, the choice of quality suture materials and the application of modern suturing techniques.

The level of analgesia/anaesthesia should be adequate for the episiotomy repair. If the patient received an adequate epidural anaesthesia during labour, it can be used to provide analgesia for the repair. Pudendal nerve block or local field block is generally adequate if there is no pre-existing analgesia.

Several studies have shown the advantages of fast-absorbing polyglactin 910 for episiotomy repair [116–119]. Meta-analysis revealed that, comparing standard synthetic with fast-absorbing sutures for repair of episiotomy and second-degree tears, short- and long-term pain scoring was similar [120]; in one trial fewer women with fast-absorbing sutures reported using analgesics at 10 days (RR 0.57) [119]. More women in the standard synthetic group required suture removal compared to those in the fast-absorbing group (RR 0.24) [119, 120].

For more than 80 years, researchers have been suggesting that continuous non-locking suture techniques for repair of the vagina, perineal muscles and skin are far better than "traditional" interrupted methods in terms of reduced postpartum pain [119, 121–123]. Recent meta-analysis showed that continuous suture technique, when compared with interrupted sutures for episiotomy or second-degree tear repair (in all layers or perineal skin only), are associated with less perineal pain for up to 10 days postpartum (RR 0.76) [124]. There was an overall reduction in analgesia use associated with the continuous subcutaneous technique versus interrupted stitches for repair of perineal skin (RR 0.70). There was also a reduction in suture removal in the continuous suturing groups versus interrupted (RR 0.56), whereas no significant differences were seen in the need for re-suturing of wounds or in long-term pain.

Several case studies and one small randomized trial have suggested that tissue adhesives could be used instead of stitches for episiotomy repair [125–128]. However, these agents are expensive and not all are widely available so further research is needed to determine the safety and efficacy of this approach.

Conclusion

Continuous non-locking suturing technique for all layers using fast-absorbing synthetic material is currently the recommended standard for the episiotomy repair. See Fig. 6.3a–d.

Episiotomy and Healing Complications. Resuturing of Episiotomy

Complications can occur in any healing process. In episiotomy and/or any degree of perineal trauma, the following variables are usually evaluated: episiotomy dehiscence and need for surgical re-intervention, infection of episiotomy and need for antibiotic treatment, haematoma in episiotomy, and the need for removal of suture material [9]. These variables have not been evaluated in any significant detail and extensive data are not available due to the relatively low prevalence of these complications which vary between 0.1 and 2.1 % [129–132].

For an overall evaluation of healing complications in episiotomy suture, the REEDA scale is generally used [133] in spite of some limitations to the

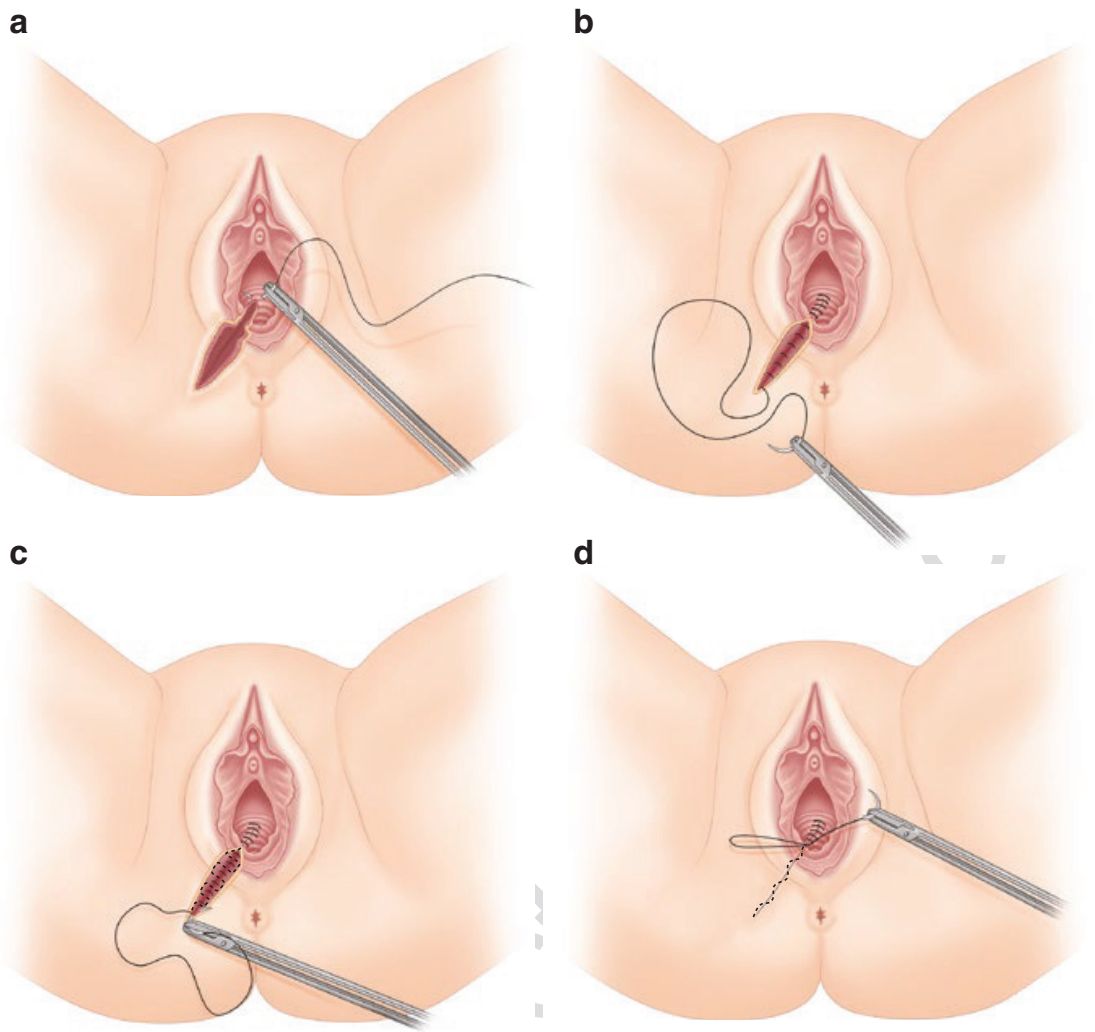

Fig. 6.3 Episiotomy repair using continuous non-locking suture (all layers). (**a**) Episiotomy repair, suturing of vaginal wall. After perineal infiltration with local anaesthetic, carefully insert first stitch to the vagina above the apex of episiotomy cut and tie a knot there. (**b**) Episiotomy repair, suturing of perineal muscles. Bring together vaginal edges with continuous non-locking stitches placed roughly 1 cm apart. Appose divided perineal muscles and deep subcutaneous tissue. Approximate skin edges as much as possible. (**c**) Episiotomy repair, approximation of the skin edges. Starting from the bottom edge of the episiotomy cut, close perineal skin in the opposite direction towards the vaginal orifice using subcuticular continuous suture. (**d**) Episiotomy repair, knotting of the stitch. Place the subcuticular stitch in the vagina just above the remnants of the hymen and tie a knot there (Illustrations adapted from Hakan Soken, MD, Eskisehir Military Hospital, Turkey, hsoken@hotmail.com)

interrater reliability evaluation [134]. This scoring system contains five domains: redness, edema, ecchymosis, discharge and approximation of the edges of the suture [133].

Dehiscence

In a recent study, dehiscence of episiotomy suture requiring further treatment was found in 1 % [129]. The technique of episiotomy repair, choice of material, instrumental delivery, OASIS, perineal body length and neonatal weight along with a

surgeon's inexperience were all found to be contributing factors for dehiscence of episiotomy suture [130, 135–143].

There is no current consensus on the definition of episiotomy dehiscence. Dehiscence may vary in severity from a mild superficial detachment of the skin to extensive separations involving a complex of anal sphincters and rectal mucosa [135]. If a more specific clinical definition is provided, a wound gaping of more than 0.5 cm [144] or complete separation of mucosa of at least 50 % of the episiotomy length [135] were used.

Infection

Infection is defined clinically by the presence of sero-purulent or purulent discharge or fever [129]. Infection is a major cause of episiotomy dehiscence occurring in 0.05–0.5 % [145, 146]. In a study by Uygur et al. [129] 67 % of dehiscences were infected. Microbiological or imaging examinations are not required to confirm the diagnosis except in severe cases requiring re-hospitalization [143]. Poor postpartum perineal hygiene or hematoma in episiotomy suture might be contributing factors [135].

Prevention of Dehiscence and/or Infection in Episiotomy

Prevention involves reducing exposure to the risk factors (see above) combined with adequate postpartum care. A satisfactory standard of episiotomy repair technique minimizes the risk of haematoma, tissue ischaemia, and inadequate approximation. Postpartum daily routine inspections of the perineal area are essential [147, 148].

Resuturing of Episiotomy

There is a paucity of evidence on the management of episiotomy dehiscence. A recent Cochrane review [149] includes only two small studies [145, 150] with a total of 52 participants. Conservative therapy consists of the cleaning of the dehiscence with local antiseptics and local or systematic application of antibiotics. The process of granulation results in spontaneous healing [129, 150].

Nowadays, some guidelines [38] and the majority of studies suggest good results with active local therapy including irrigation, devitalized tissue debridement and a sitz bath several times a day with an eventual systematic application of antibiotics followed by early resuturing, usually within 4–10 days [129, 150–152]. An earlier resumption of sexual intercourse has been observed after resuturing compared to conservative management [150]. Resuturing should be performed after careful debridement when the surface of the dehiscence is clean and its margins covered by pink granulation tissue [151]. During surgery, debridement of this granulation tissue is also performed [151]. It is not important whether a continuous running suture or interrupted sutures are used. However, mid-term absorbable suturing material is recommended [129, 135]. After resuturing, sitz baths should be continued. Administration of antibiotics is considered on an individual basis.

Conclusion

The recommended technique of episiotomy repair, adequate hygiene and regular postpartum inspection of the perineum reduce complications of the healing process.

Episiotomy and Perineal Pain

Episiotomy is a common cause of postpartum perineal pain [9, 26, 55, 153, 154]. The presence and intensity of the pain is associated with the degree of perineal injury [153, 155–157], instrumental delivery, parity, duration of delivery [154, 158], type of suturing material [116–118, 120] repair technique [119, 124] or analgesia used [159–166]. Currently, the most commonly used scoring systems are two components of SF-MPQ [167]: The Visual Analogue Scale (VAS) and Present Pain Intensity (PPI), and the four-point Verbal Rating Score (VRS) [168].

Post-episiotomy pain affects up to 97 % of women on the first day [26, 154] and up to 71 % of women 7–10 days postpartum [154]. Comparing routine and restrictive approaches, the current version of the Cochrane review [9] has found a higher incidence of pain in the routine approach at discharge [25] but no difference at 3 and 10 days and 3 months postpartum [54, 55]. Women with undergoing a routine approach to episiotomy registered more maximum intense pain within the first 5 days postpartum [51]. However, in the long term, there was no difference observed in the prevalence of perineal pain between routine and restrictive approaches [169, 170].

There are very few studies comparing different types of episiotomy and perineal pain. In a quasi-randomized trial comparing midline and mediolateral episiotomies no difference in pain was observed 3 months after delivery [26]. The only study, with a retrospective design, evaluating perineal pain after mediolateral and lateral episiotomies and only one day postpartum found no difference in perception of pain [18].

When deliveries with episiotomy were compared to deliveries without episiotomy, the incidence of short-term episiotomy pain was similar on the 1st, 7th or 10th postpartum day regarding spontaneous first- and second-degree perineal tears, but higher than figures for an intact perineum and lower than those for OASIS [153, 154]. No difference was observed at 6 weeks [154]. At 3 months the incidence of post-episiotomy perineal pain was similar compared to spontaneous first- and second-degree tears but the frequency and intensity were higher in the episiotomy group [153].

Prevention

Antenatal perineal massage [171, 172], application of warm perineal packs/compresses during the second stage [173, 174] and manual perineal protection (MPP) [175] may decrease the rate of postpartum perineal pain. If episiotomy is indicated, midline episiotomy should not be selected. Midline episiotomy significantly increases the risk of OASIS, the main cause of intense and long-term perineal pain. Another type of episiotomy should be used.

Current standards of episiotomy repair reduce post-episiotomy pain [119]. An epidural provided during labor can be used to relieve any immediate pain. If an epidural has not been provided, immediate pharmacological analgesia (rectal, oral, occasionally subcutaneous or intramuscular) can lower the maximum intensity of postpartum pain usually occurring during the first 24 h [157, 159–166]. Application of local cooling tools can reduce the subsequent development of oedema and haematoma, which contribute to perineal pain [166, 176, 177].

Treatment

Post-episiotomy pain can be significantly reduced using analgesics. There are a number of products available and several methods of administration (oral, local, rectal, etc.) can be used. A combination can enhance the effect.

A variety of oral analgesics can be used. The effects of non-steroidal anti-inflammatory drugs (NSAID): acetaminophen, celecoxib, diclofenac, indomethacin, ketoprofen or paracetamol alone or in combination were reported [157, 159, 161–163]. Diclofenac administered either orally or rectally has been found to be more effective or faster acting than others [159, 161, 162]. However, oral celecoxib has shown a larger reduction of pain score on VAS compared to oral diclofenac [163]. Rectal suppositories showed the best effect compared to oral analgesics or ice packs [157]. No trials included in the Cochrane review showed any difference in pain relief when a local anaesthetic was compared with placebo [165]. Several non-pharmacological methods have also been tested. Application of ice packs and cold gel decreased the pain in comparison with cases when no treatment was applied while gel pads were preferred over ice packs or no treatment [157, 166].

Conclusion

Current data suggest that there is no difference in perception, frequency and intensity of pain between different types of episiotomy. However, there is a paucity of literature addressing this problem. Post-episiotomy pain seems to be slightly (not significantly) increased compared to spontaneous first- and second-degree tears in the short to mid-term. However, the short-term pain is reducible with the use of analgesic agents.

Episiotomy and Sexual Function

Any childbirth, and particularly vaginal delivery, may change the qualitative level of sexual function. There are many sexual function related outcome measures to be followed. The main sexual components – desire, arousal, lubrication, orgasm, satisfaction and pain – are included in the most common tool used to evaluate postpartum sexuality, the Female Sexual Function Index (FSFI) [178]. Another scoring system frequently used is the McCoy Female Sexuality Questionnaire [179].

Apart from episiotomy and perineal trauma, sexual function after delivery can be subject to other variables: maternal age [180–182], partnership status [182, 183], breastfeeding [153, 181, 183–188], overall health and mental [183, 189] and physical status (including the partner's) [182], pre-pregnancy dyspareunia [184, 185, 190], instrumental delivery [191, 192] or parity [153, 183, 193, 194].

Resumption of Sexual Intercourse

After vaginal delivery with episiotomy, one-third of women has resumed vaginal sex by 6 weeks, two-thirds by 3 months and 90 % by 6 months [181–184, 186, 195]. At 12 months 95–100 % of women in all groups have resumed vaginal sexual intercourse [182, 183].

Primiparous women with episiotomy re-initiated their vaginal sexual intercourse later than those after vaginal delivery with an intact or unsutured perineum [182]. Comparisons with women after caesarean section have been conflicting [182, 191, 195–201], a large RCT reported no effect on resumption of sexual activity or sexual dysfunction [201]. There has been no significant difference found when episiotomy was compared to spontaneous sutured tears [182, 195]. However, women with first- and second-degree tears had less pain at first postpartum sexual intercourse than women with episiotomy [153].

Sexual Function in the Short Term

In comparing restrictive and routine approaches [9] the Cochrane review has included the data of only one trial [169] evaluating a resumption of intercourse and dyspareunia at only 3 months after the index delivery. No significant difference was noted in either of these [9, 169]. In other Cochrane reviews short-term absorbable synthetic sutures when compared to catgut [120], and continuous technique of repair for all layers when compared to interrupted stitches [124] resulted in significantly lower rate of dyspareunia at 3 months.

The rates of dyspareunia after mediolateral or midline episiotomy vary between 8 and 73 % at 3 months [181, 184, 191] and 11 and 36 % at 6 months [33, 181, 184, 191]. In a study by Barrett et al. [184] the rate of dyspareunia after episiotomy compared to that after spontaneous perineal tears was non-significant and was higher than in women with an intact perineum at 6 months. Vaginal tearing has been found to be a higher risk factor than episiotomy [183, 184]. There has not yet been any data gathered on the consequences after lateral episiotomy.

Sexuality in the Long Term

In a study by Ejegård et al. and Bühling et al. [185, 191] there was no difference in sexual satisfaction or sexual function between women with or without episiotomy at 12–18 months postpartum. However, dyspareunia [185, 191, 202] and

vaginal dryness [185] were more frequent in women after episiotomy. Long-term comparisons to second-degree tears are conflicting [185, 191]. Anyway, the most significant risk factor for long-term postpartum dyspareunia was previous dyspareunia [184, 185, 190]. Also, long-term postpartum dyspareunia seemed to be related more closely to the mother's experience of delivery than to perineal trauma [190].

Conclusion

Human sexuality is a complex interaction involving biological, sociocultural, and psychological factors in which episiotomy plays a limited role. The current data regarding postpartum sexual function are unclear because of the high variety of measured outcomes [203]. Breastfeeding [153, 181, 183–188], previous dyspareunia [184, 185, 190], instrumental delivery [191, 192] and OASIS [153, 155, 181, 183, 195] are consistent risk factors for postpartum dyspareunia or impairment of sexual activity.

Reducing perineal trauma (i.e., episiotomy or spontaneous tears) during delivery to the greatest extent possible is important for the resumption of sexual intercourse after childbirth [153, 181]. Episiotomy is occasionally considered to be more significant for short-term postpartum dyspareunia compared to spontaneous tears without OASIS. However, overall sexual satisfaction seems to be equal. Adequate episiotomy repair significantly decreases the rate of postpartum dyspareunia.

Episiotomy and Incontinence

Urinary Incontinence

Urinary incontinence (UI), the involuntary loss of urine, is a frequent consequence of pregnancy and childbirth. The cumulative incidence of de novo UI during pregnancy is 39 % [115]. Furthermore, 33 % of women reported symptoms of UI 3 months postpartum [204] and 31 % of women 6 months after delivery [205]. No difference was reported in the frequency of postpartum stress urinary incontinence (SUI) in patients with and without episiotomy at 3 months postpartum (13 % vs. 12 % [83] and 29 % vs. 35 % [206]). Regarding urinary urgency incontinence (UUI), two North American studies found episiotomy to be statistically significant in univariate, but not multivariate analysis 4 and 7 months after delivery [207, 208]. In a retrospective Italian study, women after laterally positioned episiotomies registered a non-significantly lower rate of UUI and significantly lower King's Health Questionnaire (KHQ) scores compared to a group with no episiotomy 12 months after delivery [209].

Anal Incontinence

Anal incontinence (AI), the involuntary loss of flatus, liquid or solid stool, is a serious and distressing condition with a devastating effect on quality of life including

occupational, social and sexual aspects. Fecal urgency (FU), the inability to suppress the sensation of necessity to defecate for more than 15 min, was proven to be closely associated with EAS dysfunction irrespective of rectal sensitivity and internal anal sphincter dysfunction [210]. Many tools have been developed for scoring of anal incontinence severity. The Wexner (Cleveland) score [211] is currently the most frequently used scoring system globally. However, St. Mark's score [212] or a more complex scoring tool that takes FU into consideration, i.e., Fecal Incontinence Quality of Life (Rockwood) score [213] were recommended for the follow-up of patients with childbirth trauma [214] since FU is commonly associated with EAS injury [210].

The incidence of accidental bowel leakage was reported in 6.4 % of patients 6 weeks after delivery and 5.3 % of patients 1 year post partum [215]. A Spanish study reported a 10.3 % cumulative incidence rate of de novo AI in nulliparous women during pregnancy and after delivery [115]. A large retrospective cohort study demonstrated that midline episiotomy is not effective in protecting the perineum and sphincters during childbirth and may impair anal continence. Women who had midline episiotomies had a significantly higher risk of fecal incontinence at 3 and 6 months postpartum compared to women who delivered with an intact perineum (OR 5.5 and 3.7, respectively). Even when compared with spontaneous laceration, midline episiotomy tripled the risk of fecal incontinence and doubled the risk of flatus incontinence at 3 and 6 months postpartum [60].

Contrary results were observed in cases of mediolateral episiotomy [216]. The incidence of AI in nulliparous women 10 months after delivery was comparable between those having mediolateral episiotomy, intact perineum and spontaneous laceration. Amongst multiparas the risk was higher in the episiotomy group [217]. A Dutch retrospective cohort study demonstrated a lower risk of subsequent fecal incontinence development (OR 0.17) in primiparas with OASIS after mediolateral episiotomy compared to OASIS without episiotomy [218].

Conclusion

No significant effect of episiotomy on postpartum SUI and UUI was demonstrated. No protective effect of mediolateral episiotomy on the development of AI in an uncomplicated delivery was proven. However, a significant increase in the risk of postpartum AI development in association with midline episiotomy was observed. Mediolateral episiotomy was found to be protective of postpartum fecal incontinence in cases where OASIS occurred.

Episiotomy as a Part of Complex Perineal Protection

Episiotomy is only one of many possible interventions that can be made during the final stage of vaginal delivery. Many others have been suggested either to facilitate or accelerate delivery of the fetus or to protect the perineum: obstetric gel [174, 219, 220], warm compresses [173, 174], second stage perineal massage [174, 220], water birth [221], variety of maternal positions [222], forceps, vacuum-extraction

[68, 69, 71], Thierry's spatula [223], fundal expression (Kristeller maneuver) [224, 225], slowing of the expulsion of the fetal head [40, 57, 111, 226], control of maternal co-operation, and manual perineal protection (MPP) during the expulsion of the fetal head [57, 111, 174, 226–228] or during the delivery of fetal shoulders. Moreover, as these interventions are often interrelated it is clinically difficult to analyze them separately. The complexity of the relationship between episiotomy and all other interventions is outlined in a recent population-based study [81]. During the study period the protective effect of lateral episiotomy in primiparous women has moved towards a positive association with OASIS only because of a more restrictive approach to episiotomy, while the incidence of OASIS amongst women without episiotomy has decreased [81]. The episiotomy rate in this study has just served as a surrogate for other unmeasured confounding factors [81].

A modern clinical approach is to evaluate the whole set of clinical interventions [40, 57, 58, 111, 226, 229] involving some steps of MPP, the slowing of the expulsion of the fetal head and episiotomy technique. In Norway, currently the only country with a reversed trend in the incidence of OASIS, a further lateralisation of episiotomy has been recommended [40, 57, 58, 111, 226]. The style of execution of episiotomies and MPP was derived from Finland [230] which traditionally has the lowest incidence of OASIS from all Nordic countries [40].

Norwegian studies have shown that not only known and recognized risk factors such as forceps, midline episiotomy, primiparity, fetal macrosomia or occiput posterior presentation have an impact on OASIS [231]. Some preventive steps are also possible. Lateralisation of episiotomies has not been the only one [10, 14, 15, 19, 32, 33, 40, 56–58, 66, 72, 111, 226]. At least some of the other implemented interventions – the slowing of the passage of the fetal head expulsion or a Finnish modification of MPP – have reduced the rate of OASIS [40, 57, 58, 72, 111, 226]. Recently, a potentially beneficial effect of MPP has been shown in a computerized study based on biomechanical principles where a simulation of the Viennese modification of MPP significantly reduced the perineal tension, thus supporting the concept of MPP [227]. A complex approach to protecting the perineum should be applied to all deliveries including deliveries with episiotomy. Recent studies have shown that there has been a similar reduction of OASIS amongst low- and high-risk women [57, 58, 226], and the most recent study found the most significant decrease of OASIS in deliveries of low-risk women [72].

The Role of Episiotomy in Modern Obstetrics

Throughout its history, episiotomy has been subject to various views from academic circles, media and the general population. Sometimes praised for its effect, at other times deemed too minor to be worthy of analysis, only to be condemned as useless, painful and harmful. It depends on the philosophical approach as to what rates of OASIS, pain, dyspareunia, AI and other perineal adverse outcomes are acceptable. Four percent of OASIS in Norway has recently been found to be unacceptable and led to a national audit and intervention. However, 4 % might be considered acceptable elsewhere.

Evidence suggests that correct execution of the episiotomy incision can have significant implications for the degree of perineal trauma. If episiotomy is to be performed, all its characteristics have to be clearly stated: the point of the beginning, direction and length. Midline episiotomy carries an unacceptable risk of OASIS and its consequences and should be avoided. Properly executed mediolateral or lateral episiotomy should be undertaken when indicated.

Episiotomy facilitates the delivery of the neonate and should be performed in cases of fetal compromise. It seems that properly performed mediolateral or lateral episiotomy is also protective in instrumental deliveries. The role of episiotomy either in protecting or in impending the anatomic and/or functional integrity of the perineum in general has not yet been fully explained. There is a current international consensus that a restrictive approach to episiotomy should be exercised. However, if more than a hundred mediolateral or lateral episiotomies are reported to be necessary to protect against one case of OASIS [14, 15, 232] in spontaneous deliveries, the acceptable rate of episiotomies is still undecided for the restrictive approach.

Current data suggest that if a recommended type of episiotomy repair is performed, there are no significant differences in perception, frequency and intensity of pain, dyspareunia and overall sexual function between different types of episiotomy. No significant effect of episiotomy on postpartum SUI or UUI has been found. A protective effect of mediolateral episiotomy on AI in deliveries without OASIS has not been demonstrated.

Episiotomy is merely one of many obstetric interventions considered during the second stage of labor. A complex approach to perineal protection in all vaginal deliveries is essential in order to reduce the range of perineal trauma and, subsequently, the risk of adverse outcome.

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Peter Kaščák, MD, PhD.
Department of Obstetrics and Gynecology, General Hospital
Legionárska 28
911 71 Trenčín
e-mail: pkascak@gmail.com

Perineální audit: důvody pro více než 1000 epiziotomií

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Perineal audit: reasons for more than one thousand episiotomies

Rušavý Z.[1], Kališ V.[1], Landsmanová J.[1], Kašová L.[2], Karbanová J.[1], Dolejšová K.[1], Sýkora T.[1], Nečesalová P.[1], Novotný Z.[1]

[1]Gynekologicko-porodnická klinika LF UK a FN, Plzeň, přednosta doc. MUDr. Z. Novotný, CSc.

[2]Katedra ošetřovatelství a porodní asistence Fakulty zdravotnických studií, Západočeská univerzita, Plzeň

ABSTRACT

Aim: **To analyze reasons for episiotomy use in vaginal delivery among obstetricians and midwives. Consecutively, to indentify disputable indications for its use based on published research in order to facilitate the decrease in frequency of this operation, while preserving high quality of obstetrical care.**

Methods: **Reasons for mediolateral episiotomy use were recorded by obstetricians and midwives after each vaginal delivery with episiotomy at the Ob&Gyn Department of the Charles University Hospital in Pilsen in the period of February 2006 – June 2007. The main reason and all reasons for episiotomy use were evaluated separately.**

Results: **The reason for episiotomy use was recorded in 1069 cases (93%) out of a total of 1150 vaginal deliveries, in which mediolateral episiotomy was performed (42% of all vaginal deliveries). The most common group of main reasons for episiotomy use was a concern about postpartum pelvic floor functional impairment (624, 58% of episiotomies), especially a rigid, non-elastic perineum (401, 37%). Fetal distress (181, 17%) and abnormalities of the expulsive forces/uncooperative parturient (109, 10%) followed. When evaluating all (including secondary) reasons, the most common groups of reasons for episiotomy use were the effort of pelvic floor functionality preservation (871, 50%), abnormalities of the expulsive forces/uncooperative parturient (354, 20%) and fetal distress (253, 15%). When evaluating episiotomies performed by obstetricians and midwives separately, the concern about postpartum pelvic floor functionality prevailed in midwives (81% vs. 39% of episiotomies performed primarily for this reason). Conversely, the obstetricians performed episiotomy more frequently for fetal distress (28% vs. 4 %).**

Conclusion: **In view of the fact that midwives attend only physiological deliveries in our department, the spectrum of reasons for episiotomy use among midwives is narrower and the concern about postpartum pelvic floor functionality dominates. Currently, the concern about postpartum pelvic floor functionality should not be considered a legitimate indication for episiotomy use. The fact that 624 (58%) episiotomies were performed for this reason represents a significant reserve for a decrease in the frequency of episiotomy use. The reduction should be possible primarily among midwives (81% of all main reasons for episiotomy use in the midwive group, i.e. 37% of all episiotomies performed). The analysis of reasons for episiotomy use is an important step in reduction of episiotomy rates while preserving or improving the standard of treatment provided.**

Key words: **mediolateral episiotomy, indications, pelvic floor.**

SOUHRN

Cíl: **Analyzovat důvody, které vedou porodníky a porodní asistentky k provedení episiotomie. Následně identifikovat sporné indikace jejího provedení na základě výsledků výzkumu pro snížení frekvence této operace při zachování kvality porodnické péče.**

Metodika: **Byly zaznamenány důvody provedení episiotomie u porodů vedených porodníky a porodními asistentkami na GPK FN Plzeň v období únor 2006 až červen 2007. Byl hodnocen hlavní důvod i vedlejší důvody provedení episiotomie.**

Výsledky: **Z celkového počtu 2707 odvedených vaginálních porodů byla u 1150 (42 %) porodů provedena mediolaterální episiotomie a důvod provedení byl zaznamenán v 1069 případech (93 %). Při hodnocení hlavního důvodu provedení episiotomie byla nejčastěji zastoupena obava o zachování funkce pánevního dna (624, 58 %), a to nejčastěji z důvodu tuhé, neelastické hráze (401, 37 %). Dále známky intrauterinní tísně plodu (181, 17%) a poruchy vypuzovacích sil či suboptimální spolupráce s rodičkou ve finální fázi porodu (109, 10 %). Při hodnocení všech (včetně vedlejších) důvodů nejčastějším důvodem zůstala obava o zachování funkce pánevního dna (871, 50 %). Porucha vypuzovacích sil či obtížná spolupráce s rodičkou (354, 20 %) převýšila známky intrauterinní tísně plodu (253, 15 %). Při rozdělení episiotomií podle osob, které episiotomie prováděli (lékař/porodní asistentka) byla u porodních asistentek výrazně významněji provedena episiotomie primárně z obavy před následnou poruchou pánevního dna (81 % vs. 39 %). Známky intrauterinní tísně plodu naopak patří výrazně častěji k hlavním důvodům provedení episiotomie u lékařů (28 % vs. 4 %).**

Závěr: **Vzhledem k tomu, že na našem pracovišti vedou porodní asistentky pouze fyziologické porody, je u nich spektrum důvodů provedení episiotomie užší a dominuje obava o zachování funkce pánevního dna. V současnosti není obava o zachování funkce pánevního dna považována za oprávněnou indikaci k provedení episiotomie. Fakt, že 624 (58 %) episiotomií bylo provedeno primárně z důvodu obavy o zachování funkce pánevního dna, představuje významný prostor pro snížení počtu episiotomií. Redukce by měla být možná zejména ve skupině porodních asistentek (81 % všech hlavních důvodů provedení episiotomie ve skupině porodních asistentek, tj. 37 % všech provedených episiotomií). Analýza důvodů episiotomie je důležitým krokem, který má umožnit snížení frekvence této operace při současném zachování, či zvýšení standardu poskytované péče.**

Klíčová slova: **mediolaterální episiotomie, indikace, poranění dna pánevního.**

ÚVOD

Episiotomie, nástřih hráze v průběhu vaginálního porodu je nejčastěji prováděná porodnická operace v celosvětovém měřítku, ač její indikace ani výhody provedení nebyly nikdy jasně stanoveny. Frekvence provedení episiotomie se výrazně liší mezi jednotlivými zeměmi a institucemi [1] i v průběhu historie [13, 37]. V 70. letech minulého století byla episiotomie doporučována v širokém spektru indikací téměř rutinně po celém světě. V poslední době bylo publikováno velké množství studií a jejich metaanalýz zavrhujících rutinní provádění této operace. Podle posledních poznatků by měla být episiotomie prováděna v méně než 30 % případů [4, 16]. Recentní tchajwanská studie potvrzuje, že episiotomie zvyšuje bolestivost 1, 3 a 6 týdnů po porodu a údajně i incidenci močové inkontinence 3 měsíce po porodu [25]. Obecně, přes nejednotnou metodiku, existuje celá řada prací podporujících restriktivní přístup k provedení episiotomie, avšak žádná, která by obhájila její rutinní provedení. V současnosti panuje obecný konsensus, že je třeba celosvětově snížit frekvenci provádění episiotomie. V popředí výzkumu je snaha definovat správný způsob, jakým má být episiotomie provedena a nalézt skupinu rodiček, které mohou z provedení episiotomie skutečně profitovat.

Česká republika se dosud řadila mezi země s „rutinním přístupem“ k provádění episiotomie. Vzhledem k mezinárodním snahám o redukci frekvence provádění této operace byla na našem pracovišti provedena detailní analýza indikací a faktorů, které ovlivňují rozhodnutí

lékařů a porodních asistentek o provedení epiziotomie. Následně byly shrnuty dostupné poznatky světových studií k nalezení opodstatnění provedení epiziotomie v jednotlivých indikacích.

CÍL STUDIE

Cílem této studie bylo zjistit frekvenci provedení epiziotomie u vaginálních porodů na našem pracovišti a analyzovat důvody, které vedou porodníky a porodní asistentky k provedení mediolaterální epiziotomie. Dalším cílem bylo identifikovat sporné indikace k provedení epiziotomie na základě výsledků publikovaných studií a nalézt tak prostor pro snížení frekvence této operace při zachování kvality porodnické péče.

METODIKA

Do této prospektivní dotazníkové studie byly zahrnuty všechny porody odvedené na GPK FN Plzeň, u nichž byla provedena mediolaterální epiziotomie v období únor 2006 až červen 2007. Všechny porody byly vedeny v litotomické poloze. Osoba provádějící epiziotomii po porodu zaznamenala jeden hlavní a případně i vedlejší důvody provedení epiziotomie z nabízených důvodů (tab. 1).

Hlavním sledovaným parametrem byl důvod provedení epiziotomie. Dalšími sledovanými proměnnými byly: osoba provádějící epiziotomii (porodník/porodní asistentka), parita a frekvence provedení epiziotomie během sledovaného období. Výsledky byly vyhodnoceny zvlášť pro hlavní důvod a pro všechny důvody provedení epiziotomie a pro porody vedené porodními asistentkami a lékaři.

VÝSLEDKY

Z celkového počtu 2707 odvedených vaginálních porodů, bylo celkem provedeno 1150 (42 %) epiziotomií. Ze všech provedených epiziotomií bylo 652 (57 %) provedeno lékaři a 498 (43 %) porodními asistentkami. Obě skupiny byly srovnatelné s ohledem na věk a paritu. Ze zaznamenaných epiziotomií jich bylo 581 (54 %) provedeno lékaři a 488 (46 %) porodními asistentkami. V 750 (70 %) případech byla epiziotomie provedena při prvním vaginálním porodu a 319 (30 %) u vícerodiček (tab. 2). Tento poměr zůstal zachován i při porovnání porodů vedených porodníky (71 % prvorodiček) a porodními asistentkami (69 % prvorodiček).

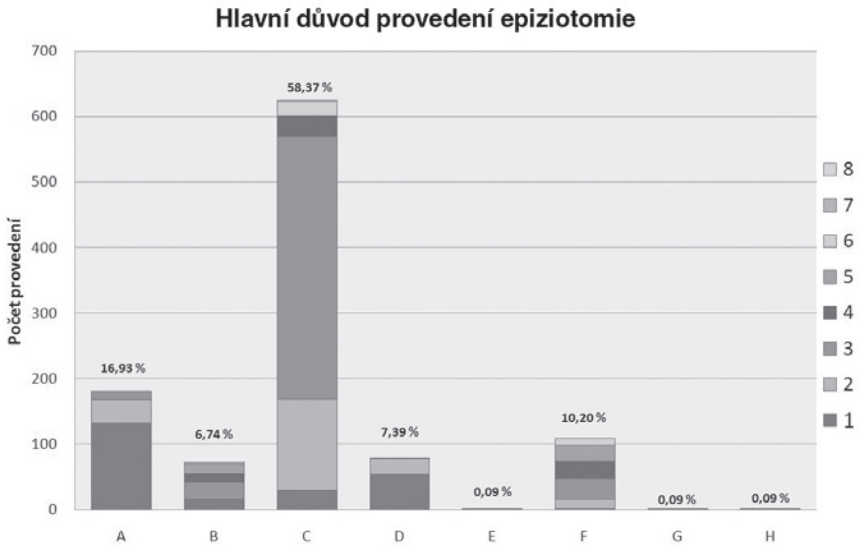
Důvod provedení epiziotomie byl zaznamenán v 1069 (93 %) případech. U 80 epiziotomií nebyl důvod zaznamenán: ve 40 případech osoba vykonávající epiziotomii neuvedla důvod před provedením. Ve 26 případech osoba vykonávající epiziotomii zapomněla důvod zaznamenat. V 10 případech byl ztracen záznam se zdůvodněním epiziotomie a v 5 případech nebyl důvod zaznamenán z jiné příčiny.

Tab. 1. Nabízené důvody provedení epiziotomie

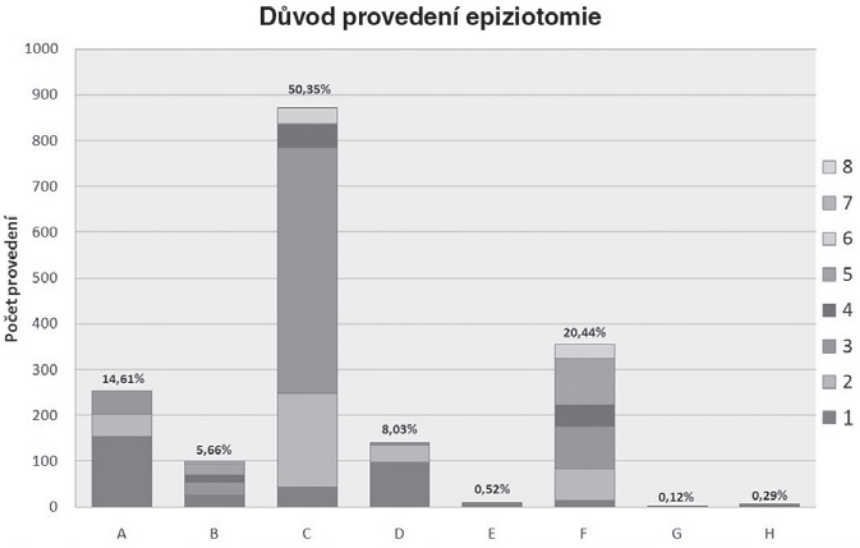
A	**Známky tísně plodu**	
	A1	Alterace ozev plodu (decelerace)
	A2	Bradykardie na konci porodu
	A3	Zelená voda plodová
B	**Porodnické operace a nepravidelné polohy plodu**	
	B1	Forceps
	B2	Vakuumextrakce
	B3	Poloha plodu koncem pánevním
	B4	Dvojčetné těhotenství
	B5	Abnormální rotace, deflexní polohy
	B6	Dystokie ramének
C	**Obava o zachování funkce pánevního dna**	
	C1	Krátká hráz
	C2	Dlouhá hráz
	C3	Rigidní neelastická hráz
	C4	Fibrózní jizva po předchozí epiziotomii zhojená per secundam
	C5	Stav po resutuře epiziotomie při předchozím porodu
	C6	Hrozící ruptura perinea z jiného důvodu
	C7	Ruptura III. a IV. stupně v anamnéze
	C8	Předchozí rekonstrukční operace perinea
D	**Patologie plodu**	
	D1	Makrosomie plodu
	D2	Prematurita
	D3	Hypotrofie plodu
	D4	VVV plodu
E	**Operace na děloze**	
	E1	Stav po císařském řezu
	E2	Stav po operaci na děloze
F	**Poruchy vypuzovacích sil a spolupráce s rodičkou**	
	F1	Chabý břišní lis
	F2	Unavená rodička
	F3	Slabé děložní kontrakce
	F4	Protrahovaná II. doba porodní
	F5	Špatně tlačící rodička
	F6	Nespolupracující rodička
G	**Epiziotomie na přání rodičky**	
H	**Jiné důvody**	

Tab. 2. Vliv parity na frekvenci provedení epiziotomie

Parita	**1**	**2**	**3**	**4**	**5**
Počet	750	294	23	1	1
%	70	28	2	0	0



Graf 1. Hlavní důvod provedení epiziotomie
Kategorie na ose x reprezentují skupiny důvodů, jednotlivé důvody v rámci skupiny jsou rozlišeny ve stupních šedi.
Pro vysvětlení označení viz tab. 1.

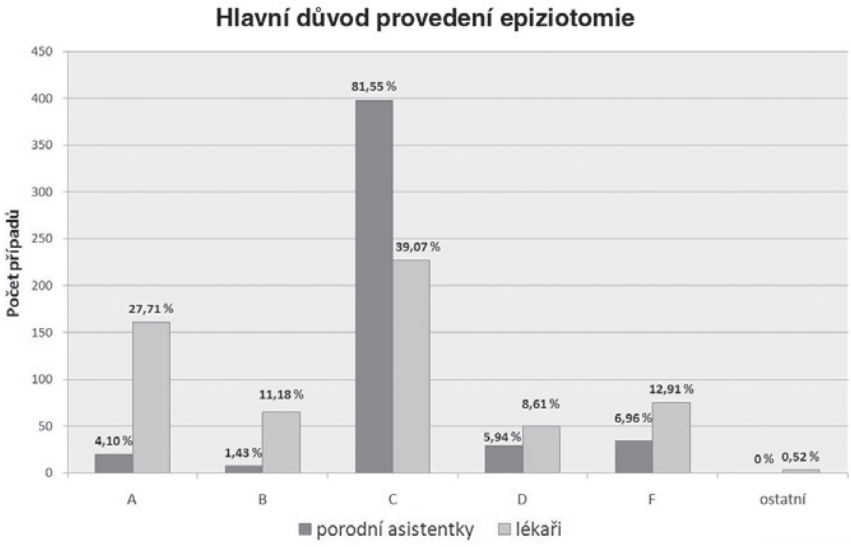


Graf 2. Důvod provedení epiziotomie
Kategorie na ose x reprezentují skupiny důvodů, jednotlivé důvody v rámci skupiny jsou rozlišeny ve stupních šedi.
Pro vysvětlení označení viz tab. 1.

Z celkového hodnoceného počtu 1069 epiziotomií byl v 565 (53 %) případech uveden pouze jeden důvod epiziotomie a v 504 (47 %) případech bylo uvedeno důvodů více. Celkem bylo uvedeno 1732 důvodů provedení epiziotomie.

Nejčastěji zastoupenou skupinou důvodů provedení epiziotomie při hodnocení hlavního důvodu byla obava o zachování funkce pánevního dna. Epiziotomie byla z tohoto důvodu primárně provedena v 624 (58 %) případech, a to nejčastěji z důvodu tuhé, neelastické hráze ve 401 (3 7%) případech. Známky intrauterinní tísně plodu byly indikací pro provedení epiziotomie u 181 (17 %) rodiček a poruchy vypuzovacích sil či potíže spojené se suboptimální spoluprací s rodičkou ve finální fázi porodu ve 109 (10 %) případech. Při hodnocení jednotlivých důvodů bylo hlavním důvodem provedení epiziotomie rigidní perineum – 401 (37 %) epiziotomií. Ve 140 (13 %) případech byla důvodem nadměrně dlouhá hráz, která brání obvyklému prořezávání hlavičky bez poranění perinea. Až třetím nejčetnějším důvodem byla indikace z důvodu známek fetálního distresu v podobě deceleráce v průběhu druhé doby porodní – ve 131 (12 %) případech (graf 1).

Při hodnocení všech (včetně vedlejších) důvodů bylo spektrum důvodů zachováno s významně častějším zastoupením epiziotomií provedených z důvodu poruch vypuzovacích sil a spolupráce s rodičkou. Frekvence udání důvodů z této skupiny byla dvojnásobná proti hod-



Graf 3. Porovnání všech důvodů provedení epiziotomie mezi porodníky a porodními asistentkami

nocení hlavního důvodu (10 % vs. 20 %). Při hodnocení skupin všech důvodů zůstala nejčastějším důvodem obava o zachování funkce pánevního dna v 871 (50 %) případech epiziotomií. Porucha vypuzovacích sil, či zhoršená spolupráce s rodičkou (354, 20 %) převýšila známky intrauterinní tísně plodu (253, 15 %). Při hodnocení všech jednotlivých důvodů provedení epiziotomie byly nejvýznamněji zastoupeny: tuhé, neelastické perineum – 537 (31 %) všech udaných důvodů, nadměrně dlouhá hráz (205, 12 % případů) a decelerace v průběhu druhé doby porodní (154, 9 % případů) (graf 2).

Při rozdělení epiziotomií podle osob, které epiziotomie vykonávaly (porodník/porodní asistentka), se liší zastoupení jednotlivých důvodů. V obou skupinách je nejčastějším důvodem možná porucha pánevního dna po porodu, ač u porodních asistentek je zastoupena výrazně významněji. Epiziotomie byla v této skupině primárně provedena v 398 případech, tj. 81 % všech hlavních důvodů ve skupině porodních asistentek vs. 227 (39 %) u lékařů. Naopak známky intrauterinní tísně plodu patří výrazně častěji k primárním důvodům provedení epiziotomie u lékařů (161, tj. 28 %) než u porodních asistentek (20, tj. 4 %). Obecně lze říci, že spektrum důvodů provedení epiziotomie je u lékařů širší než u porodních asistentek, kde dominuje obava ze zachování funkce pánevního dna (graf 3).

DISKUSE

Postupná detailní analýza nejčastější indikace pro provedení epiziotomie – prevence dysfunkce pánevního dna – je nezbytná pro snížení frekvence epiziotomií. V prospektivních studiích zabývajících se funkcí pánevního dna po porodu nebyla prokázána žádná výhoda provedení epiziotomie. Bylo prokázáno, že mediolaterální epiziotomie v porovnání se spontánní rupturou perinea nechrání před inkontinencí moči ani stolice či před sestupem dělohy [44], a je navíc spojena s nižší silou svalů pánevního dna [42] a častější dyspareunií [22]. Byly prokázány častější infekční komplikace hojení epiziotomie oproti jiným porodním poraněním [35]. Význam délky perinea na vznik porodního poranění perinea je diskutabilní. Skupina rodiček s krátkou hrází by skutečně mohla být rizikovou skupinou [14, 41], je však diskutabilní, zda provedení epiziotomie nezvýší riziko poranění análního sfinkteru vzhledem k jeho dilataci v průběhu 2. doby porodní [27]. Dlouhé perineum není jednoznačně definováno, k dispozici jsou však normogramy pro délku perinea v 1. a 2. době porodní [14, 27]. Fibrózně zhojená jizva po předchozí epiziotomii by neměla být indikací k opakování epiziotomie, pokud byla předchozí epiziotomie vedena pod adekvátním úhlem mimo dilatovaný análí sfinkter. V opačném případě je role nové epiziotomie diskutabilní. Podíl epiziotomií primárně provedených pro tuhé, neelastické perineum (37 %) se zdá být příliš vysoký. Z výsledků rozsáhlé metaanalýzy prací z let 1980 až 2005 vyplývá, že epiziotomie z důvodu prevence závažných poranění perinea, inkontinence moči a stolice a genitálního prolapsu by neměla být prováděna [12]. Fakt, že 624 (58 %) epiziotomií bylo provedeno primárně z důvodu obavy o zachování funkce pánevního dna, ukazuje na významnou rezervu pro snížení počtu epiziotomií.

Hlavní důvod představuje indikaci k provedení epiziotomie. Souhrn všech důvodů tvoří soubor všech okolností a vnějších faktorů, které ovlivňují rozhodování ohledně provedení epiziotomie. Poruchy vypuzovacích sil a spolupráce s rodičkou by měly být spíše vedlejšími faktory, které by pouze ovlivňovaly rozhodování ohledně provedení epiziotomie, neměly by tedy být hlavním důvodem. Rozdíl v počtu epiziotomií provedených z této indikace při hodnocení všech důvodů oproti hlavnímu důvodu by měl být co nejvyšší. Širší spektrum důvodů provedení epiziotomie u lékařů vyplývá z faktu, že na

našem pracovišti vedou porodní asistentky pouze fyziologické porody.

Protektivní vliv provedení epiziotomie proti rupturám hráze 3. stupně je nadále předmětem diskuse. Podle Sultana a kol. mezi rizikové faktory významně spjaté s rupturou perinea 3. stupně patří partus per forcipem, primiparita, váha plodu nad 4000 gramů a porod při abnormální rotaci či deflexní poloze plodu. V této studii 41 % ruptur hráze 3. stupně proběhlo i přes provedení mediolaterální epiziotomie [48]. Podle skandinávských statistik počty epiziotomií postupně klesají, zatímco incidence poranění análního sfinkteru stoupá [34, 47]. Na rozdíl od výsledků Cochranovy databáze [4], rozsáhlá retrospektivní analýza z holandského [10] a britského [38] národního porodnického registru jednoznačně prokazuje protektivní vliv mediolaterální epiziotomie před vznikem ruptur perinea 3. stupně. Podle de Leeuwa a kol. jsou lékaři s restriktivním přístupem k provádění epiziotomie schopni lépe odhadnout rizikovou skupinu rodiček [10]. Podle těchto studií provedení mediolaterální epiziotomie pod dostatečným úhlem má protektivní efekt vůči závažným poraněním perinea, její rutinní provádění však nikoliv.

Na našem pracovišti, v souladu s evropskými zeměmi, je prováděna mediolaterální epiziotomie. Mediální epiziotomie je spojena s vyšším rizikem poranění rekta [3, 5, 46]. Riziko poranění análního sfinkteru při provedení mediální epiziotomie je šestinásobně vyšší ve srovnání s mediolaterální [3]. Odklon úhlu incize epiziotomie od svislé linie určuje riziko traumatu análního sfinkteru; každých 6 stupňů odklonu úhlu epiziotomie od střední čáry snižuje riziko poranění análního sfinkteru o 50 % [15]. Rozhodující je úhel provedení epiziotomie, úhel sutury je zcela odlišný [28].

Je velice obtížné vyvozovat obecné závěry ze studií hodnotících přínos a rizika mediolaterální epiziotomie vzhledem k tomu, že neexistuje přesná definice mediolaterální epiziotomie [30]. Recentní dotazníková studie prokázala, že v souboru 122 evropských porodnic se definice mediolaterální epiziotomie významně liší [29]. Bylo prokázáno, že ruptury perinea bývají často podhodnoceny a poranění análního sfinkteru může zůstat nediagnostikováno [2, 20, 26, 50]. Van Dillen proto navrhuje zavedení auditů podle mezinárodně akreditované klasifikace do běžné nemocniční praxe k zlepšení rozpoznávání a klasifikace poranění análního sfinkteru [51]. Bez takových auditů může být hodnocení četnosti ruptury análního svěrače nespolehlivé a doporučení ohledně vhodnosti provedení epiziotomie z této indikace má své limitace. Přesto z výše uvedených výsledků a analýzy publikované literatury vyplývá, že v současné době nejsou k dispozici jednoznačná data podporující provedení epiziotomie z důvodu obavy o poruchy funkce pánevního dna. Z našich výsledků vyplývá, že naprostá většina epiziotomií je prováděna z tohoto důvodu; u fyziologických porodů vedených porodními asistentkami byla epiziotomie primárně provedena z tohoto důvodu v 81 %. Eliminujeme-li epiziotomie provedené z této indikace, dosáhneme snížení o 58 % z provedených epiziotomií (21 % u lékařů a 37 % u porodních asistentek).

Na rozdíl od mediální epiziotomie [6] de Leeuw prokázal jasný protektivní vliv provedení mediolaterální epiziotomie u operativních vaginálních porodů a navrhl její rutinní užívání u porodu per forcipem i vakuumextrakcí [9]. Nutnost provedení epiziotomie při porodu vakuumextrakcí je diskutabilní [6, 36, 48]. Při porodu per forcipem je na našem pracovišti epiziotomie užívána rutinně, a byla tak provedena v 25 případech. Vakuumextrakce v hodnoceném období nebyla prováděna.

Podle současné literatury je možné se vyhnout provedení epiziotomie i v některých rizikových porodnických situacích, pokud to umožňují podmínky [39]. Provedení epiziotomie nesnižuje riziko dystokie ramének plodu [36, 53] a podle Gurewitsche a kol. není nutná ani při provedení manévrů při řešení dystokie ramének [21] či při extrakci druhého dvojčete [40]. Podle Hartmannové nemusí být epiziotomie rutinně prováděna při porodu plodu v abnormální rotaci [22], ač je spojen se sedminásobnou incidencí poranění análního svěrače [17]. Průměrná frekvence provedení epiziotomie při porodu plodu koncem pánevním v holandských nemocnicích je 71,5 %, přičemž nejnižší frekvence je 18,8 % [23]. Neexistuje žádná studie, která by se zabývala přínosem provedení epiziotomie z této indikace. V hodnoceném období byla epiziotomie v souvislosti s nepravidelnými polohami plodu a operativními porody provedena pouze v necelých 6 %.

Makrosomie plodu patří k významným rizikovým faktorům závažného poranění perinea [43, 45]. Rutinní provádění epiziotomie je zde diskutabilní, neboť diagnostika makrosomie antenatálně je klinicky obtížná. Podle Weinera a kol. je přínos ultrazvuku při rutinním odhadu hmotnosti plodu klinicky nevýznamný a vede jen k dalšímu navýšení frekvence císařských řezů [52]. V hodnoceném období byla epiziotomie pro makrosomii plodu provedena celkem v 97 případech (5,6 %).

Podobných studií zaměřených na analýzu indikací k provedení epiziotomie je poměrně malé množství. Typickými zeměmi s rutinním prováděním epiziotomie jsou rozvojové země [33]. Charakteristické spektrum indikací provedení epiziotomie v těchto zemích demonstruje brazilská studie na pouze 122 vaginálních porodech. Epiziotomie byla provedena v 76 % porodů, u primipar dokonce v 95 %. Mezi nejčastější důvody zde patřily rigidní hráz, primiparita a makrosomie plodu. Zajímavé je, že primiparita sama o sobě byla důvodem k provedení epiziotomie, zatímco tíseň plodu nebyla vůbec zařazena mezi analyzované důvody [11]. Z výsledků katarské studie vyplývá, že epiziotomie byla provedena u 60 % porodů, hlavní indikací zde byla primiparita (93 % případů) a epiziotomie zde byla provedena u více než 95 % prvorodiček [24].

Zcela opačné výsledky přinesla švédská analýza důvodů provedení epiziotomie na 2144 porodech. Nejčastějším důvodem zde byla hrozící ruptura perinea a známky tísně plodu, a to v 35 % a 33 % u prvorodiček a 47 % a 32 % u vícerodiček. Epiziotomie byla v této studii provedena u primipar ve 40 %, zatímco u vícerodiček pouze v 9,9 % [35]. Nejčastějším důvodem pro provedení epiziotomie v této studii byla hrozící ruptura perinea

[35], přitom německá prospektivní randomizovaná kontrolovaná studie a její follow-up studie jasně dokládají, že provedení epiziotomie v tomto případě není přínosné ohledně funkce pánevního dna a je vhodné se mu vyhnout [7, 8]. I ve zmíněné švédské studii tedy ještě existuje rezerva pro snížení počtu provedených epiziotomií. V naší studii bylo provedeno 35 (2 %) epiziotomií pro hrozící rupturu perinea.

V recentní řecké dotazníkové studii lékaři při vaginálním porodu rutině provádějí epiziotomii v 51 % případů u prvorodiček a u 12 % vícerodiček [19]. Grigoriadis zde upozorňuje na fakt, že vzhledem k tomu, že většina studií srovnávajících rutinní a konzervativní provedení epiziotomie pochází ze zemí severní Evropy a severní Ameriky, může být přijetí a zavedení nových poznatků obtížné v zemích s odlišnými kulturními a zdravotnickými podmínkami a jiným přístupem k porodu, kde jsou očekávání od zdravotníků i pacientů zcela odlišná [19]. To dokládá i souhrnná práce ze statistik jednotlivých zemí celého světa sestavená Grahamem a kol. [18], nejnižší frekvence je v zemích severní Evropy a Austrálie, největší naopak v jižní Americe a Asii. Frekvence provedení epiziotomie je celosvětově velice vysoká [18].

Změna přístupu lékařů a porodních asistentek k provádění epiziotomie by mohla významně přispět ke snížení frekvence provádění epiziotomie. Klein a kol. zjistili velké rozdíly mezi výsledky jednotlivých lékařů při snaze provádět epiziotomii rutinně a restriktivně [31]. Ve své následné studii zjistili, že lékaři s odmítavým přístupem k provádění rutinní epiziotomie byli schopni změnit své postupy podle protokolu studie, zatímco lékaři obhajující provádění epiziotomie rutinně nebyli schopni dodržet protokol studie, častěji zhodnotili normální průběh porodu jako abnormální a častěji diagnostikovali tíseň plodu u normálního porodu [32].

Cílem dalšího výzkumu je identifikace rizikových skupin, které z provedení epiziotomie mohou profitovat a dále nalezení a dodržování bezpečného postupu provádění epiziotomie. Analýza důvodů epiziotomie je důležitým krokem, který má umožnit snížení frekvence této operace při současném zachování či zvýšení standardu poskytované péče.

ZÁVĚR

Náhled na mediolaterální epiziotomii prochází v poslední době výraznou změnou. Původní názor, že jde o jednoznačný protektivní faktor těžkého poranění perinea, vedl k rutinnímu používání této operace v mnoha zemích téměř u všech provorodiček. I přes výhrady k metodice mnoha studií (provedení epiziotomie, diagnostika stupně perineálního traumatu) je restriktivní přístup k epiziotomii obecně výhodnější než rutinní provádění. V mnoha státech praxe rutinního provádění této operace nadále přetrvává a je velmi složité změnit zažité a „osvědčené“ postupy, zejména v zemích s odlišným systémem zdravotnictví a jiným zdravotnickým i kulturním přístupem k porodu.

Kliničtí lékaři musí brát ohled na publikovaný výzkum ohledně přínosu epiziotomie. Podle Hartmannové „nadešel čas omezit provádění epiziotomie podobně jako byla omezena operace kolen u artritis nebo tonsilektomie u dětí“ [33]. Jasné definování indikací epiziotomie je významným krokem ke snížení frekvence této operace. Při striktním dodržování jednoznačných indikací pro provedení epiziotomie je pak možné snížení této intervence bez zhoršení perinatálních výsledků a maternální morbidity.

Existuje mnoho důkazů, že provádění epiziotomie z důvodu obavy o zachování funkce pánevního dna není opodstatněné a mělo by být omezeno. Naše studie dokládá, že právě tato indikce patří mezi nejčastější a tvoří významnou rezervu pro snížení frekvence provádění této operace. Potenciál pro tuto redukci je nejvyšší zejména v případě fyziologických porodů vedených porodními asistentkami (81 % všech hlavních důvodů provedení epiziotomie ve skupině porodních asistentek, tj. 37 % všech provedených epiziotomií).

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MUDr. Zdeněk Rušavý
Gynekologicko-porodnická klinika
FN Plzeň
Alej Svobody 80
304 60 Plzeň
e-mail: rusavyz@fnplzen.cz

Příloha 6:

0 SHRNUTÍ PORODU

Jméno + oš. č. *(štítek)* **oš. č**.	
Kontakty:	
Telefonní číslo:	
Email:	
Poštovní adresa:	

Datum porodu . . . . . .

Krevní ztráta během porodu	***ml***
Děložní hypotonie po porodu	***1 ano*** ***0 ne***

Rutinní porodnické charakteristiky	
věk matky	***roky***
vzdělání	***1 základní*** ***2 učební obor*** ***3 středoškolské*** ***4 vysokoškolské*** ***5 univerzitní***
etnikum	***1 kavkazské*** ***2 romské*** ***3 asijské*** ***4 jiné***
vdaná, žijící s partnerem vs. single	***1 ano vdaná, žijící s partnerem*** ***0 ne***
hmotnost rodičky	***kg***
výška rodičky	***cm***
délka 2. doby porodní	***min***
epidurální analgezie	***1 ano*** ***0 ne***
forceps	***1 ano*** ***0 ne***
typ forcepsu	***1 Simpson*** ***2 Breus*** ***3 Kjelland*** ***4 Shute***
vakuumextrakce	***1 ano*** ***0 ne***
perzistující okcipitoposteriorní naléhání (abormální rotace, deflexní polohy)	***1 ano*** ***0 ne***
fetální distress ve 2. době porodní	***1 ano*** ***0 ne***

dystokie ramének	***1 ano*** ***0 ne***
osoba, která vede finální fázi porodu, provádí episiotomii	***1 lékař*** ***2 por. asistentka*** ***3 studentka***
Novorozenecká hmotnost	***g***
Apgar skóre	***v 1.minutě***
	v 5.minutě
	v 10.minutě
Novorozenecké pH	

Klasifikace ruptur perinea dle *RCOG*

3. stupně: Poranění komplexu análního svěrače
- **3a** méně než 50% síly zevního análního svěrače
- **3b** více než 50% síly zevního análního svěrače
- **3c** ruptura zevního i vnitřního análního svěrače

4. stupně: Ruptura zevního i vnitřního análního svěrače a mukózy rekta

stupeň poranění hráze dle RCOG 1. observer	***0*** ***1*** ***2***	***3a*** ***3b*** ***3c*** ***4***
stupeň poranění hráze dle RCOG 2. observer	***0*** ***1*** ***2***	***3a*** ***3b*** ***3c*** ***4***
typ episiotomie	***1 mediolaterální*** ***2 laterální***	
délka episiotomie	***mm***	
nejkratší vzdálenost poranění od okraje anu	***mm***	
dodatečná ruptura v pokračování episiotomie na hrázi	***1 ano*** ***0 ne***	
délka	***mm***	
směr	***1 pokračování episiotomie*** ***2 odkloněna mírně k AS*** ***3 odkloněna kolmo k AS***	
tkáň *(zatrhni i více odpovědí, pokud je aplikovatelné)*	***1 vaginální sliznice*** ***2 perineální svaly*** ***3 kůže***	
ruptura pochvy v pokračování episiotomie	***1 ano*** ***0 ne***	
	mm	
timing episiotomie	***1 hlavička prořezává*** ***2 před prořezáváním hlavičky***	
čas potřebný k sutuře episiotomie	***min***	
množství spotřebovaného materiálu *(120cm vicryl rapide, 2/0, W9948)*	***ks***	

1 24H po porodu

Jméno + oš. č. *(štítek)*	**oš. č**. . . . .

A PERINEÁLNÍ BOLEST

Hodnocení perineální bolesti	
Pain Visual Analogue scale	
0 ***žádná bolest*** ***5*** ***střední bolest*** ***10*** ***největší bolest***	
Verbal Rating Scale (VRS)	
Bolest v klidu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohybu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohlavním styku (nyní neaplikovatelné)	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Total Verbal Rating Score	
Interference s denními aktivitami (ADL)	
Bolest během močení	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest během spánku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	*Viz Verbal Rating Scale*
Bolest při chůzi	*Viz Verbal Rating Scale*
Množství užitých analgetik (ibuprofenových tablet 400mg za posledních 24h)	***počet***

B HOJENÍ

Hodnocení komplikací hojení	
Přítomnost infekce	***1 ano*** ***0 ne***
Nutnost podání antibiotik vzhledem k infekci sutury	***1 ano*** ***0 ne***
Hematom v episiotomii	***1 ano*** ***0 ne***
Nutnost operační revize v prvních 24hodinách	***1 ano*** ***0 ne***
Dehiscence	***1 ano*** ***0 ne***
Defekační problémy – bolest při defekaci	***1 ano*** ***0 ne***

2 72H po porodu

Jméno + oš. č. *(štítek)*	**oš. č**. . . . .

A Bolestivost hráze (oblasti mezi pochvou a řitním otvorem)

Hodnocení perineální bolesti	
Pain Visual Analogue scale	
0 ***žádná bolest*** ***5*** ***střední bolest*** ***10*** ***největší bolest***	
Verbal Rating Scale (VRS)	
Bolest v klidu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohybu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Total Verbal Rating Score	
Interference s denními aktivitami (ADL)	
Bolest během mikce	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest během spánku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	*Viz Verbal Rating Scale*
Bolest při chůzi	*Viz Verbal Rating Scale*
Množství užitých analgetik (ibuprofenových tablet 400mg za posledních 24h)	***počet***

B HOJENÍ

Hodnocení komplikací hojení	
Přítomnost infekce	***1 ano*** ***0 ne***
Nutnost podání antibiotik vzhledem k infekci sutury	***1 ano*** ***0 ne***
Hematom v episiotomii	***1 ano*** ***0 ne***
Dehiscence	***1 ano*** ***0 ne***
Defekační problémy – bolest při defekaci	***1 ano*** ***0 ne***
Sekundární sutura	***1 ano*** ***0 ne***

C Sexualita

Hodnocení sexuality	
Dyspareunie před porodem – Býval v období před porodem pro Vás pohlavní styk bolestivý?	***1 ano*** ***0 ne***

D Dotazník anální kontinence

St. Mark's skóre	
Předporodní potíže	
Byla jste před porodem léčena pro onemocnění střev (mimo běžného průjmovitého onemocnění)?	***1 ano (pro jaké:.....)*** ***0 ne***
Měla jste nějaké potíže s nechtěným únikem plynů či stolice již před porodem?	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně*** ***5 Ne, ale měla jsem občas náhlé nucení (nemožnost oddálení stolice déle než 15 minut)***
Měla jste nějaké potíže se zácpou již před porodem?	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Denně***

3 10dní po porodu

Vyplňte, prosím, přiložený dotazník.

Jméno *(štítek)*	
	datum porodu . . . . .

A Bolestivost hráze (oblasti mezi pochvou a řitním otvorem)

Hodnocení perineální bolesti **Prosím, zhodnoťte průběh posledního týdne**		
Pain Visual Analogue scale		
označte na přímce adekvátní místo odpovídající Vašemu vnímání bolesti _____|_____ ***0*** ***5*** ***10*** ***žádná bolest*** ***střední bolest*** ***největší bolest***		
Verbal Rating Scale (VRS)		
Bolest v klidu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest v sedu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest při pohybu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Total Verbal Rating Score		
Interference s denními aktivitami (ADL)		
Bolest během močení	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest během spánku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest v sedu	*již vyplněno výše*	
Bolest při chůzi	*již vyplněno výše*	
Množství užitých analgetik (ibuprofenových tablet 400mg za posledních 24h)		***počet***
Celková doba trvání bolestí od porodu do jejich vymizení	***datum vymizení***	***počet dní***

B HOJENÍ

Hodnocení komplikací hojení	
Cosmetic Visual analogue score označte na přímce adekvátní místo odpovídající Vaší spokojenosti s kosmetickým efektem	
0 ***5*** ***10*** ***nejhorší hojení*** ***nejlepší hojení***	
Pozorovala jste známky zánětu v oblasti nástřihu? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Nutnost podání antibiotik vzhledem k infekci „šití“ Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Dehiscence – rozpad celého „šití“ nebo jeho části Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Pozorujete po porodu bolestivou defekaci (bolesti na WC při „tlačení na stolici“	***1 ano*** ***0 ne***
Bylo nutné opakované šití nástřihu hráze? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Spokojenost se jizvou označte na přímce adekvátní místo odpovídající Vaší celkové spokojenosti	
0 ***5*** ***10*** ***naprostá nespokojenost*** ***naprostá spokojenost***	

4 3měsíce po porodu

Vyplňte, prosím, přiložený dotazník.

Jméno *(štítek)* **datum porodu** . . . . . . **Kontakty:** *při změně*	
Telefonní číslo:	
Email:	
Poštovní adresa:	

A Bolestivost hráze (oblasti mezi pochvou a řitním otvorem)

Hodnocení perineální bolesti **Prosím, zhodnoťte průběh posledního týdne.**	
Pain Visual Analogue scale	
označte na přímce adekvátní místo odpovídající Vašemu vnímání bolesti ***0*** *žádná bolest* — ***5*** *střední bolest* — ***10*** *největší bolest*	
Verbal Rating Scale (VRS)	
Bolest v klidu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohybu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohlavním styku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Total Verbal Rating Score	
Interference s denními aktivitami (ADL)	
Bolest během močení	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***

Bolest během spánku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest v sedu	*již vyplněno výše*	
Bolest při chůzi	*již vyplněno výše*	
Množství užitých analgetik (ibuprofenových tablet 400mg za poslední týden)		***počet, ks***
Celková doba trvání bolestí od porodu do jejich vymizení	***datum vymizení***	***počet dní***

B HOJENÍ

Hodnocení komplikací hojení	
Cosmetic Visual analogue score označte na přímce adekvátní místo odpovídající Vaší spokojenosti s kosmetickým efektem	
0 ***5*** ***10*** ***nejhorší hojení*** ***nejlepší hojení***	
Pozorovala jste známky zánětu v oblasti nástřihu? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Nutnost podání antibiotik vzhledem k infekci oblasti nástřihu Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Dehiscence – rozpad celého „šití“ nebo jeho části Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Pozorujete po porodu bolestivou defekaci (bolesti na WC při „tlačení na stolici“)	***1 ano*** ***0 ne***
Bylo nutné opakované šití nástřihu hráze? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Spokojenost se jizvou označte na přímce adekvátní místo odpovídající Vaší celkové spokojenosti	
0 ***5*** ***10*** ***naprostá nespokojenost*** ***naprostá spokojenost***	

C Ovlivnění sexuality

Hodnocení sexuality (hodnocení posledního měsíce)	
Vaše současná hmotnost	*kg*
Kojíte?	*1 ano* *0 ne*
Měla jste již pohlavní styk po porodu	*1 ano* *0 ne*
Máte pohlavní styk již pravidelně?	*1 ano* *0 ne*
Po jak dlouhé době od porodu jste měla první pohlavní styk?	*1 < 6 týdnů* *2 6 týdnů* *3 7-8 týdnů* *4 9-12 týdnů* *5 > 12 týdnů*
Pokud jste už měla po porodu pohlavní styk, vyskytla se u Vás během pohlavního styku bolest?	*1 ano* *0 ne*
Pokud ano, jak často a jak intenzivní?	*1 výjimečně* *2 někdy* *3 obvykle*
	1 mírná *2 střední* *3 velká*
Jaké je u Vás sexuální vzrušení ve srovnání s obdobím před porodem?	*1 mnohem menší* *2 menší* *3 stejné* *4 větší* *5 mnohem větší*
Jaké je u Vás sexuální uspokojení ve srovnání s obdobím před porodem?	*1 mnohem menší* *2 menší* *3 stejné* *4 větší* *5 mnohem větší*
Jaká je u Vás schopnost dosahování orgasmu (vyvrcholení) ve srovnání s obdobím před porodem?	*1 mnohem menší* *2 menší* *3 stejné* *4 vyšší* *5 mnohem vyšší*
Jaké je Vaše zvlhčení pochvy během styku (lubrikace) ve srovnání s obdobím před porodem?	*1 mnohem menší* *2 menší* *3 stejné* *4 větší* *5 mnohem větší*

D Dotazník análnÍ kontinence (hodnocení posledního měsíce) (*St. Mark's skóre)*

Potíže po porodu. **Prosím, zhodnoťte průběh posledního měsíce.**	
Pozorujete po porodu nechtěný únik tuhé, formované stolice	*0 Nikdy* *1 Výjimečně* *2 Někdy* *3 Týdně* *4 Denně*

Pozorujete po porodu nechtěný únik tekuté, průjmovité stolice	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Pozorujete po porodu nechtěný únik plynů	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Nutí Vás tyto potíže ke změně Vašeho životního stylu?	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Musíte používat hygienické pomůcky (např. vložky) kvůli úniku plynů či stolice	***2 ano*** ***0 ne***
Užíváte z těchto důvodů nějaké protiprůjmové prostředky:	***2 ano*** ***0 ne***
Trápí Vás tzv. fekální urgence (nemožnost oddálení stolice déle než 15 minut)	***4 ano*** ***0 ne***
Pokud jste na předchozí otázku (nemožnost oddálení stolice déle než 15 minut) odpověděla **ano**, trápí Vás tato záležitost:	***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Co Vám z uvedeného nejvíce vadí – odpovězte pouze jednou z možností.	***0 nic, nemám žádné problémy*** ***1 únik tuhé, formované stolice*** ***2 únik tekuté, průjmovité stolice*** ***3 nechtěný únik plynů*** ***4 nemožnost oddálení stolice déle než 15 minut***
Pozorujete po porodu výskyt zácpy	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Musíte tuto zácpu nějak řešit?	***0 Ne, protože tyto potíže nemám*** ***1 Ano, ale potíže nejsou nutné řešit.*** ***2 Ano, úpravou jídelních zvyklostí.*** ***3 Ano, pomocí glycerinových čípků.*** ***4 Ano, pomocí laktulozy.*** ***5 Ano, pomocí jiného prostředku. Konkrétně: . . . . . .***
Pozorujete po porodu bolestivou defekaci (bolesti na WC při „tlačení na stolici“)	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Pokud byste dopředu věděla, jak bude vypadat Váš zdravotní stav po posledním (dalším) porodu. Vybrala byste si:	***1 Císařský řez*** ***2 Normální přirozený porod*** ***3 Již bych znovu nerodila*** ***4 Nejsem t.č. rozhodnuta***

5 6měsíců po porodu

Vyplňte, prosím, přiložený dotazník.

Jméno *(štítek)* **Kontakty:** *při změně*	**datum porodu** . . . . .
Telefonní číslo:	
Email:	
Poštovní adresa:	

A Bolestivost hráze (oblasti mezi pochvou a řitním otvorem)

Hodnocení perineální bolesti **Prosím, zhodnoťte průběh posledního týdne.**	
Pain Visual Analogue scale	
označte na přímce adekvátní místo odpovídající Vašemu vnímání bolesti ***0*** *žádná bolest* — ***5*** *střední bolest* — ***10*** *největší bolest*	
Verbal Rating Scale (VRS)	
Bolest v klidu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest v sedu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohybu	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Bolest při pohlavním styku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***
Total Verbal Rating Score	
Interference s denními aktivitami (ADL)	
Bolest během mikce	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***

Bolest během spánku	***0 žádná bolest*** ***1*** ***2*** ***3 největší bolest***	
Bolest v sedu	*již vyplněno výše*	
Bolest při chůzi	*již vyplněno výše*	
Množství užitých analgetik (ibuprofenových tablet 400mg za poslední týden)		***počet, ks***
Celková doba trvání bolestí od porodu do jejich vymizení	***datum vymizení***	***počet dní***

B HOJENÍ

Hodnocení komplikací hojení	
Cosmetic Visual analogue score označte na přímce adekvátní místo odpovídající Vaší spokojenosti s kosmetickým efektem	
0 ***5*** ***10*** ***nejhorší hojení*** ***nejlepší hojení***	
Pozorovala jste známky zánětu v oblasti nástřihu? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Nutnost podání antibiotik vzhledem k infekci sutury Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Dehiscence – rozpad celého šití nebo jeho části Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Pozorujete po porodu bolestivou defekaci (bolesti na WC při „tlačení na stolici“	***1 ano*** ***0 ne***
Bylo nutné opakované šití nástřihu hráze? Pokud ano, kontaktujte nás kvůli konzutaci léčby.	***1 ano*** ***0 ne***
Spokojenost se jizvou označte na přímce adekvátní místo odpovídající Vaší celkové spokojenosti	
0 ***5*** ***10*** ***naprostá nespokojenost*** ***naprostá spokojenost***	

C Ovlivnění sexuality

Hodnocení sexuality **(hodnocení posledního měsíce)**	
Vaše současná hmotnost	***kg***
Kojíte?	***1 ano*** ***0 ne***
Měla jste již pohlavní styk po porodu	***1 ano*** ***0 ne***
Máte pohlavní styk již pravidelně?	***1 ano*** ***0 ne***
Po jak dlouhé době od porodu jste měla první pohlavní styk?	***1 < 6 týdnů*** ***2 6 týdnů*** ***3 7-8 týdnů*** ***4 9-12 týdnů*** ***5 > 12 týdnů***
Pokud jste už měla po porodu pohlavní styk, vyskytla se u Vás během pohlavního styku bolest?	***1 ano*** ***0 ne***
Pokud ano, jak často a jak intenzivní?	***1 výjimečně*** ***2 někdy*** ***3 obvykle***
	1 mírná ***2 střední*** ***3 velká***
Jaké je u Vás sexuální vzrušení ve srovnání s obdobím před porodem?	***1 mnohem menší*** ***2 menší*** ***3 stejné*** ***4 větší*** ***5 mnohem větší***
Jaké je u Vás sexuální uspokojení ve srovnání s obdobím před porodem?	***1 mnohem menší*** ***2 menší*** ***3 stejné*** ***4 větší*** ***5 mnohem větší***
Jaká je u Vás schopnost dosahování orgasmu (vyvrcholení) ve srovnání s obdobím před porodem?	***1 mnohem menší*** ***2 menší*** ***3 stejné*** ***4 vyšší*** ***5 mnohem vyšší***
Jaké je Vaše zvlhčení pochvy během styku (lubrikace) ve srovnání s obdobím před porodem?	***1 mnohem menší*** ***2 menší*** ***3 stejné*** ***4 větší*** ***5 mnohem větší***

D Dotazník análnÍ kontinence **(hodnocení posledního měsíce)** (*St. Mark's skóre)*

Potíže po porodu. **Prosím, zhodnoťte průběh posledního měsíce.**	
Pozorujete po porodu nechtěný únik tuhé, formované stolice	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***

Pozorujete po porodu nechtěný únik tekuté, průjmovité stolice	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Pozorujete po porodu nechtěný únik plynů	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Nutí Vás tyto potíže ke změně Vašeho životního stylu?	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Musíte používat hygienické pomůcky (např. vložky) kvůli úniku plynů či stolice	***2 ano*** ***0 ne***
Užíváte z těchto důvodů nějaké protiprůjmové prostředky:	***2 ano*** ***0 ne***
Trápí Vás tzv. fekální urgence (nemožnost oddálení stolice déle než 15 minut)	***4 ano*** ***0 ne***
Pokud jste na předchozí otázku (nemožnost oddálení stolice déle než 15 minut) odpověděla **ano**, trápí Vás tato záležitost:	***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Co Vám z uvedeného nejvíce vadí – odpovězte pouze jednou z možností.	***0 nic, nemám žádné problémy*** ***1 únik tuhé, formované stolice*** ***2 únik tekuté, průjmovité stolice*** ***3 nechtěný únik plynů*** ***4 nemožnost oddálení stolice déle než 15 minut***
Pozorujete po porodu výskyt zácpy	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Musíte tuto zácpu nějak řešit?	***0 Ne, protože tyto potíže nemám*** ***1 Ano, ale potíže nejsou nutné řešit.*** ***2 Ano, úpravou jídelních zvyklostí.*** ***3 Ano, pomocí glycerinových čípků.*** ***4 Ano, pomocí laktulozy.*** ***5 Ano, pomocí jiného prostředku. Konkrétně: . . . . . .***
Pozorujete po porodu bolestivou defekaci (bolesti na WC při „tlačení na stolici“)	***0 Nikdy*** ***1 Výjimečně*** ***2 Někdy*** ***3 Týdně*** ***4 Denně***
Pokud byste dopředu věděla, jak bude vypadat Váš zdravotní stav po posledním (dalším) porodu. Vybrala byste si:	***1 Císařský řez*** ***2 Normální přirozený porod*** ***3 Již bych znovu nerodila*** ***4 Nejsem t.č. rozhodnuta***

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CLINICAL ARTICLE

Stereophotogrammetry of the perineum during vaginal delivery

Robert Zemčík [a], Jaroslava Karbanova [b], Vladimir Kalis [b,*], Libor Lobovský [c], Magdalena Jansová [d], Zdenek Rusavy [b]

[a] Department of Mechanics, University of West Bohemia, Pilsen, Czech Republic
[b] Department of Obstetrics and Gynecology, Charles University, Pilsen, Czech Republic
[c] College of Engineering and Informatics, National University of Ireland, Galway, Ireland
[d] European Centre of Excellence NTIS – New Technologies for Information Society, University of West Bohemia, Pilsen, Czech Republic

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ABSTRACT

Objective: To analyze deformation of the perineum during normal vaginal delivery in order to identify clinical steps that might be beneficial when executing manual perineal protection. *Methods:* The present prospective study at Charles University Hospital, Pilsen, Czech Republic, enrolled 10 primiparous women at term undergoing non-instrumental vaginal delivery assisted by the same obstetrician between September 2009 and September 2010. A modified hands-poised technique performed concurrently with stereophotogrammetry was used to analyze and quantify perineal deformation and strain at the final stage of delivery. *Results:* The highest tissue strain (mean, 177%; 95% confidence interval [CI], 106.3–248.5) was in a transverse direction and occurred at the level of the fourchette (i.e. 1 cm was transversely stretched and deformed to 2.77 cm during the final stage of vaginal delivery). This strain was more than 4 times higher than the maximum anteroposterior strain (mean, 43%; 95% CI, 28.6–57.4). *Conclusion:* On the basis of these stereophotogrammetry data, a technique of perineal protection executed by fingers of the posterior (right) hand can be proposed. Further experimental and clinical studies are needed to evaluate whether this technique might assist in reducing obstetric perineal trauma.

1. Introduction

Studies on manual perineal protection (MPP) during the final phase of vaginal delivery have been limited. Although MPP was described in traditional obstetric textbooks [1–3], this intervention is often missing from modern textbooks altogether. Current evidence-based guidance for management decisions during labor and delivery recommends against routinely providing "hands-on" MPP [4]. Both "hands-on" and "hands-off" approaches are accepted for aiding spontaneous vaginal delivery in the UK [5,6]. This acceptance is based on the results of 2 studies [7,8]. A recent British observational study found that nearly half of all midwives surveyed preferred a "hands-off" technique [9]. Similarly, 52% of Australian midwives "almost always" or "frequently" use "hands-off" the perineum [10].

The idea that proper management of the perineum was no longer taught properly was expressed over 120 years ago, when it was also acknowledged that none of the suggested techniques was scientifically credible [11]. At that time, DeWees [11] found that only 2 out of 42 experts supported "total perineal abstaining;" however, perineal support executed by the palm was the approach that was most used. Only 6 out of 30 experts used 2 fingers (thumb and index finger) for MPP, and only 2 of those 6 reported using active coordination between these 2 fingers [11].

To categorize MPP as "hands-on," "hands-poised," or "hands-off" techniques is an unsatisfactory simplification of the problem, because previous studies have used these terms to indicate different interventions [4,8,9,12]. This is a sign of our current technical inability to describe this intervention so that it is clearly understandable, and thus reproducible and comparable.

Modern obstetric practices, which are exclusively evidence-based, commonly disregard this intervention [4]. The delivery technique, including the position of the accoucheur's hands, is not routinely registered in delivery records [13,14], and population-based retrospective studies are difficult to conduct. Only 3 randomized studies have been undertaken in which MPP was categorized into "hands-on," "hands-poised," or "hands-off" techniques [8,9,12]. Those studies did not find evidence supporting the concept that MPP is a beneficial procedure.

As a result, the aim of the present study was to describe and quantify deformation and strain of the perineal structures during the final part of delivery and, by derivation from the data collected, to suggest a modification of MPP that might decrease the degree of perineal tension.

* Corresponding author at: Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic. Tel.: +420 377 105228; fax: +420 377 105290.
E-mail address: kalisv@fnplzen.cz (V. Kalis).

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2. Materials and methods

The present prospective study conducted at Charles University Hospital, Pilsen, Czech Republic, enrolled primiparous women at term undergoing non-instrumental vaginal delivery assisted by the same obstetrician between September 1, 2009, and September 1, 2010. The study was part of a larger project PEERS 5P's: the Perineal Evaluation, Education and Repair Study International Group: Perineal Protection Program incorporating the Principles of Physics. The local ethics committee approved the study and all participants signed a detailed informed consent form before they were enrolled.

The time allocated for the study was 2 Fridays (between 12 pm and 12 am) every month over the 12-month study period. The inclusion criteria were primiparity, term singleton pregnancy, vertex presentation, non-instrumental vaginal delivery without episiotomy, neonatal weight of more than 3000 g, competent Czech or English, and a signed informed consent.

Two researchers (an obstetrician and biomechanical engineer) attended each delivery. The obstetrician assisted at all deliveries, and the biomechanical engineer executed all technical work. The obstetrician's hands did not touch the perineum before crowning of the fetal head. At the time of crowning, the modified "hands-poised" technique was used for MPP [8,9]. In keeping with this technique, the hands were applied to the perineum at the time of expulsion and not before. The anterior hand only slowed down expulsion of the fetal head, and the posterior hand and its fingers were placed alongside the fourchette and vaginal opening precisely at the time of expulsion. That meant that there was no deformation or strain on the perineal tissues.

Stereophotogrammetry was used to analyze deformations in the perineal region. It is a non-invasive method that facilitates reconstruction of an object's surface in 3-dimensional space by using a pair of images taken from 2 different positions at the same time [15]. The principle of stereophotogrammetry resembles human eye vision. The investigated object is photographed by 2 digital cameras. To perform a reconstruction of the object's surface, it is necessary to know the exact position and orientation of the 2 cameras with respect to a chosen reference system, and also the parameters of the lenses. These parameters are obtained through calibration of the scene by photographing a calibration grid first instead of the object of interest. The image coordinates of chosen points on the calibration grid, together with these points on the investigated object, are used to calculate real coordinates in the reference system.

The search for pairs of corresponding image points was performed by using the digital image correlation technique [16]. Assessment of the depth of the image was made via a mathematical model based on direct linear transformation [17]. If 2 states are processed in this way (i.e. before and after an object's deformation), it is possible to assess the components of mechanical strain (deformation) by comparing the corresponding displacement vectors of the individual points on the surface.

Given the character and speed of vaginal delivery, a system with large image resolution (10 megapixels) was used. A pair of cameras (Canon EOS D400 and D450 with Sigma 105-mm lenses) were placed approximately 1.5 m (mean, 1.49; range, 1.05–1.89) apart, and 2.4 m (mean, 2.41 and 2.46; range, 1.68–2.82 and 1.92–2.87) from the participant. Standard hospital lighting was used without any flash that could disturb the participant. Snapshots were taken manually using a synchronized remote control at a rate of approximately 1 per second during each contraction. The sequence of snapshots was then analyzed and post-processed via a stereophotogrammetry code that was written in-house.

The perineum was marked with small dark green dots (with a 1% aqueous solution of collodion stained with brilliant green). The number of dots varied between 54 and 116. The points visible in every frame were selected for the creation of a mesh composed of triangles (Fig. 1). The displacements were calculated for each point as it moved in time. The strains (deformations) were then calculated via each triangle as it deformed through time under the assumption that the strain components (dilatational, shear) were constant across the area of each triangle. Thus, a deformation field was determined on the mesh representing the surface of the perineal region.

The soft tissues of the perineal region are highly heterogeneous materials, and their mechanical response is nonlinear and anisotropic. Because the complex material properties of the perineal tissues are not known with any precision, only strain values that are commonly used in mechanics, such as the maximum (ε_1) and minimum (ε_2) principal strains, maximum shear strain (γ_{max}), and equivalent strain (ε_{eq}), were investigated in the study. These strains are invariants; that is, they are independent of the chosen reference coordinate system (position of cameras) because at every point on the surface, the deformation can be uniquely described by a combination of 3 numbers: either by 2 normal strain components ε_x and ε_y (elongation, shrinking), and 1 shear strain γ_{xy} (change in angle between perpendicular lines) with respect to a chosen Cartesian coordinate system x–y; or by 2 principal strains ε_1 and ε_2 along 2 principal directions 1 and 2, and 1 angle defining the rotation between the x–y and 1–2 axes. There is always 1 possible (or an infinite number) rotation of system x–y for which the shear strain is 0 [15]; in this case, the axes x–y coincide with the principal directions 1 and 2 ($\varepsilon_1 \geq \varepsilon_2$). The latter quantities of interest are defined as $\gamma_{max} = \varepsilon_1 - \varepsilon_2$ and $\varepsilon_{eq} = \sqrt{(\varepsilon_1^2 + \varepsilon_2^2 - \varepsilon_1\varepsilon_2)}$.

In the present study, the strain was investigated for each participant at the last possible moment of delivery (immediately before fetal head expulsion), and in contrast to the original configuration—that is, the configuration when the participant was positioned on the bed (before active pushing) and the obstetrician applied the dotted pattern.

Statistical analysis was performed with STATISTICA version 9.0 (StarSoft, Tulsa, OK, USA). Basic statistical values (such as mean, median, standard deviation, variance, minimum, maximum, quantile, and frequency) were computed for the study. The relations among the variables investigated were described via Spearman correlation coefficients. A P value of less than 0.05 was considered to be statistically significant.

3. Results

During the study period, 15 primigravid women fulfilled the inclusion criteria, consented, and were enrolled in the study before delivery. Among these women, 2 underwent cesarean delivery, and episiotomies were performed on another 3 because of fetal distress. These 5 women were, therefore, excluded from the study.

Among the remaining 10 women included in the study, 4 had an intact perineum, whereas 2 had first-degree and 4 had second-degree tears after delivery. The neonatal umbilical artery pH was lower than 7.20 in 2 cases. The obstetric data of the study group are given in Table 1.

The strain values of all of the participants are summarized in Table 2. The maximum and minimum values correspond to the whole mesh. Positive values of ε_1 and ε_2 denote tension, whereas negative values denote compression.

An example of the contours of the maximum principal strain ε_1 on the deformed mesh is shown in Fig. 2, together with the real position of the original mesh in the background. The axes x, y, and z correspond to the reference coordinate system defined by the position of cameras. An example of directions corresponding to the maximum (red) and minimum (green) principal strains is shown in Fig. 3. The lengths of the lines are also proportional to the values of the strains.

The location undergoing the largest strain was always in the area of the posterior fourchette (mean, 177%; 95% confidence interval [CI], 106.3–248.5). The maximum principal strain was predominantly

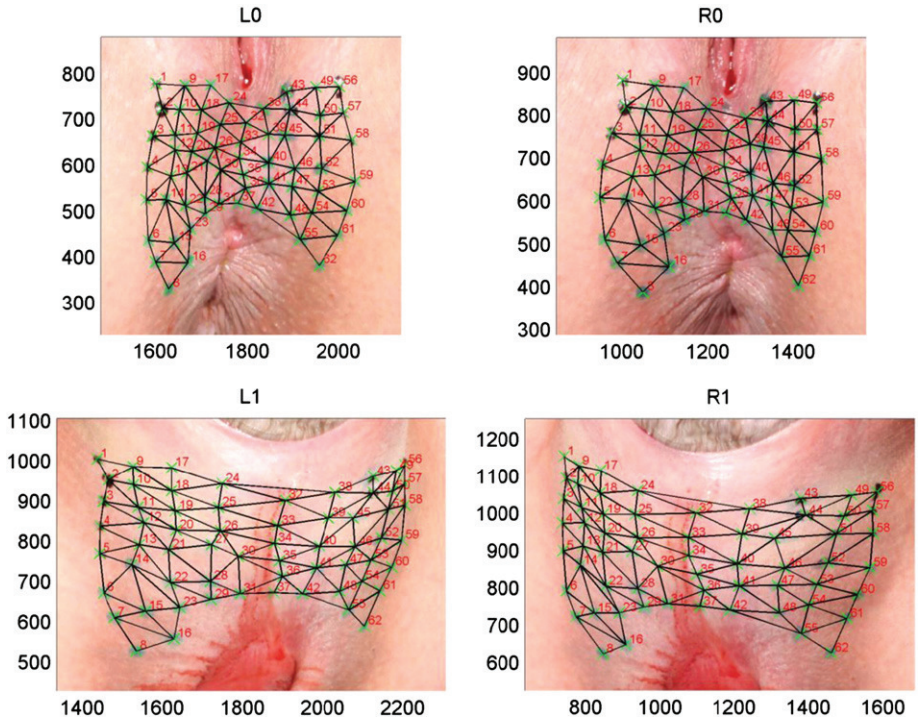

Fig. 1. The experimental mesh composed of triangles defined by dark green dots on the perineum. Shown is an example of the dot pattern applied and triangular areas (mesh) generated on 1 participant as seen from the left (L) and right (R) cameras at the original (0) and deformed (1) configurations. Values on the axes are given in pixels.

oriented in the transverse direction (Fig. 3, longest red line). The highest maximum anteroposterior strain was in the midline (mean, 43%; 95% CI, 28.6–57.4).

Of the obstetric variables measured, head circumference and neonatal weight were found to be significant in relation to the ratio of the perineal transverse strain to the anteroposterior maximum strain ($P<0.01$) (Table 3).

4. Discussion

The present results show that the highest tissue strain occurs at the posterior fourchette. The highest tissue strain was in a transverse direction at the level of the fourchette (i.e. 1 cm was transversely stretched and deformed to 2.77 cm during the final stage of vaginal delivery), and was more than 4 times higher than the maximum anteroposterior strain. If we accept the validity of the maximum strain criterion used for anisotropic materials [18], this area would be the critical location prone to tearing.

The 3 previous randomized studies comparing different techniques of MPP did not obtain clear data [8,9,12]. In the study of Albers et al. [12], the use of warm compresses, perineal massage with lubricants, and "no touch" of the perineum until crowning of the fetal head were compared. No further explanation was provided; thus, it is not clear what was performed during the crowning, or whether, at the final phase, a modification of the "hands-on" technique was provided.

The other 2 studies described the "hands-on" technique either as pressure placed on the fetal head to maintain the flexion and "guard the perineum" [8] or as "placing the right hand against the perineum for support" [9]. The terms "guard" and "support" the perineum were not further defined. Furthermore, no rectal exam was performed prior to suturing in the previous studies [8,9,12]; as a result, the information on the incidence of anal sphincter injury provided by these studies may be questionable.

Conversely, MPP has been found to reduce severe perineal tears in other studies [19–23]. In 3 of those studies only, MPP was described to some extent together with a picture with the position of the fingers of the posterior hand [21–23]. There was no description of the coordination between fingers, however, making it difficult to understand MPP and subsequently to reproduce it.

Given the principles of mechanics, there are 4 ways to reduce perineal strain and tension: decrease frictional forces; increase the elasticity of the perineum; decrease the size of the passing object—that is, minimize the largest head circumference (the suboccipitobregmatic circumference should pass through the perineal structures); or redistribute the perineal tension to reduce the localized perineal tension at

Table 1
Obstetric data of the study group.

Procedure-independent characteristics	Obstetric data	
	Median (range)	Mean ± SD
Maternal age, y	29.50 (23–34)	28.40 ± 3.44
Body mass index [a]	28.70 (23.0–37.9)	29.54 ± 4.40
Duration of the second stage of labor, min	24 (15–106)	38.50 ± 31.95
Head circumference, cm	34 (32–37)	34.30 ± 1.64
Neonatal weight, g	3530 (3220–4750)	3589 ± 433.88
Apgar score at 1 min	9 (5–10)	8.60 ± 1.65
Apgar score at 5 min	10 (8–10)	9.50 ± 0.71

[a] Calculated as weight in kilograms divided by the square of height in meters.

Table 2
Strain values measured via stereophotogrammetry among all participants.

Procedure-related characteristics		Median (range)	Mean ± SD
$\varepsilon_{1,\%}$	Min	0 (−11.53 to 0)	−2.0 ± 3.87
	Max	136.32 (76.83–381.20)	177.40 ± 99.42
$\varepsilon_{2,\%}$	Min	−38.35 (−79.61 to −16.62)	−41.65 ± 18.98
	Max	40.35 (8.21–70.29)	42.97 ± 20.13
γ_{max}	Max	1.18 (0.73–4.11)	1.74 ± 1.04
$\varepsilon_{eq,\%}$	Max	125.90 (77.31–396.83)	176.60 ± 100.85
$\varepsilon_{1\ max}/\varepsilon_{2\ max}$	Max	3.75 (2.24–9.35)	4.60 ± 2.27

Abbreviations: ε_1, maximum principal strain; ε_2, principal strain in the area of each triangle perpendicular to the maximum principal strain; γ_{max}, maximum shear strain; ε_{eq}, equivalent strain.

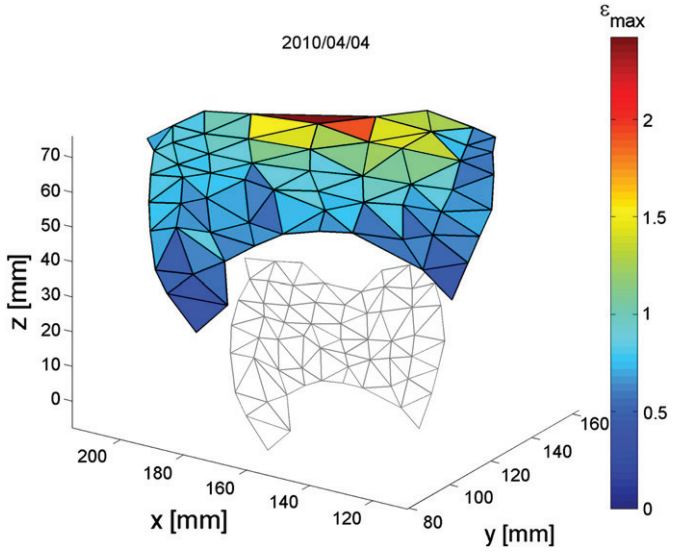

Fig. 2. Contours of the maximum principal strain ε_1 on the deformed mesh. The real position of the original mesh is shown in the background. The axes correspond to the reference coordinate system.

its maximum point by spreading the peak over a larger area (smearing) with regard to transverse tension and anteroposterior tension.

It is known that most severe perineal tears happen during the second stage of labor at the final phase of vaginal delivery. As a result, it is important to describe all dynamic changes on the perineum to understand the biomechanics of perineal trauma. On the basis of the surface geometry, the anus undergoes considerable changes during vaginal delivery and the anal sphincter dilates to an average of 25 mm [24]. Because the head dilates the vaginal orifice and the suboccipitobregmatic circumference has to be delivered, it is no use executing MPP before the fetal head crowns (i.e. there is no recession of the head between contractions because the biparietal diameter has passed through the bony pelvis).

The present study is a first step toward achieving a scientific calculation to determine the technique of MPP that should be used. If MPP is to be beneficial and reproducible, it must be described in detail, including the role of the anterior (left) hand; positioning of the palm, thumb, index, and middle-finger of the posterior (right) hand; and at what time and in which direction the gentle manual filigrane should be executed to reduce the degree of perineal trauma.

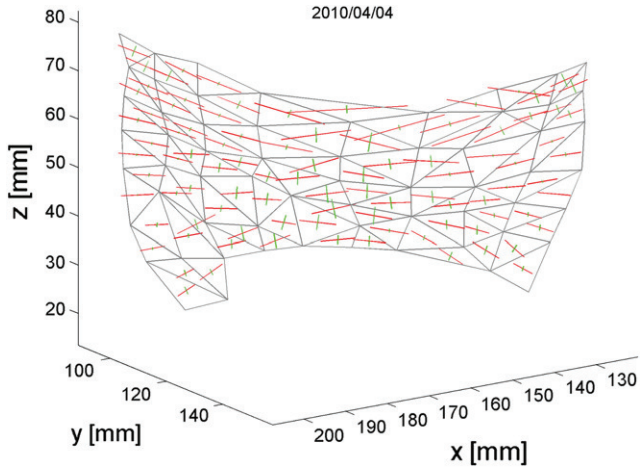

Fig. 3. Directions corresponding to the maximum (red) and minimum (green) principal strains within each triangle of the mesh. The lengths are proportional to the actual values of the strains (red line, maximum principal strain; green line, minimum principal strain). The *x*, *y*, and *z* axes correspond to the reference coordinate system.

Table 3
Relationships among the obstetric variables and perineal strain.

Variable	Spearman coefficient (*P* value)		
	$\varepsilon_{1\ max}$	$\varepsilon_{2\ max}$	$\varepsilon_{1\ max}/\varepsilon_{2\ max}$
Maternal age, y	0.104 (0.77)	0.104 (0.77)	−0.153 (0.67)
Body mass index [a]	0.636 (0.05)	0.479 (0.16)	0.042 (0.91)
Duration of the second stage of labor, min	−0.098 (0.79)	−0.018 (0.96)	−0.226 (0.53)
Head circumference, cm	−0.185 (0.61)	0.136 (0.71)	−0.790 (0.01)
Neonatal weight, g	−0.213 (0.56)	0.055 (0.88)	−0.815 (<0.01)
Apgar score at 1 min	−0.447 (0.20)	−0.497 (0.14)	0.063 (0.86)
Apgar score at 5 min	−0.624 (0.054)	−0.562 (0.09)	−0.166 (0.64)
Neonatal umbilical artery pH	−0.529 (0.12)	−0.620 (0.06)	0.237 (0.51)

[a] Calculated as weight in kilograms divided by the square of height in meters.

On the basis of the present results, we suggest the approach of relieving the transverse strain (and tension) by placing the posterior (right) hand so that the ulnar side of the thumb and radial side of the index finger are placed alongside the fourchette and vaginal opening—that is, the Vienna method [16]. To reduce the tension in the midline, the finger tips should be firmly pressed against the perineum and a region of parietal eminences of the fetal head, and should be pulled toward each other—mainly at the time of pushing—by contracting the superficial and deep flexor digitorum, the thenar muscles (especially the flexor and adductor of the thumb), the first (and occasionally also the second) lumbrical, and the first interosseous muscles.

The palm (or flexed remaining fingers) might be placed on the median part of the perineum to provide gentle support to the crowning head at the point of the highest anteroposterior strain. Whether the middle finger should be placed close to the index finger or used in another way [21–23] is a matter for further research. Whether the contraction of the accoucheur's palmar muscles in the proposed way is clinically feasible, and whether this contraction can release the strain throughout the thickness of the perineal body, has yet to be tested.

Previous unsatisfactory results from countries where the "hands-off" technique has recently been widely adopted enforce a scientific re-evaluation of the traditional method known and practiced for centuries. The present study has described quantified stereophotogrammetry data regarding the perineal strain and its direction during vaginal delivery. Further experimental and clinical studies must evaluate whether these data and their analysis might assist in the future reduction of obstetric perineal trauma.

Acknowledgments

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Conflict of interest

The authors have no conflicts of interest.

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ORIGINAL ARTICLE

Modeling manual perineal protection during vaginal delivery

Magdalena Jansova · Vladimir Kalis · Zdenek Rusavy · Robert Zemcik · Libor Lobovsky · Katariina Laine

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Abstract
Introduction and hypothesis We compared hands-on manual perineal protection (MPP) and hands-off delivery techniques using the basic principles of mechanics and assessed the tension of perineal structures using a novel biomechanical model of the perineum. We also measured the effect of the thumb and index finger of the accoucheur's dominant-posterior hand on perineal tissue tension when a modified Viennese method of MPP is performed.
Methods Hands-off and two variations of hands-on manual perineal protection during vaginal delivery were simulated using a biomechanical model, with the main outcome measure being strain/tension throughout the perineal body during vaginal delivery.
Results Stress distribution with the hands-on model shows that when using MPP, the value of highest stress was decreased by 39 % (model B) and by 30 % (model C) compared with the hands-off model A. On the cross section there is a significant decrease in areas of equal tension throughout the perineal body in both hands-on models. Simulation of the modified Viennese MPP significantly reduces the maximum tension on the inner surface of the perineum measured at intervals of 2 mm from the posterior fourchette.
Conclusions In a biomechanical assessment with a finite element model of vaginal delivery, appropriate application of the thumb and index finger of the accoucheur's dominant-posterior hand to the surface of the perineum during the second stage of delivery significantly reduces tissue tension throughout the entire thickness of the perineum; thus, this intervention might help reduce obstetric perineal trauma.

Keywords Manual perineal protection · Hands-on · Hands-off · Modeling · Perineal tension · Perineal strain

Introduction

Vaginal delivery can lead to perineal trauma, which can cause pain [1] and infection [2] in the short term and pelvic organ prolapse (POP) and stress urinary incontinence (SUI) [3] in the long term. A number of measures have been explored to avoid/reduce such trauma, including episiotomy [4] and perineal support. In the past, perineal support during the time of the delivery of the fetal head was standard practice. Several different guiding techniques for protecting the perineum during the second stage of delivery have been suggested, but no consensus for definition of manual perineal protection exists. Manual perineal protection can be understood as the use of either one or two hands when the fetal head is crowning. Flexion or extension techniques have been suggested for the accoucheur's left-anterior hand. Three main procedures were described in 1889 [5] to support the perineum using the accoucheur's right-posterior, dominant hand: the central perineal support [5], the

M. Jansova
New Technologies—Research Centre, University of West Bohemia, Pilsen, Czech Republic

V. Kalis (✉) · Z. Rusavy
Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic
e-mail: kalisv@fnplzen.cz

R. Zemcik
Department of Mechanics, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

L. Lobovsky
NTIS—New Technologies for Information Society, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

K. Laine
Department of Obstetrics, Oslo University Hospital, Oslo, Norway

Viennese method [5], and Ritgen maneuver [6]. In the central support, the palm is firmly applied to the perineum in the midline, with no coordinative work mediated by fingers [5]. In the Viennese technique, the fingers are placed alongside the fourchette and vaginal opening [5]. In the Ritgen maneuver, the tips of four fingers are placed on the posterior perineum, behind the anus, and execute a forward pressure on the fetal chin to extend the fetal head [6]. In some countries, the practice of routine manual perineal protection has fallen out of favor and seems to have disappeared in recent years.

In the USA, evidence-based guidelines for managing the second stage of labor do not recommend routine performance of MPP [7]. In the UK, both the hands-on MPP or the hands-off delivery techniques are considered appropriate for facilitating spontaneous vaginal delivery [8, 9], and a recent survey showed that a majority of junior midwives prefer the hands-off delivery technique [10] based on results of two randomized trials [11, 12]. These randomized studies compared different MPP techniques and showed no beneficial effect on the rate or degree of perineal injury. However, the hands-on technique was insufficiently defined [11–13]. The studies failed to describe whether the purpose of the light pressure (executed by the anterior hand) was merely to slow down the passage of the fetal head through the perineal structures or if it should, in addition, maintain flexion [11, 12]. The terms "guarding" and "supporting" the perineum (executed by the right-posterior hand) were not defined or explained in detail [11, 12].

Lacking a technical tool to measure changes in perineal tissue tension during delivery has made it difficult to evaluate the effects of using MPP. Recently, an analytical study showed that the maximum perineal transverse strain is more than four times higher than the highest maximum anteroposterior strain and that 1 cm of the perineal tissue at the fourchette is transversely stretched to 2.77 cm in the final phase of the second stage of delivery [14]. Derived from the principles of mechanics, reduced perineal tension can be achieved by redistributing and spreading maximum tension over a larger area. A biomechanical model allowing depiction of displacements and stresses in tissue is being developed to measure alterations on perineal tissue tension during the simulation of vaginal delivery.

The aim of this study was to evaluate whether the modified Viennese method with fingers applied to perineal skin can reduce perineal tension throughout the entire thickness of the perineum when compared with the hands-off delivery technique. The goal of this testing was to evaluate the role of the thumb and index finger of the accoucheur's dominant-posterior hand during the modified Viennese method of MPP. This study is a part of a larger project: Perineal Trauma Prevention, Evaluation, Education, and Recognition Study Group: Perineal Protection Program Incorporating the Principles of Physics (PEERS 5P's project).

Methods

Developing the biomechanical model

To design this model, the initial geometry of the female pelvic floor at the beginning of the second stage of labor was based on available data from previous experimental, clinical, and biomechanical studies. The following anatomical and mechanical parameters were chosen to define the biomechanical model in order to correspond more accurately with dynamic changes in perineal anatomy during the final stage of labor: location and dimensions (length, thickness, angle) of the perineal structures (e.g. pubis, subpubic angle, inferior pubic rami, genital hiatus, perineal body, anus), fetal-head dimensions, trajectory of fetal head passage, location of the thumb and the index finger on the perineal surface, area of contact between fingers and perineum, coordinated movement between fingers, together with its vector and experimental data obtained from previous clinical measurements [15–28], and stereophotogrammetry performed during the second stage of labor [14]. The initial perineal body length (distance between the posterior margin of the hymen and the anterior margin of the anus) was set at 3.7 cm [15, 16] with a potential to stretch to 5.0 cm [17]. The thickness of the perineal body (the craniocaudal diameter in the sagittal plane in the midline) was set at 3 mm at the posterior margin of the hymen and 14 mm at the site of the external anal sphincter [18, 19]. The subpubic angle was selected at 90° [20–22]. The anteroposterior diameter of the pelvic outlet was 11.5 cm [21]. The chosen intertuberous diameter was 11 cm [22]. All these dimensions defined the length of the inferior puboischial rami at 7 cm. The chosen diameter of the genital hiatus was 3 cm. This was derived from the diameter of the levator hiatus [23–26], the length of the genital hiatus [27], and the circumference of the two fingers of the accoucheur being used for the routine gynecological examination. The chosen diameter of the molded fetal head was 9.5 cm [25, 28], and the chosen trajectory of fetal head passage through the birth canal followed the curve of Carus. Based on the available scientific data, a numerical finite element model of the perineum was created. Model geometry and mesh were created with HyperMesh software [29]; simulations were performed using Pam-Crash software [30].

The 3D mesh was composed of 162,310 tetrahedral elements (elements composed of four triangular faces). The mean edge size of the elements was 2 mm. Elastic, viscoelastic, or hyperelastic material models are usually used for soft biological tissue [31]. The perineal tissue undergoes extremely large deformations during vaginal delivery [14]. Therefore an elastic material model was not suitable. The finite element model was designed for slow and long processes that can be performed by quasistatic simulations. Response of viscoelastic materials is time dependent, but

the final phase of the vaginal delivery takes minutes, which is considered to be a long time. A hyperelastic material model allows for large deformations and is not time dependent, which allows for shortening of the simulation without compromising the correct material response. Therefore, we used the quasi-incompressible, transversely isotropic, hyperelastic Mooney–Rivlin material model for soft tissue. Strain energy density function for this material is:

$$W = A\cdot(I_1-3) + B\cdot(I_2-3) + C\cdot\left(\frac{1}{(I_3)^2}-1\right) + D\cdot(I_3-1)^2,$$

where I_1, I_2, I_3 are the invariants of the right Cauchy–Green deformation tensor.

The 2nd Piola–Kirchhoff stress tensor is obtained as follows:

$$S_{ij} = \frac{\partial W}{\partial \varepsilon_{ij}},$$

where ε_{ij} is the Green–Lagrange strain tensor.

Coefficients A and B are material parameters; coefficient C=0.5A+B; coefficient D is a penalty factor that depends on the equivalent Poisson's ratio. If the material is close to being incompressible, the value of I_3 tends toward 1, and the penalty factor, D, approaches infinity. In our model, the quasi-incompressibility was obtained using Poisson's ratio 0.49. Coefficients A and B were set to 1 and 5 GPa, respectively.

The fetal head was modeled as a rigid body formed by 8,010 shell elements. Its trajectory was imposed so to move as close as possible to the pubic rami to resemble the fetal head movement along the curve of Carus during vaginal delivery. Sliding contact was defined as being between the fetal head and the soft tissue. Soft-tissue boundary conditions were set with respect to the anatomy. The inner area behind the pubic rami had fixed displacements to simulate tissue connection to the bone. To fix the model in space, its outer edge was fixed for all degrees of freedom. In hands-on models, finger movement was simulated by the imposed movement of nodes corresponding to the area of the fingers in contact with the skin. In model B, the movement was imposed in two directions and in model C in the posterior direction only. Other degrees of freedom of the area of the fingers remained free.

Testing MPP on the model

Vaginal delivery of the fetal head was simulated using the model. The modified Viennese method described previously [14] was used to simulate the hands-on MPP technique. The area of contact between the fingers of the right-posterior hand and the perineal skin was calculated from the experimental measurements of finger imprints. The area covered by the accoucheur's thumb and index finger corresponded to 2.5 cm^2 and 2 cm^2, respectively. We calculated the exact timing and location of finger application to the perineum and a coordinated movement between thumb and index finger using experimental stereophotogrammetric measurements from a pair of images taken in two different positions at the same time. It was calculated that fingers were applied when the vaginal introitus was dilated to 8 cm anteroposteriorly and 4 cm transversely. In the model, the fingers were applied when the anteroposterior diameter was 7 cm and the transverse diameter was 5.3 cm.

In model B, the thumb and index finger were placed alongside the fourchette and vaginal opening 11 cm apart and squeezed against the vector of the principal strain, 1 cm medially toward each other and 1 cm posteriorly toward the fourchette. Finger positions were not changed until expulsion of the fetal head was simulated (Fig. 1). In model C, a weaker grip between thumb and index finger was tested. The fingers were placed alongside the fourchette and vaginal opening 11 cm apart, together moved the touched skin 1 cm posteriorly toward the fourchette, but were not moved medially toward each other and remained 11 cm apart (Fig. 1). Axial and sagittal planes of the fetal head and perineal structures at the moment of fetal head expulsion,

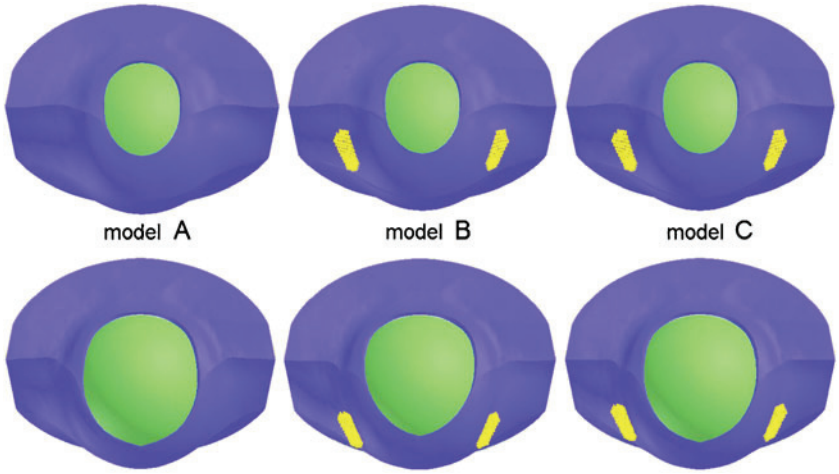

Fig. 1 Application and coordination of the thumb and index finger of the dominant-posterior hand. *Model A*: hands-off; *model B*: hands-on (squeezed 1 cm medially toward each other and 1 cm posteriorly toward the fourchette, fingertips remain 10 cm apart); *model C*: hands-on (squeezed 1 cm posteriorly toward the fourchette, fingertips remain 11 cm apart). *Blue*, soft tissue; *green*, fetal head; *yellow dots* finger location at the time of application (*first line*) and final location (*second line*)

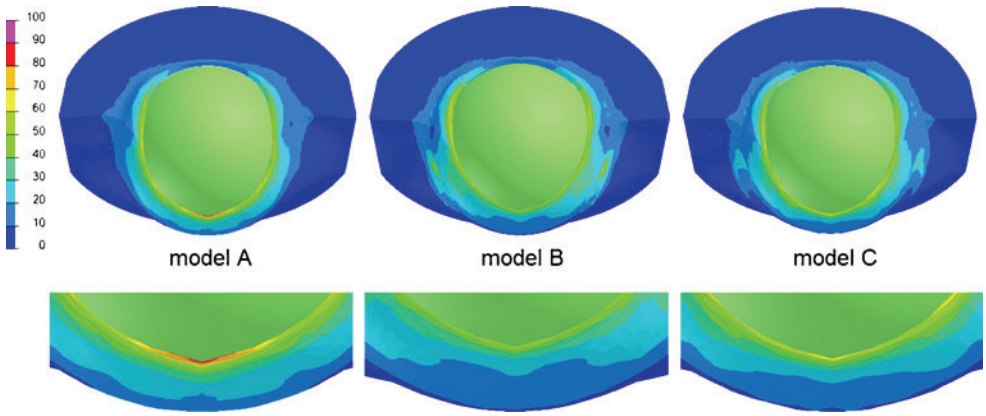

Fig. 2 Axial planes of the perineum and stress distribution in tissue, with a color spectrum in multiples of stress units at the moment of fetal-head expulsion. *Model A* hands-off; *model B* hands-on (squeezed 1 cm medially toward each other and 1 cm posteriorly toward the fourchette, fingertips remain 10 cm apart); *model C* hands-on (squeezed 1 cm posteriorly toward the fourchette, fingertips remain 11 cm apart). General view (*first line*), details of the perineum (*second line*)

are shown with a color spectrum in multiples of stress units in Figs. 2 and 3, respectively.

To facilitate comparison, perineal tissue tension was calculated in stress units, with the maximum measured tension in the hands-off model at 100 % and at rest at 0 %. The following variables in all three models were evaluated: maximum perineal tension for each model, size of areas of the proportionate tension for each model (in divisions of 20 %, i.e., 0–20 %, 20–40 %, 40–60 %, 60–80 %, and 80–100 % of stress units) (Table 1), size of areas with aggregate proportionate tension for each model (in divisions of 20 %, i.e., ≥20 %, ≥40 %, ≥60 %, and ≥80 % of stress units) (Table 2), and maximum tension on the inner surface of the perineum at each 2-mm interval from the posterior fourchette (Table 3). No statistical analysis was performed due to the nature of the study.

Results

This study revealed that for the stress distribution with the hands-off technique, the highest tension in the midline at the time of fetal-head expulsion was at the fourchette. Stress distribution with hands-on MPP showed the same location of the maximum tension at the equivalent moment of fetal head expulsion. Table 3 shows that using MPP, stress peak decreased by 39 % in model B and 30 % in model C compared with the hands-off technique. Cross sections through the midline of the perineal body (Fig. 3) revealed that in the hands-off method, the area of tissue tension >20, >40, and >60 units of stress was significantly larger compared with the hands-on techniques (Tables 1 and 2). Table 2 shows that in the hands-off technique, nearly 30 % of the perineal area was exposed to tension ≥20 stress units, whereas in the hands-on technique used in model B, the exposed area of tension ≥20 stress units was only 10 % and in model C 15 %.

Discussion

The aim of this study was to assess whether MPP can reduce perineal tension during delivery in comparison with the hands-off technique. Simulating vaginal delivery on this biomechanical model showed that according to the principles of mechanics, appropriately performed MPP reduced the maximum tension in perineal structures by 39 %. This novel perineal model allowed us to assess the effect of MPP on strain and stress on perineal tissue during a simulated vaginal delivery. The simulation focused on the correct positioning and coordination of the thumb and index finger of the accoucheur's dominant-posterior hand in order to reduce the maximum principal—transverse

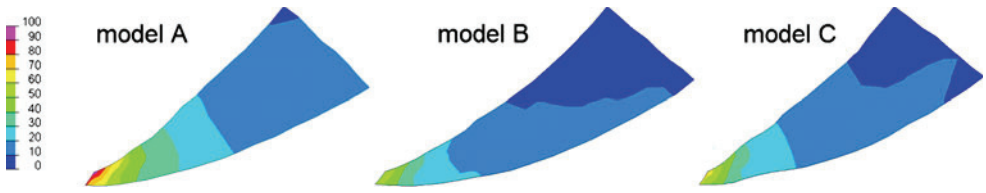

Fig. 3 Details of sagittal planes of the perineum and stress distribution in tissue, with a color spectrum in multiples of stress units at the moment of fetal-head expulsion. *Model A* hands-off; *model B* hands-on (squeezed 1 cm medially toward each other and 1 cm posteriorly toward the fourchette, fingertips remain 10 cm apart); *model C* hands-on (squeezed 1 cm posteriorly toward the fourchette, fingertips remain 11 cm apart)

Table 1 Sagittal plane through the perineal body at the moment of fetal head expulsion, with redistribution of perineal tension range. Comparison of proportionate areas of perineal body between models

Perineal tissue tension [stress units]	Proportionate area of the perineal body [%]		
	Hands-off	Hands-on	
	Model A	Model B	Model C
<20	70.2	89.9	84.8
20–40	23.3	8.5	12.7
40–60	4.7	1.6	2.3
60–80	1.4	0	0.2
80–100	0.4	0	0

(tangential) strain. Reduced strain in the posterior perineum was notable, and these results may help identify which manual procedures may reduce perineal injuries in clinical practice.

Perineal injuries are associated with many factors, and protecting the perineum against tearing during vaginal delivery is probably a multifactorial issue as well. More research is needed to assess how the accoucheur's nondominant left-anterior hand and the remaining part of the dominant right-posterior hand could be utilized. To categorize MPP into hands-on, hands-poised, or hands-off techniques only is insufficient; more detailed description of the function of the accoucheur's hands is needed to define MPP in an exact and understandable way that is reproducible and comparable with other methods. Previous studies [11–13, 32, 33] did not find the hands-on technique to be beneficial in reducing perineal trauma. However, these studies could be criticized for an imprecise methodological concept because the exact execution of hands-on MPP was neither described nor controlled, and hence the results of these studies must be interpreted with caution. In some other studies, MPP was found to be a protective factor for anal sphincter tears [34–40]. Also, in two of them [34, 35], the exact performance of MPP employed is missing.

Table 2 Sagittal plane through the perineal body at the moment of fetal head expulsion, with redistribution of perineal tension range. Comparison of aggregate areas of perineal body between models

Perineal tissue tension (stress units)	Aggregate area of the perineal body (%)			Ratio of aggregate areas	
	Hands-off	Hands-on		Hands off/on	
	Model A	Model B	Model C	Model A/B	Model A/C
<20	70.2	89.9	84.8	0.78	0.83
≥20	29.8	10.1	15.2	2.95	1.96
≥40	6.5	1.6	2.5	4.06	2.6
≥60	1.8	0	0.2	N/A	9
≥80	0.4	0	0	N/A	N/A

Table 3 Maximum tension values on the inner surface of the perineum, with tension measured at 2-mm intervals from the posterior fourchette

Distances from the fourchette (mm)	Maximum tension (%)		
	Hands-off	Hands-on	
	Model A	Model B	Model C
0	100	61	70
2	70	41	49
4	40	32	36
6	32	21	27
8	27	18	21
10	21	12	16
20	9	6	6

In a retrospective study by Pirhonen et al. [36], MPP was the only obstetric variable that significantly differed between two countries with similar quality perinatal care and remarkably different rates of severe perineal trauma. In studies by Laine et al. [37–39], Hals et al. [40], and Stedenfeldt et al. [41], several obstetric interventions were modified, resulting in a radical reduction of anal sphincter tear rate in Norway. Therefore, the exact role of MPP alone was difficult to assess.

The main limitation of this study is the lack of data regarding the material parameters of the perineal tissue. Therefore, various parameters were tested and evaluated according to their realistic behavior during the simulation. The shape of the bulging perineum and the previous experimental data (dilation of the vaginal introitus or change in perineal body length) served for this evaluation. The authors are aware of the main weakness, and so the study approach was based on general biomechanical principles. Absolute stress values achieved during simulations may differ with use of different material parameters and thus were not presented. The main message of this simulation is that there was a significant decrease in perineal tension when an adequate modification of MPP is executed. Simulations with different tested material parameters corresponding to much softer tissue showed a very similar proportionate reduction for individual modifications of MPP. At the moment, due to the lack of available data, results of this study cannot be compared with other studies that evaluate the behavior of the levator plate because the anatomic layout of the levator muscle and type of levator deformation regarding maximum strain is different than that of the perineal body. Another limitation is that this simulation was not a clinical study. There has yet to be a study on whether reducing maximum perineal tension, as shown in this computational study, can lead to clinical reduction of adverse anatomical and functional perineal outcomes. However, for future clinical evaluation, study methodologies and MPP depiction and individual clinical performance must be markedly improved to achieve reliable and reproducible results.

Conclusion

In a biomechanical assessment with a finite element model of vaginal delivery, appropriate application of the thumb and the index finger of the accoucheur's dominant-posterior hand to the surface of the perineum during the second stage of delivery significantly reduced tissue tension throughout the entire thickness of the perineum. Thus, this intervention might be beneficial in reducing the rate and/or degree of obstetric perineal trauma.

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Conflicts of interest None.

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ORIGINAL ARTICLE

The role of thumb and index finger placement in manual perineal protection

Magdalena Jansova · Vladimir Kalis · Libor Lobovsky · Ludek Hyncik · Jaroslava Karbanova · Zdenek Rusavy

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Abstract
Introduction and hypothesis Comparison of the modifications of the Viennese method of manual perineal protection (VMPP) and hands-off delivery techniques by applying basic principles of mechanics with assessments of tensions within perineal structures using a novel biomechanical model of the perineum. Evaluation of the role of the precise placements of the accoucheur's posterior (dominant) thumb and index finger in perineal tissue tension when performing a modified Viennese method of MPP.
Methods We carried out an experimental study on a biomechanical model of the perineum at NTIS (New Technologies for Information Society, Pilsen, Czech Republic). Hands-off and 38 variations of VMPP were simulated during vaginal delivery with the finite element model imitating a clinical lithotomy position.
Results The main outcome measures were quantity and extent of strain/tension throughout the perineal body during vaginal delivery. Stress distribution between modifications of VMPP showed a wide variation in peak perineal tension from 72 to 102 % compared with 100 % for the "hands-off" technique. Extent of reduction depended on the extent of finger movement across a horizontal, transverse x-axis, and on final finger position on a vertical, antero-posterior y-axis. The most effective modification of VMPP was initial position of fingers 12 cm apart ($x=\pm 6$) on the x-axis, 2 cm anteriorly from the posterior fourchette ($y=+2$) on the y-axis with 1cm movement of both finger and thumb toward the midline on the x-axis ($\Delta x=1$) with no movement on the y-axis ($\Delta y=0$).
Conclusions In a biomechanical assessment with simulation of vaginal delivery, exact placement of fingertips on the perineal skin, together with their co-ordinated movement, plays an important role in the extent of reduction of perineal tension.

Keywords Manual perineal protection · Hands-on · Hands-off · Modeling · Perineal tension · Perineal strain

Introduction

Obstetrical anal sphincter injuries (OASIS) may have serious short- and long-term consequences such as perineal pain and/or defecatory disorders. Despite a recent and dramatic rise in the incidence of OASIS [1] little has been done to implement any preventive steps to reverse this trend.

Manual perineal protection (MPP) during the final phase of the second stage of vaginal delivery has historically been one of the most frequently considered interventions for protecting the perineum. However, it has only rarely been investigated in recent years. In the past, a variety of techniques for MPP were proposed in relation to the pelvic anatomy and fetal head trajectory during vaginal delivery. The anterior (non-dominant) hand may assist either in the flexion or possibly the extension of the fetal head during the crowning of the perineum [2–4] or may just be used to slow the passage of the fetal head through the perineal structures without any additional flexion or extension. To answer the question regarding the substantial range of deformation to the perineum during the final phase of vaginal delivery, suggestions for the posterior (dominant) hand of the accoucheur [2] have included

Magdalena Jansova and Vladimir Kalis are joint first authors

M. Jansova · L. Hyncik
New Technologies—Research Centre, University of West Bohemia, Pilsen, Czech Republic

V. Kalis (✉) · J. Karbanova · Z. Rusavy
Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic
e-mail: kalisv@fnplzen.cz

L. Lobovsky
NTIS—New Technologies for Information Society, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

palmar support executed in the midline [3], the Viennese method with fingertips alongside the vaginal introitus [2–4], or the Ritgen maneuver [5].

It is still difficult to prove the clinical significance of MPP. Previous randomized clinical studies [6, 7] have not found MPP to be beneficial in its effect on the range and/or degree of perineal trauma. In spite of the fact that a significant reduction in pain was observed in the group undergoing MPP [6], owing to the poor effect of MPP regarding the OASIS rate demonstrated in these studies [6, 7], neither the current evidence-based guidelines [8–10] nor the reviews [11] recommend the routine use of MPP for every vaginal delivery.

In the methods of these clinical studies [6, 7] the definitions of the terms "hands-on," "hands-off," and "perineal support" applied to non-identical interventions that differed from study to study [11] since a complete and precise description of the execution MPP was lacking [2, 4, 11]. Also, there was no adequate control of the exact execution of MPP, nor was any evaluation made of the real range of perineal trauma [2, 4].

Manual perineal protection (MPP) has also been put forward as a protective factor for OASIS [12–17]. In a retrospective study, it represented the only obstetric variable that differed significantly between two countries that exercise similar perinatal care while displaying remarkably different OASIS rates [12]. Other studies [13–17], incorporating a set of various modified interventions, led to significant decreases in OASIS. Therefore, the exact role played by MPP alone was difficult to assess.

Recently, simulation of the vaginal delivery of a spherical head using a novel biomechanical model both with and without MPP has shown that a part of this complex obstetrical intervention, the Viennese method (VMPP), markedly reduced the perineal tension throughout the full thickness of the perineum [2]. Two modifications of VMPP were compared with the hands-off approach resulting in a reduction in perineal tension of 39 % and 30 % respectively [2].

The aim of this study was to evaluate which specific location of the fingers on the perineum, together with co-ordinated movements between them, might achieve the maximum reduction in perineal tension with a view to minimizing perineal trauma.

A finite element biomechanical model [2] was used to analyze and compare the tension of the perineum during vaginal delivery for 38 different modifications of VMPP and the hands-off technique. This study was the third part of a larger project: PEERS 5P's (Perineal Trauma Prevention, Evaluation, Education and Recognition Study Group: Perineal Protection Program incorporating the Principles of Physics).

Materials and methods

The finite element model designed in a previous study [2], based on data from previous experimental, clinical, and biomechanical studies, and female pelvic floor geometry during the second stage of labor [4, 18–27], was used in this study for the simulation of the passage and expulsion of the fetal head during vaginal delivery.

A quasi-incompressible, transversely isotropic hyperelastic Mooney–Rivlin material model for the soft tissue was used in this study. The material and its parameters were described in a previous study [2].

The model geometry and the computational mesh were generated using a HyperMesh software package (Altair, Troy, MI, USA).

For the development of the numerical model of the realistic molded fetal head, a comparison was made between the dimensions resulting from the MR imaging of the full-term neonatal skull and from the CT scan of a real neonatal skull borrowed from the Department of Anatomy. To obtain dimensions and shapes for the molded fetal skulls, the widths of the skull sutures were subtracted and the final skull dimensions compared with the plastic molded model of the neonatal skull (Educational and Scientific Products, Rustington, UK). As the differences in the dimensions of the three skulls were insignificant and considering that it was easy to handle, the plastic molded model of the fetal skull was used for further development of the numerical finite element model (Fig. 1).

The trajectory of the passage of the fetal head through the birth canal followed the curve of Carus. The simulations were performed using Pam-Crash software [28]. Defining the exact timing of VMPP was achieved with the aid of experimental stereophotogrammetric measurements [2]. MPP was initiated when the dimensions of the vaginal introitus were 7 cm antero-posteriorly and 5.3 cm transversely [2]. The referential points for defining an exact location for the application of the finger (the tip of the distal phalanx) on the perineum were the anterior foci of the elliptic imprints of the fingertips (Fig. 2).

Calculation of the exact location (x, y) of finger application to the perineum was made using the referential point (0, 0) at the posterior fourchette (Fig 2). An axial plane of the perineal structures and fetal head was used for defining the x- and y-axes. These axes were defined as horizontal and vertical lines crossing the referential point. The co-ordinated movement between thumb and index-finger was performed along these axes (Δx, Δy).

The finite number of applications for each of four variables (x, y, Δx, Δy) was chosen regarding the real range of the deformation of the perineal structures, the anthropometric characteristics of the human hand, and the limits of the clinical precision of this intervention. The initial placement of the thumb and the index finger (x, y) was: 12 (−6, +6), 11 (−5.5, +5.5) or 10 (−5, +5) cm apart on the x-axis and at +3, +2, +1, 0, −1, −2 or −3 cm on the y-axis. The movement of each of the virtual fingers on the perineal skin (Δx, Δy) was 1, 0.5 or 0 cm medially from each side (on the x-axis) and 2, 1 or 0 cm posteriorly (on the y-axis). For example, in simulation 1, the

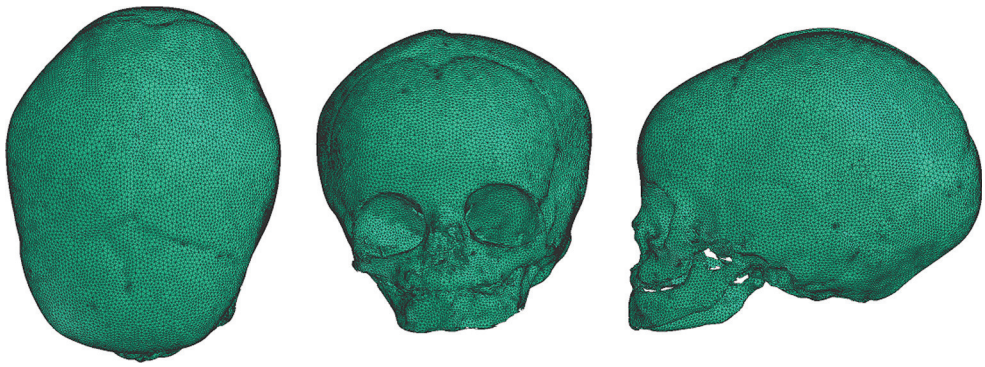

Fig. 1 Finite element model of the realistic molded fetal head

initial position of the thumb was on the right side 6 cm from the midline and 3 cm anteriorly of the level of the fourchette, while the initial position of the index finger was on the left side 6 cm from the midline and 3 cm anteriorly of the level of the fourchette (x=±6, y=+3). The movement of the finger tips (the movement of the tip of the distal phalanx) was 1 cm medially on both sides and 2 cm posteriorly (Δx=1, Δy=2), making the final position of the thumb 5 cm to the right of the midline and 1 cm anteriorly of the level of the fourchette, and for the index finger 5 cm left of the midline and 1 cm anteriorly of the level of the fourchette (x=±5, y=+1; Table 1).

The maximum perineal tissue tension and the size of the area of high tension (defined as an area of the perineal body on the cross-section through the mid-sagittal plane where the increment of perineal tension exceeded 20 % of the maximum tension achieved during the "hands-off" simulation) measured during the simulated expulsion of the fetal head (Fig 3) were compared with "hands-off," i.e., where no MPP was used.

The stretching and movements of the perineal tissue around the fetal head were recorded for all modifications of VMPP and "hands-off" techniques during a video simulation. The measurements were performed at the time of the passage of the suboccipito-bregmatic circumference through the vaginal introitus. A colored scale was used for digital visualization of the relative perineal tension, whereby 100 % corresponds to the maximum stress in the "hands-off" technique (Fig. 3).

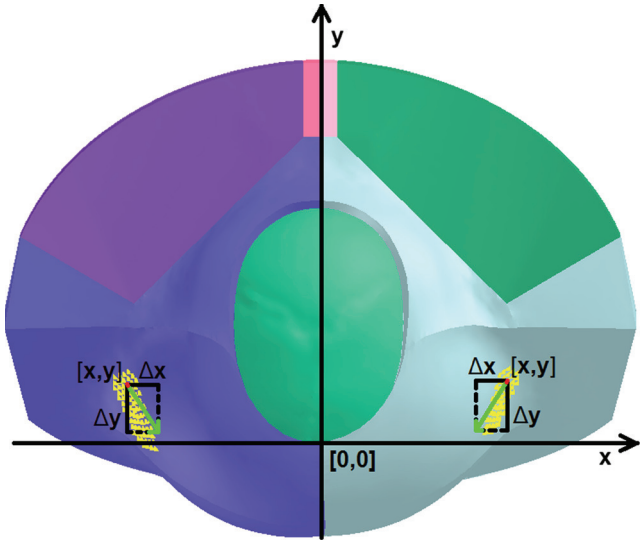

Fig. 2 Calculation of the exact placement (x, y) of the fingers on the perineum together with their subsequent movement (Δx, Δy)

Results

The stress distribution between modifications of VMPP simulated in the tests showed a wide variation in the peak tension between 72.1 and 102.1 % compared with the "hands-off" technique. In a majority of modifications of VMPP some degree of reduction in the maximum perineal tension was achieved (Table 1). The extent of this reduction depended on the modification used, i.e., on the extent of the movement of the fingers along the x-axis and on the final finger position on the y-axis (Table 1). On the cross-section of the stretched perineum there is a considerable decrease in the area of high tension throughout the perineal body in simulations performed with VMPP (e.g., hands-off and simulations 7 and 11, see Fig 3). With no modification of VMPP made on the cross-section, the area of high tension was larger than when the "hands-off" technique was used.

In the most effective modification of VMPP (simulation 7), the initial position of the fingertips was 12 cm apart (x=±6) on the x-axis and 2 cm anteriorly from the posterior fourchette (y=+2) on the y-axis with 1cm movement of both finger and thumb toward the midline on the x-axis (Δx=1) and no movement on the y-axis (Δy=0).

The following comparisons illustrate the importance of precision in the execution of such a complex procedure as MPP.

The placement of fingers and their movement along the y-axis

Identical initial position, different final positions on the y-axis

When simulations 5, 6, and 7 were compared, the only difference between them in this regard was the change in the finger's

Table 1 Initial and final thumb and index finger placement on the perineum, their co-ordination, and the relative perineal tension achieved

Model	Initial placement (x-axis)	Initial placement (y-axis)	Transverse movement (Δx)	Antero-posterior movement (Δy)	Maximum perineal tension (%)	Area of increment of perineal tension >20 % (%)
0	Hands off				100.0	20.4
1	12 (−6; +6)	3	1	2	90.5	12.3
2	12 (−6; +6)	3	1	1	76.9	9.5
3	12 (−6; +6)	3	0.5	2	101.1	17.4
4	12 (−6; +6)	3	0.5	1	92.6	14.2
5	12 (−6; +6)	2	1	2	97.4	12.8
6	12 (−6; +6)	2	1	1	88.4	12.3
7	12 (−6; +6)	2	1	0	72.1	8.9
8	12 (−6; +6)	2	0.5	2	100.5	18.9
9	12 (−6; +6)	2	0.5	1	93.7	16.1
10	12 (−6; +6)	2	0	2	102.1	20.0
11	12 (−6; +6)	2	0	1	101.1	19.3
12	12 (−6; +6)	1	1	1	97.4	13.7
13	12 (−6; +6)	1	0.5	1	98.4	19.2
14	12 (−6; +6)	1	1	0	90	12.6
15	12 (−6; +6)	1	0.5	0	91.6	19.4
16	12 (−6; +6)	0	1	0	93.7	13.2
17	12 (−6; +6)	0	0.5	0	97.9	19.4
18	11 (−5.5; +5.5)	3	0.5	2	96,.3	12.4
19	11 (−5.5; +5.5)	3	0.5	1	81.1	13.1
20	11 (−5.5; +5.5)	2	0.5	2	86.9	19.0
21	11 (−5.5; +5.5)	2	0.5	1	88.4	12.5
22	11 (−5.5; +5.5)	2	0.5	0	77.9	12.8
23	11 (−5.5; +5.5)	2	0	1	99.5	19.2
24	11 (−5.5; +5.5)	1	0.5	1	95.8	17.3
25	11 (−5.5; +5.5)	1	0.5	0	85.8	12.8
26	11 (−5.5; +5.5)	0	0.5	0	92.6	17.6
27	11 (−5.5; +5.5)	0	0	0	96.3	20.4
28	11 (−5.5; +5.5)	−1	0	0	99.5	20.4
29	11 (−5.5; +5.5)	−2	0	0	100.0	20.4
30	10 (−5; +5)	2	0	2	100.5	18.8
31	10 (−5; +5)	2	0	1	91.1	14.2
32	10 (−5; +5)	1	0	1	100.5	19.1
33	10 (−5; +5)	1	0	0	85.3	13.4
34	10 (−5; +5)	0	0	0	91.1	13.7
35	10 (−5; +5)	−1	0	0	97.4	17.9
36	10 (−5; +5)	−2	0	0	98.4	19.4
37	8 (−4; +4)	−2	0	0	92.1	12.2
38	8 (−4; +4)	−3	0	0	97.4	15.4

posterior movement along the y-axis (Fig 4a). In simulations 5 and 6, an additional posterior movement was made (simulation 5: Δy=2, simulation 6: Δy=1), while in simulation 7, the fingers remained unmoved on the y-axis (Δy=0; Fig 4). The reduction in maximum perineal tension in simulation 5 was 2.6 %, in simulation 6 it was 11.6 % compared with 27.9 % in simulation 7. The comparisons of results of other simulations, in which the only difference was the movement of the fingers along the y-axis, showed a similar pattern (e.g., simulations 12 versus 14 or simulations 20 versus 21 versus 22).

Comparing the sizes of the areas of high tension in these models, the areas in simulations 5 and 6 were comparable (12.8 % for simulation 5 and 12.3 % for simulation 6) and significantly smaller in simulation 7 (8.9 %; see Table 1).

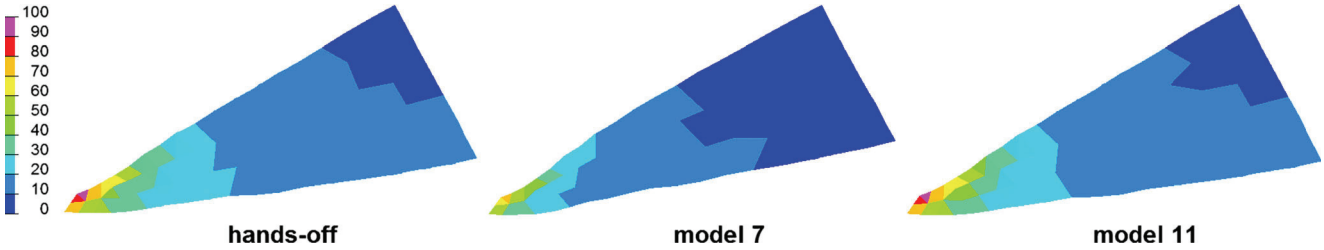

Fig. 3 Mid-sagittal planes of the perineum and stress distribution in the tissue with a color spectrum in multiples of stress units at the moment of fetal head expulsion

Different initial position, identical final position on the y-axis

Simulations 18, 21, and 25 were compared (Fig 4b). Because of the initial position of the fingers and their subsequent movement along the y-axis (simulation 18: y=+3, Δy=2; simulation 21: y=+2, Δy=1; simulation 25: y=+1, Δy=0), the final positions of the fingers were identical (x=±5, y=+1; Fig 4b). The reductions achieved in maximum perineal tension were 3.7 %, 11.6 %, and 13.2 % respectively, and the sizes of the areas of high tension covered 12.4 %, 12.5 %, and 12.8 % of the perineum respectively. The results were consistent when other simulations (e.g., 1, 6, and 14 or 3, 9, and 15) were compared (Table 1).

It can be surmised that the resulting final position of fingers on y=+2 is the most effective. The role of the movement of the fingers along the y-axis is less significant than the final position. However, it seems that for Δy=0 (i.e., when the initial position on the y-axis corresponds to the final position), the reduction in perineal tension is the most profound.

The placement of fingers and their movement along the x-axis

Identical initial position, different final position on the x-axis

In simulations 6, 9, and 11 the only difference is the extent of the movement of the fingers along the x-axis (Fig 4c). In simulation 6 the fingers were moved bilaterally 1 cm toward the midline (Δx=1), while in simulation 9 the fingers approximated to 0.5 cm on each side (Δx=0.5) and in simulation 11, the fingers were not approximated at all (Δx=0; Fig 4c). The reduction in maximum perineal tension in simulation 6 was 11.6 %, in simulation 9 it was 6.3 %, while no reduction in tension occurred in simulation 11.

Comparing the sizes of the areas of high tension, the area in simulation 6 was 12.3 %, in simulation 9 it was 16.1 %, and in simulation 11 it was 19.3 %. The situation was similar for other simulations, which compared only the difference in the movement of the fingers along the x-axis (e.g., simulations 1

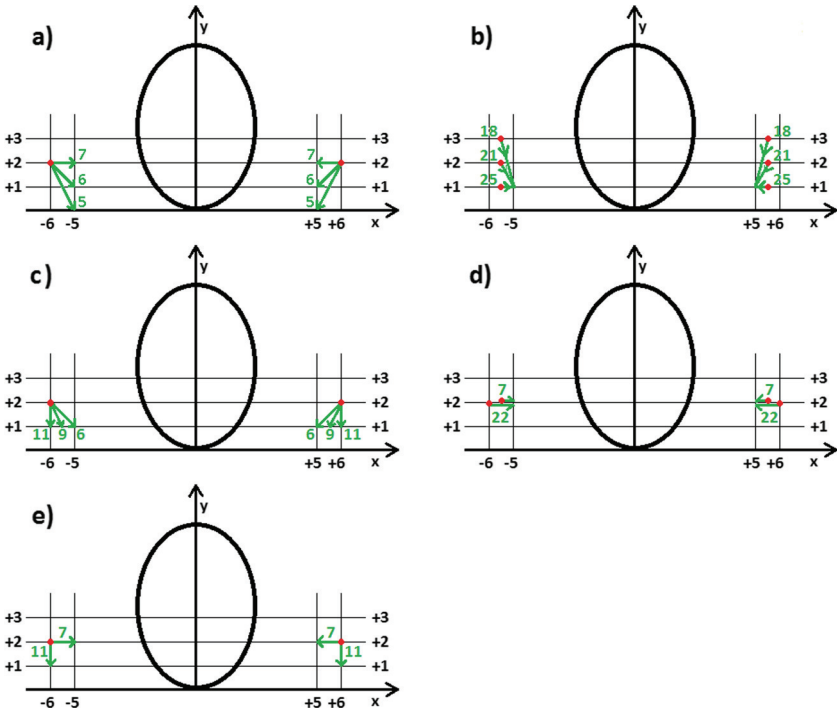

Fig. 4 Scheme of the initial and final locations of the thumb and index finger in various modifications of VMPP on axial planes of the perineum.
a Simulations 5, 6, and 7.
b Simulations 18, 21, and 25.
c Simulations 6, 9, and 11.
d Simulations 7 and 22.
e Simulations 7 and 11

versus 3; 2 versus 4; 21 versus 23). However, in comparisons of simulations 12 versus 13; 14 versus 15; or 16 versus 17 the differences in maximum tension and in the areas of high tension were not significant. The explanation for this finding could be that in these models the final position of the fingers on the y-axis was less than 2 cm anteriorly from the posterior fourchette (i.e., y=+1 for simulations 14 and 15 and y=0 for simulations 12, 13, 16, and 17) Therefore, having been positioned away from the vector of the principal perineal strain, the contraction of the thumb and index finger toward each other could not achieve the full effectiveness.

Different initial position, identical final position on the x-axis

In simulations 7 and 22 the fingers moved from 12 cm apart in simulation 7 (x=±6, Δx=1) and from 11 cm in simulation 22 (x=±5.5, Δx=0.5) to an identical final position at 10 cm apart (x=±5, y=+2; Fig 4d). The reductions in maximum perineal tension achieved were 27.9 % and 22.1 % respectively and the sizes of areas of high tension were 8.9 % and 12.7 % respectively. The measurements showed a similar pattern when other simulations (e.g., 2 and 19) were compared, with a slightly lower degree of similarity for the sets of simulations 6, 21, and 31 and 12, 24, and 32 (Table 1). The explanation for this phenomenon is that fingers in those simulations moved to a final position on the y-axis that was more posterior than 2 cm anteriorly of the fourchette (i.e., y=+1 for simulations 6, 9, and 31 and y=0 for simulations 14, 24, and 33).

Analyzing these simulations, it seems that the extent of the movement of the fingers along the x-axis toward the midline is important for the effectiveness of the procedure, on the condition that this movement occurs anteriorly of the fourchette to a substantial degree (i.e., when y=+2).

The placement of fingers and their movement along both the x- and y-axes

The importance of the mutual co-operation between fingers in both dimensions is documented in the comparisons of simulations 7 and 11 (Fig 4e). The initial placement of both fingers was identical in both simulations (x=±6, y=+2). The fingers were then moved by 1 cm, but in a different direction. In simulation 7, fingers were approximated at 1 cm on each side with no movement along the y-axis (Δx=1, Δy=0) while in simulation 11, fingers were not approximated and moved 1 cm posteriorly (Δx=0, Δy=1) (Fig 4). The difference between the maximum perineal tension achieved was 29 % and the size of the area of high tension was more than twice as large in simulation 11. Comparing these two simulations, a distance of 1 cm in the wrong direction is responsible for nearly 30 % of the difference in the maximum perineal tension using this model.

Discussion

In a biomechanical computerized simulation, VMPP markedly reduces the tension in the perineal body at the point of maximum strain. The exact placement of the fingertips on the perineal skin together with their co-ordinated movement plays an important role in the extent of this reduction.

The previous randomized controlled trials [6, 7] have not found MPP to be effective. However, no information on the exact positioning and subsequent movement of the fingers during MPP was provided by any of these studies. In the light of current findings it seems that these trials were poorly designed and controlled regarding the precision of the execution of MPP [6, 7]. The clear advantage of this modeling over clinical studies is that the simulation could be stopped at any moment during the delivery and the tension measured precisely, which is impossible in a clinical setting. The other advantage is that one variable (i.e., positioning of the fingers) could be changed while others remain unchanged. This allows for comparisons to be easily made between the simulations/deliveries and obstetric interventions, along with the corresponding results.

The main limitation of this study is the material and the setup of its parameters. There is a lack of data describing the behavior of perineal tissue under load and that is why the authors selected the parameters after repeated tests and evaluations had been performed based on their realistic behavior during the simulation [2].

Generally, there are two types of materials used for soft tissue modeling: viscoelastic and hyperelastic. Viscoelastic material is dependent on the strain rate and the loading history. In order to properly assess the viscoelasticity of the perineal structures, long-time simulations are required. However, the duration of the second stage of vaginal delivery is counted in minutes and simulations using viscoelastic material would require excessive computational effort. Hyperelastic material was adopted for this study as it has been in other similar studies [27, 29, 30].

Two suitable hyperelastic material models can be applied in the solver: the Ogden and Mooney–Rivlin types. In areas of large deformation, these materials differ in the rate in which the change in stress values depends upon the change in strain. Change in stress is smaller for the Mooney–Rivlin material than the Ogden type. As the result of the study should be an evaluation of stress reduction with regard to strain, the reduction when using the Mooney–Rivlin material is expected to be smaller than when using the Ogden material. Therefore, the authors used Mooney–Rivlin material in order to avoid any bias in the results of the study. Moreover, the Mooney–Rivlin material exhibited more stable and realistic behavior during simulation. A precondition of this study was that the experimental results, i.e., the reduction in stress/tension, should never become unrealistically more profound than that in a clinical setting.

In order to achieve realistic behavior of the model, values of an order of GPa were used for coefficients of material parameters [2]. The stress values are linearly dependent on the order of the chosen coefficient values, i.e., 10 times lower values of coefficients result in 10 times lower stress values. The goal of the study was not to compare the absolute values of the stress, but the relative difference in stress/tension between particular versions of the model simulations. Thus, the peak of the stress in the hands-off simulation was selected as the reference value of 100 % and the results of simulations of MPP were related to this value as percentages. This approach compensates for any inaccuracy in the material parameters selected due to the lack of experimental data. Therefore, the selection of values for material parameters, in GPa or in MPa or in kPa, does not affect the results of the study.

This study did not provide a value for exact tissue tension that could represent the threshold for tearing of the perineum. The aim of the study was to find out how to position the fingers on the perineum and how to move them in order to reduce the perineal tension most effectively. Because of the high inter-individual variability in the perineal tissue characteristics amongst women, it is possible that the same maneuver, capable of preserving an intact perineum in one patient, might result in a perineal tear in another. However, using the suggested maneuver, the decrease in maximum perineal tension should be proportionate; thus, the rate and degree of perineal trauma should generally be reduced.

According to the computerized simulation presented in this study, the extent of this reduction depends on the modification used, i.e., on the final finger position and that, for the most part, on the y-axis, and the extent of movement and final position of the fingers mainly depends on the x-axis. To execute MPP effectively, the fingers must be placed sufficiently anteriorly and sufficiently apart following the vector of the principal perineal strain [4]. If the positioning of the fingers moves away from this vector, the effectiveness of MPP is substantially reduced.

Further studies are needed to evaluate whether and to what extent the effectiveness of the optimal placement and coordinated movement of the fingertips during VMPP differs in various anatomical settings (fetal head size, edema of the perineum, etc.). Furthermore, a subsequent clinical study based on this simulation ought to be performed to document whether the reduction in maximum perineal tension shown in this study, computational in nature, might play a significant role in a clinical reduction of any of the known adverse anatomical and functional perineal outcomes.

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CLINICAL ARTICLE

Clinical evaluation of peripartum outcomes of mediolateral versus lateral episiotomy

Jaroslava Karbanova [a], Zdenek Rusavy [a], Lucie Betincova [a], Magdalena Jansova [b], Antonin Parizek [c], Vladimir Kalis [a,*]

[a] Department of Gynecology and Obstetrics, University Hospital, Faculty of Medicine, Charles University, Pilsen, Czech Republic
[b] European Centre of Excellence NTIS – New Technologies for Information Society, Faculty of Applied Sciences, University of West Bohemia, Czech Republic
[c] Department of Gynecology and Obstetrics, General University Hospital, First Faculty of Medicine, Charles University, Prague, Czech Republic

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ABSTRACT

Objective: To evaluate the incidence and extent of vaginal and perineal trauma among primiparous women after mediolateral and lateral episiotomy. *Methods:* In a prospective randomized study at University Hospital Pilsen, Czech Republic, 790 consecutive primiparous women were enrolled between April 2010 and April 2012. Mediolateral episiotomy (MLE) followed an angle of at least 60° from the midline. Lateral episiotomy (LE) started 1–2 cm laterally from the midline and was directed toward the ischial tuberosity. A rectal examination was performed before episiotomy repair. *Results:* MLE was performed for 390 women, and LE for 400. The groups did not differ in maternal or neonatal characteristics. No difference was found in incidence or extent of vaginal and perineal trauma; or in additional perineal (1.8% vs 1.5%, $P = 0.6$) or vaginal (8.5% vs 10.6%, $P = 0.2$) trauma continuing along the episiotomy incision. The incidence of anal sphincter injury did not differ between MLE and LE (1.5% vs 1.3%, $P = 0.7$). MLE was associated with shorter repair times ($P < 0.05$), less suturing material ($P < 0.05$), and shorter distances from the anus ($P < 0.001$). *Conclusion:* Risk of additional vaginal and perineal trauma, and anal sphincter injury after adequately performed mediolateral episiotomy is relatively low and corresponds to that of lateral episiotomy.

1. Introduction

Episiotomy, the enlargement of the vaginal orifice by an incision in the perineum during the second stage of labor, is primarily performed to facilitate delivery in cases of fetal distress, instrumental delivery, or thick inelastic perineum. The relationship between various types of episiotomy and obstetric anal sphincter injuries (OASIS) has not been clearly evaluated.

A meta-analysis in the Cochrane database evaluated studies in which only 2 episiotomy types, midline and mediolateral, were used [1]. However, 7 different types of episiotomy have recently been described and a comprehensive classification has been suggested [2]. Furthermore, the meta-analysis did not provide a definition of mediolateral episiotomy [1]. An exact definition of the type of episiotomy regarding the location of its beginning, and the direction and length of incision is essential for an exact comparison of results from various studies [2].

Some studies have evaluated the execution of mediolateral episiotomy [3–10]. An angle of at least 60° from the midline has been suggested to define the incision of mediolateral episiotomy [2,6]. By contrast, lateral episiotomy starts 1–2 cm from the midline and is directed toward the ischial tuberosity [2]; this type of episiotomy is rarely mentioned in obstetric literature, despite its relatively frequent use. The British pictorial questionnaire study demonstrated that one-third of health professionals started cutting the episiotomy laterally from the midline [5]. Lateral episiotomy is commonly used in Finland and Greece [11–14]. Furthermore, 7% of European institutions interchange episiotomy types and define the beginning of mediolateral episiotomy as 1 or 2 cm laterally from the midline [4].

There have been a few retrospective studies of lateral episiotomy that have found it to be a protective factor of OASIS [11,12,15,16]; however, no studies comparing mediolateral and lateral episiotomies have been performed.

On the basis of the results of previous studies evaluating mediolateral episiotomy, the incidence of OASIS varies between 1% and 9% [17–19]. However, in a previous study by Kalis et al. [6] in which episiotomy was performed by 2 experienced obstetricians on 60 primiparous women with a measured incision angle of 60°, no anal sphincter tear was diagnosed. It was assumed that if their definition of mediolateral episiotomy is always applied, the incidence of OASIS would remain low even if vaginal delivery were assisted by a range of doctors and midwives.

The aim of the present study was to test the following hypotheses. First, mediolateral episiotomy does not increase the incidence of OASIS.

* Corresponding author at: Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic. Tel.: +420 377 105 212, +420 777 067 699; fax: +420 377 105 290.
E-mail address: kalisv@fnplzen.cz (V. Kalis).

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Second, mediolateral episiotomy does not increase the incidence or extent of additional vaginal and perineal trauma in the continuation of the episiotomy. Third, mediolateral episiotomy is shorter in length and in distance between the episiotomy and the anus compared with lateral episiotomy. Fourth, mediolateral episiotomy decreases maternal blood loss, time of episiotomy repair, and suturing material used compared with lateral episiotomy.

2. Materials and methods

The present prospective randomized study was carried out among consecutive primiparous women who delivered at University Hospital Pilsen, Czech Republic, between April 1, 2010, and April 1, 2012. The study was approved by the local ethics committee. All participants signed detailed informed consent prior to enrollment.

A power calculation for the number of patients needed for each group was performed before the study. On the assumption of an incidence of OASIS of 1% in the comparative lateral episiotomy group [11,12,15], at least 326 women were required in each intervention group to achieve a power of 80% at a 2-sided α level of 0.1 with a limit of tolerance of ±2.0%.

An educational seminar, together with practical workshops, was arranged for all obstetric staff before study commencement to discuss processing of study participants in detail. Two researchers (J.K., Z.R.) attended prenatal classes to discuss the study. A written list of all steps was delivered to all doctors and midwives. Regular educational seminars were held throughout the study period. During the vaginal birth, each woman was attended to by a doctor and a midwife, both of whom were experienced with the study instructions.

The study inclusion criteria were vaginal birth, primiparity, episiotomy performed in accordance with the study protocol, gestational age of 37 completed weeks, and signed informed consent. The exclusion criteria were maternal age below 16 years, previous perineal surgery, stillbirth or delivery of a newborn with extensive congenital abnormalities, severe perineal condylomata or extensive varicose veins, and inability to communicate in Czech or English.

Potential participants were divided into 2 study groups: primiparous women with right-sided mediolateral episiotomy, and those with right-sided lateral episiotomy. Randomization was performed at admission in the first stage of labor by selecting and opening 1 of the pre-prepared opaque envelopes indicating episiotomy type (mediolateral or lateral) to be performed if indicated. Women were blind to the episiotomy type that was selected and performed during delivery.

Mediolateral episiotomy was defined as an incision beginning in the midline at the posterior fourchette and directed at an angle of at least 60° toward the ischial tuberosity [2,8,10]; lateral episiotomy was defined as an incision beginning 1–2 cm laterally from the midline and directed toward the ischial tuberosity [2]. All episiotomies were repaired using the same continuous, non-locking technique and subcuticular insertion of the stitch [20]. In all cases, a 120-cm length of 2-0 short-term absorbable polyglactin 910 was used for repair [20].

The following maternal and neonatal obstetric characteristics and variables were recorded: maternal age, level of education, ethnic group, marital status, body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters), number of fetuses, fetal presentation (cephalic occipitoanterior, occipitoposterior, breech), epidural, duration of the second stage of labor, signs of fetal distress (abnormality in the fetal heart rate pattern observed using cardiotocography with or without concomitant ST segment analysis), instrumental delivery (forceps, vacuum extraction), shoulder dystocia, person performing the episiotomy (doctor/midwife), neonatal weight, neonatal umbilical artery pH, 5-minute Apgar score, maternal blood loss, postpartum uterine atony (Table 1), episiotomy length, shortest distance of the episiotomy from the anus, OASIS, additional vaginal and perineal trauma in the continuation of the episiotomy, repair time, amount of suturing material used (Table 2).

Table 1
Maternal and neonatal baseline characteristics of the study groups.[a]

	Mediolateral episiotomy (n = 390)	Lateral episiotomy (n = 400)	*P* value
Fetal lie and presentation			0.97[c]
Cephalic	384 (98.5)	396 (99.0)	
Breech	4 (1.0)	4 (1.0)	
Twins	2 (0.5)	0 (0)	
Postpartum uterine atony	48 (12.3)	51 (12.8)	0.86[c]
Maternal age, y	28 (17–41)	28 (17–40)	0.50[b]
Education			0.60[c]
Elementary	21 (5.4)	23 (5.8)	
Vocational	58 (14.9)	49 (12.3)	
High school	187 (47.9)	213 (53.2)	
College/university	124 (31.8)	115 (28.7)	
Ethnicity			0.01[c]
Caucasian	366 (98.7)	393 (100.0)	
Romany	3 (0.8)	0 (0.0)	
Asian	2 (0.5)	0 (0.0)	
Marital status			0.19[c]
Single	18 (4.6)	26 (6.5)	
Married, with partner	372 (95.4)	374 (93.5)	
BMI	28.1 (17.8–47.5)	28.0 (19.3–45.7)	0.95[b]
Epidural	2 (0.5)	2 (0.5)	0.98[c]
Instrumental delivery			
Forceps	4 (1.0)	3 (0.7)	0.68[c]
Vacuum extraction	17 (4.3)	22 (5.5)	0.46[c]
Occipitoposterior presentation	21 (5.4)	16 (4.0)	0.36[c]
Fetal distress	114 (29.2)	116 (29.0)	0.94[c]
Execution of episiotomy			0.75[c]
Doctor	214 (54.9)	224 (56.0)	
Midwife	176 (45.1)	176 (44.0)	
Neonatal weight, g	3311 (2050–4860)	3350 (2460–4620)	0.19[b]
Maternal blood loss, mL	346 (150–500)	352 (250–600)	0.27[b]
Duration of second stage, min	26 (2–140)	25 (4–94)	0.28[b]
Shoulder dystocia	7 (1.8)	7 (1.8)	0.96[c]
Apgar score <8 at 5 min	6 (1.54)	6 (1.5)	0.96[c]
Neonatal umbilical artery pH	7.25 (6.81–7.51)	7.25 (6.82–7.83)	0.33[b]

Abbreviation: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters).
[a] Values are given as mean (range) or number (percentage).
[b] By non-parametric analysis of variance (2-sample Wilcoxon test).
[c] By χ^2 test and contingency tables.

Blood loss was estimated visually during the study. Cases of uterine atony were excluded from maternal blood loss evaluation in order to eliminate potential bias. All episiotomy characteristics and parameters were determined with a flexible tape measure immediately after the suture in the lithotomy position with the woman's legs flexed at an angle of 90°–100° [21]. Episiotomy length was measured from the beginning of episiotomy at the posterior margin of the hymen to the end of the

Table 2
Maternal obstetric trauma and episiotomy characteristics of the study groups.[a]

Type of injury	Mediolateral episiotomy (n = 390)	Lateral episiotomy (n = 400)	*P* value
Tear			
First degree	10 (2.6)	7 (1.8)	0.73[c]
Second degree	374 (95.9)	388 (96.9)	
Third degree	6 (1.5)	5 (1.3)	
Fourth degree	0	0	
Additional perineal trauma	14 (3.6)	12 (3.0)	0.64[c]
Additional vaginal trauma	67 (17.2)	84 (21.0)	0.17[c]
Episiotomy characteristics			
Shortest distance between episiotomy and anus, mm	33 (0–70)	40 (0–70)	<0.001[b]
Duration of repair, min	12 (4–40)	14 (3–45)	0.03[b]
Length of episiotomy, mm	37 (15–70)	38 (12–85)	0.48[b]
No. of threads used for episiotomy repair	1.04 (1–2)	1.08 (1–3)	0.03[c]

[a] Values are given as mean (range) or number (percentage).
[b] By non-parametric analysis of variance (2-sample Wilcoxon test).
[c] By χ^2 test and contingency tables.

original incision. The distance of the episiotomy from the anus was defined as the shortest distance between the episiotomy suture and the anal epithelium [21].

The real extent of perineal injury was diagnosed by an obstetrician in all cases. Rectal examination was performed before episiotomy repair to evaluate the degree of perineal trauma combining visual checks with bidigital examinations of the anterior portion of the anal sphincter with a characteristic pill-rolling movement between the accoucheur's thumb and index finger [22–24]. In cases of uncertainty regarding the degree of perineal injury, another doctor was called to confirm the diagnostics. The RCOG classification was used to describe OASIS severity as follows: 3a degree, involvement of less than 50% of the thickness of the external anal sphincter; 3b degree, involvement of more than 50% of the thickness of the external anal sphincter; and 3c degree, involvement of both external and internal anal sphincters [24].

The primary outcome was the incidence of OASIS; the secondary outcome was the rate of additional vaginal and perineal trauma in the continuation of the episiotomy. Further outcomes were the episiotomy length and distance from the anus, maternal blood loss related to episiotomy, duration of repair, and number of suturing threads needed for the repair.

R version 2.4.0 (R Foundation, Vienna, Austria) and Statistica version 9.0 (StarSoft, Tulsa, Oklahoma, USA) were used for statistical analysis. Basic statistical values (e.g. mean, median, SD, variance, minimum, maximum, quantile, and frequencies) were calculated for the study groups. Comparison of the distribution of variables in the 2 groups was done by non-parametric analysis of variance (2-sample Wilcoxon test). Categorical variables were analyzed by χ^2 test and described via contingency tables. A P value of 0.05 was considered to be significant.

3. Results

During the study period, 3534 primiparous women delivered at University Hospital Pilsen, and 2919 with expected vaginal delivery were eligible for enrollment. Among these, 1452 women were allocated to receive a mediolateral episiotomy, and 1467 to receive a lateral episiotomy (Fig. 1). After excluding women who did not receive the study intervention, 790 consecutive primiparous women who delivered vaginally with an episiotomy were enrolled in the study: 390 had a mediolateral episiotomy and 400 had a lateral episiotomy. Apart from ethnicity, no significant differences were found in maternal characteristics between the 2 groups (Table 1).

There were 6 cases of OASIS (1.5%) in the mediolateral group, all of which were 3a degree. In the lateral group, 5 women (1.3%) had OASIS: 1 with 3a degree, 2 with 3b degree, and 2 with 3c degree. No fourth-degree perineal tear was diagnosed among the study women. The difference in incidence of OASIS between the 2 study groups was not significant ($P = 0.73$) (Table 2).

No significant difference was found in additional perineal tears without consequent OASIS (14 women [3.6%] with mediolateral vs 12 women [3.0%] with lateral episiotomy; $P = 0.64$), or in additional vaginal tears in the continuation of the episiotomy (67 women [17.2%] with mediolateral vs 84 women (21.0%) with lateral episiotomy; $P = 0.17$) (Table 2).

There was no significant difference in the mean length between mediolateral and lateral episiotomies (37 vs 38 mm; $P = 0.48$) (Table 2). The mean distance between the episiotomy and anus was significantly shorter in the mediolateral group than in the lateral group (33 mm vs 40 mm; $P < 0.001$) (Table 2).

The duration of episiotomy repair was significantly shorter in the mediolateral group (12 vs 14 min; $P < 0.05$) (Table 2). Furthermore, significantly less suturing material was used for mediolateral episiotomy repair ($P < 0.05$) (Table 2).

No significant difference was found between the 2 study groups regarding maternal blood loss, 5-minute Apgar score, or neonatal arterial pH (Table 1).

4. Discussion

In the present prospective study, the difference in incidence of OASIS between women with mediolateral and those with lateral episiotomies was 0.2%. By the test of equivalence, the 95% confidence interval for the difference in OASIS rate between the 2 study groups was calculated as −1.4% to 1.9%. Because the 95% confidence interval lies within the

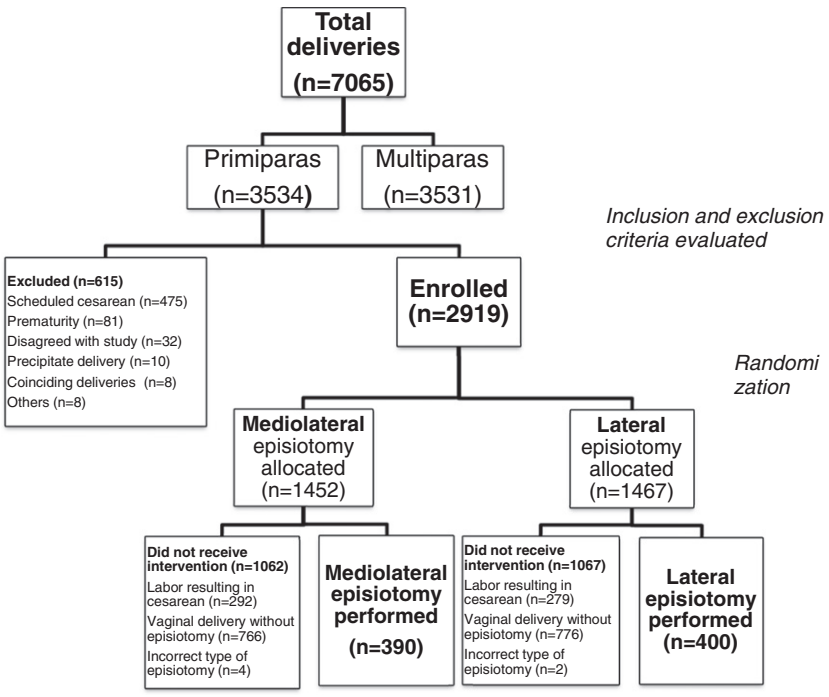

Fig. 1. Participant flow, randomization, and intervention assignment in the study. "Precipitate delivery" and "coinciding deliveries" indicate cases in which there was not enough time for explanation of the study, for obtaining signed informed consent, and/or for randomization.

pre-defined interval (±2.0%), it might be concluded that no significant difference between these 2 types of episiotomy was found. Along with additional perineal or vaginal trauma, maternal blood loss, and neonatal outcome, the incidence of OASIS in the 2 groups was equivalent.

There are very few studies focusing on lateral episiotomy. In a retrospective population study, Räisänen et al. [12] found that performing a lateral episiotomy decreases the risk of OASIS among primiparous but not multiparous women, and that an increase in the rate of lateral episiotomies is connected with a reduction in the risk of OASIS. This type of episiotomy has also been inadvertently evaluated in some other studies. For example, in the study of Aytan et al. [19] all episiotomies, which were termed mediolateral, "started at 7 o'clock" and were performed by 1 person, and thus it can be stated that they were not truly mediolateral but lateral according to the new classification [2]. In that study, an incidence of OASIS of 1% was found [19].

It must be stressed that restrictive use of episiotomy is recommended [13]. In addition, the indication for episiotomy should be carefully premeditated [25], because it has been shown to be necessary to perform 900 lateral episiotomies to save 1 anal sphincter [11,12].

The results of the present study were expected on the basis of our previous study [6], and a study by Stedenfeldt et al. [9] evaluating episiotomy characteristics. The risk factors for OASIS were reported as episiotomies of short length or those performed with the beginning very close to the posterior fourchette; episiotomies with angles less than 15° or larger than 60°; and episiotomies cut a short distance from the midline [9]. It seems that an appropriately executed mediolateral episiotomy and an appropriately executed lateral episiotomy are among the procedures that have the most profound effect on diverting the principal perineal tissue strain away from the midline.

None of the abovementioned studies [11,12,15–19,25] compared the outcomes of mediolateral and lateral episiotomies. Not only did the present study compare them, but it also worked within an exact definition of both types of episiotomy. This is important because recent emerging evidence suggests that the exact location of the episiotomy affects the risk of OASIS [6,7,9]. Furthermore, the present study focused on primiparous women to exclude the impact of previous vaginal deliveries on the perineum.

The present results differ in part from those of Fodstad et al. [16], who found no OASIS in a group of 109 women with lateral episiotomies, but 3 cases (8%) of OASIS in a group of 38 women with mediolateral episiotomies. However, Fodstad et al. [16] enrolled all women with episiotomy rather than only primiparous women. In addition, the measured suture angle of mediolateral episiotomy varied between 25° and 60° [16]. In light of the results of a recent study showing that an angle of incision of mediolateral episiotomy of 60° results in a subsequent mean angle of suture of 45° (range 32° to 59°) [6], it seems that a certain proportion of mediolateral episiotomies categorized by Fodstad et al. [16] would not have fulfilled the definition of mediolateral episiotomy used in the present study.

Apart from primiparity, recognized risk factors for OASIS were identifiable in all cases of OASIS in the present study: namely, instrumental delivery, occipitoposterior presentation, and/or fetal macrosomy. The neonatal weight in all deliveries with OASIS varied between 3800 g and 4480 g.

Compared with the studies discussed above [16–18], the present study found the lowest rate of OASIS to be among primiparous women with mediolateral episiotomy. This suggests that mediolateral episiotomy cut at an angle of at least 60° is a safe procedure with regard to direct anal sphincter trauma. A further decrease in incidence of OASIS might be achievable by modifying the technique of other obstetric interventions during the final stage of vaginal delivery.

In the present study, a significantly longer time was needed for lateral episiotomy repair. The mean difference between mediolateral and lateral episiotomy repair was 2 minutes. Before the initiation of the study, the type of episiotomy performed remained at the discretion of the attending personnel. Mediolateral episiotomy directed toward the ischial tuberosity [10] was preferred, although lateral episiotomy was also occasionally performed. Furthermore, on the basis of recent studies [3–5], it can be assumed that, albeit unintentionally, more lateral episiotomies were performed than were officially reported. Therefore, staff on the labor ward were not inexperienced in the technique of lateral episiotomy.

The difference in the amount of suturing material (120-cm long polyglactin 910) used between mediolateral and lateral episiotomy repair totaled 19 threads across the whole study. As a result, we assume that the significant difference observed ($P = 0.03$) has very little in common with clinical significance.

The study has 2 main limitations. First, owing to the busy clinical work of the researchers, the precision of the execution of the incision of episiotomy and the precision of the rectal exam before the episiotomy suturing could not always be controlled by members of the research team. Second, because all deliveries were attended by both a midwife and a doctor who had previously taken part in the educational sessions, the execution of episiotomy and subsequent evaluation of perineal trauma was supervised by a doctor, who then always sutured the episiotomy. In cases when a doctor performed the delivery in person, however, no further control was made unless a second opinion was required by the doctor themself.

In summary, the present results demonstrate that the risk of additional vaginal and perineal trauma and the risk of OASIS after adequately performed mediolateral episiotomy are low and correspond to the risk after lateral episiotomy. On the basis of these findings, it seems that an incision within the area of the perineum bordered by internationally defined mediolateral and lateral episiotomies [2] most effectively diverts the principal perineal tissue strain away from the midline and hence minimizes the risk of OASIS. To obtain a complete comparison of the 2 types of episiotomy, it will be necessary to evaluate other variables such as the healing process, pain, dyspareunia or continence status in short-, mid- and long-term follow-up. More studies concerning the difference between mediolateral and lateral episiotomy regarding peripartum outcomes should be performed to verify the results of the present study.

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Conflict of interest

The authors have no conflicts of interest.

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CLINICAL ARTICLE

Clinical evaluation of early postpartum pain and healing outcomes after mediolateral versus lateral episiotomy

Jaroslava Karbanova [a], Zdenek Rusavy [a], Lucie Betincova [a], Magdalena Jansova [b], Pavlina Necesalova [a], Vladimir Kalis [a,*]

[a] Department of Gynecology and Obstetrics, University Hospital, Faculty of Medicine, Charles University, Pilsen, Czech Republic
[b] New Technologies for the Information Society, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

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ABSTRACT

Objective: To evaluate short-term perineal pain among primiparous women after mediolateral episiotomy (MLE) and lateral episiotomy (LE). *Methods:* The prospective randomized study was conducted in the Czech Republic during 2010–2012. Consecutive primiparous women who gave birth at or after 37 weeks of pregnancy and had indications for an episiotomy were enrolled and randomly assigned to undergo MLE or LE. Patients were unaware of the episiotomy type performed. The primary outcomes were pain at 24 hours, 72 hours, and 10 days post partum, measured by a visual analog scale, verbal rating scale, interference with activities of daily living, and amount of analgesic use. *Results:* The analysis included 266 women who underwent MLE and 297 women who underwent LE. Complete relief of pain was observed in 6 (2.3%) of 266 women after 24 hours, 21 (8.0%) of 264 after 72 hours, and 77 (29.1%) of 265 after 10 days in the MLE group, and in 11 (3.9%) of 285, 23 (7.7%) of 297, and 78 (26.4%) of 295 in the LE group, respectively ($P = 0.36$). There were no significant differences in overall pain scores from any rating system or in the amount of analgesics used. *Conclusion:* Incidence and extent of pain in the first 10 days after LE correspond to those after adequately performed MLE.

1. Introduction

Adverse outcomes after vaginal delivery can impair a woman's overall quality of life and markedly affect her social relationships. Perineal pain, a common consequence of vaginal delivery [1–4], is related to the type and/or degree of perineal injury and affects up to 97% of women on the first day post partum [1,2,5] and up to 71% of women 7–10 days post partum [2,6].

Episiotomy, a surgical incision of the perineum during the final stage of vaginal delivery, contributes considerably to postpartum perineal pain [1,2,4–6]. The incidence of pain on the first day post partum after episiotomy is similar to that among women with spontaneous first- or second-degree perineal tears, but higher than that among women with an intact perineum and lower than that after an obstetric anal sphincter injury [2]. The rate and intensity of perineal pain are not only affected by episiotomy, but also by instrumental delivery [7], parity and duration of delivery [2,8], suturing material [9,10], repair technique [10,11], and analgesia used [12].

Considering all consequences of episiotomy and the results of clinical studies, there is currently an international consensus to abandon the routine use of episiotomy [4]. However, the type of episiotomy that should be executed if this procedure is indicated is still a matter of debate.

Seven different types of episiotomy have been defined [13]. However, only midline episiotomy [1,2,4,5,14], mediolateral episiotomy (MLE) [2–6,9–11,14–17], and lateral episiotomy (LE) [14,18–20] are used routinely, and only midline episiotomy and MLE are frequently evaluated. Perineal pain after MLE and LE has been compared in only one retrospective study [15], in which the perceived pain was equal in the two study groups. Prospective data on the short- and long-term peripartum outcomes of MLE versus LE are lacking.

The primary aim of the present study was to evaluate short-term perineal pain among primiparous women who had undergone MLE or LE; the secondary aims were to evaluate the rates of healing complications and painful defecation during the first 10 days post partum. The following hypotheses were tested: that LE would not increase pain scores or need for analgesics during the first 10 days post partum; that LE would not increase the incidences of infection, antibiotic use, hematoma, dehiscence, and requirement for resuturing during the first 10 days after delivery; and that LE would not decrease the incidence of painful defecation during the first 10 days post partum.

* Corresponding author at: Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic. Tel.: +420 377 105 212, +420 777 067 699; fax: +420 377 105 290.
E-mail address: kalisv@fnplzen.cz (V. Kalis).

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2. Materials and methods

The present prospective randomized study was part of a large project and the continuation of a previous study [16] evaluating the incidence and extent of vaginal and perineal trauma after MLE versus LE. The study included consecutive primiparous women who gave birth at the University Hospital in Pilsen, Czech Republic, between April 1, 2010, and April 1, 2012 [16]. Eligible women had a vaginal delivery at or after 37 weeks of pregnancy and had indications for an episiotomy. Women were excluded if they were younger than 16 years, were not able to communicate in Czech or English, had undergone previous perineal surgery, had previously had a stillbirth, had extensive congenital abnormalities, had severe perineal condylomata, or had extensive varicose veins. The local ethics committee approved the study, and all participants provided written informed consent prior to enrollment.

Before the study, a power analysis was performed to calculate the numbers of patients needed for the two study groups. Based on the assumption of a presence of perineal pain 7–10 days post partum in 70% in the MLE group [2], 260 women were required for each intervention group to achieve a power of 80% at an α of 0.05 and a tolerance limit of $\pm$ 10%. Subsequently, a test of equivalence was performed to confirm whether the investigated types of episiotomy did not differ.

The women were randomized to undergo right-sided MLE or right-sided LE. Randomization was done using preprepared nontransparent envelopes that contained a sheet of paper listing the episiotomy type to be performed if indicated; the envelopes were opened during the first stage of labor. Women were unaware of the episiotomy type selected and performed.

For MLE, the incision began in the midline and was directed toward the ischial tuberosity, following an angle of at least 60° [13,17]. For LE, the incision began 1–2 cm laterally from the midline and was also directed toward the ischial tuberosity [13]. All episiotomy repairs involved the subcuticular insertion of a short-term absorbable suture (2-0 polyglactin 910, Johnson & Johnson Medical, Sint-Stevens-Woluwe, Belgium) using the same continuous, nonlocking technique [11].

The following maternal and neonatal obstetric characteristics and variables were recorded: maternal age, education level, ethnicity, marital status, body mass index (calculated as weight in kilograms divided by the square of height in meters), number of fetuses, fetal presentation, epidural anesthesia, duration of the second stage of labor, signs of fetal distress, instrumental delivery, shoulder dystocia, person performing the episiotomy (doctor/midwife), neonatal weight, episiotomy length, shortest distance of the episiotomy from the anus, obstetric anal sphincter injury, and additional vaginal or perineal trauma after adequately performed episiotomy. Flexible tape measures were used to obtain the episiotomy measurements immediately after suturing in the lithotomy position with the woman's legs flexed at an angle of 90°–100° [21,22].

At 24 hours (22–28 hours if the 24-hour mark occurred during the night when the women were asleep) and 72 hours (68–76 hours) post partum, pain and healing scores were assessed by direct questioning. Personal contact was possible because the usual duration of postpartum hospitalization for mothers and neonates was at least 72 hours. On day 10, the women completed an identical questionnaire and posted it to the hospital. If the questionnaire was not delivered by day 13, a telephone or e-mail consultation was made.

The intensity of pain was scored on a visual analog scale (VAS) [23], a verbal rating scale (VRS) [24], and a scale rating the interference with activities of daily living (ADL) [2]. On the VAS [23], 0 points represented no pain and 100 points represented the worst possible pain. On the VRS [24], pain was rated at rest, sitting, and moving. Each of these was scored from 0 (no pain) to 3 (worst pain); the maximum achievable VRS pain score was 9. The ADL scale [2] is a modified pain severity scoring system evaluating pain while sitting, walking, voiding, and sleeping, with a maximum pain score of 12.

Information on the use of oral analgesics was obtained by direct questioning at 24 hours and 72 hours, and after 10 days. To enable a comparison, all women had received 400 mg ibuprofen tablets (Ibalgin 400, Zentiva, Prague, Czech Republic) when oral analgesics were necessary.

Healing complications recorded were: episiotomy infection (defined by edema, redness, discharge, and/or wound gaping [25]; pain at rest; and palpation), requirement for antibiotics, episiotomy dehiscence (complete or partial wound gaping of some or all suture layers), hematoma, need for surgical reintervention, and painful defecation.

On day 10, the women rated the aesthetic appearance of the suture and their overall satisfaction with the episiotomy on two modified VASs (range 0–100, with 100 being most favorable) [17,23]. Each woman received a small mirror to provide a clear view of the suture.

The primary outcome measures were the VAS, VRS, and ADL pain scores, and amount of analgesic use. The secondary outcome measures were the rates of hematoma, dehiscence, resuturing, episiotomy suture infection, antibiotic treatment of infection, painful defecation, and the cosmetic and overall satisfaction scores.

The statistical analyses were performed with R version 2.4.0 (R Foundation for Statistical Computing, Vienna, Austria), SAS (SAS Institute Inc, Cary, NC, USA), and Statistica version 9.0 (StatSoft, Tulsa, OK, USA). Data comparisons were performed using nonparametric analysis of variance (two-sample Wilcoxon test). Categorical variables were analyzed with the χ^2 test and described using contingency tables. The equivalence testing was performed using a two one-sided test with predefined equivalence limits of +/- 10%. $P < 0.05$ was considered statistically significant.

3. Results

Among 3534 primiparous women with a vaginal delivery during the study period, 2919 women were eligible for inclusion in the study (Fig. 1). Overall, 390 women underwent MLE and 400 underwent LE (Fig. 1). The final analysis included 266 women in the MLE group and 297 women in the LE group who completed all questionnaires (Fig. 1).

The maternal and neonatal characteristics did not differ significantly between the study groups except shortest distance between episiotomy and anus, which was significantly longer in the LE group (Table 1). This difference is a result of the way the episiotomy was performed in this group.

Complete relief of pain was observed in 6 (2.3%) of 266 women who answered the relevant question after 24 hours, 21 (8.0%) of 264 after 72 hours, and 77 (29.1%) of 265 after 10 days in the MLE group, and in 11 (3.9%) of 285, 23 (7.7%) of 297, and 78 (26.4%) of 295 in the LE group, respectively ($P = 0.36$).

There were no significant differences between the two groups in terms of overall pain scores on the VAS, VRS, and ADL scale, and in the amount of analgesics used at 24 hours, 72 hours, and 10 days post partum (Table 2). The test of equivalence confirmed that the investigated types of episiotomy did not differ in presence of pain 10 days post partum; the 95% confidence interval (–4.66% to 2.09%) was within the predefined tolerance interval of $\pm$ 10%. Moreover, there were no significant differences when each pain domain (at rest, sitting, moving, voiding, sleeping) was evaluated separately (Table 2).

No statistically significant differences were found regarding surgical reintervention, the occurrence of hematoma, episiotomy dehiscence, and painful defecation during the first 10 days post partum (Table 3). Seven (33.3%) of 21 dehiscences required resuturing.

No infections were registered at 24 hours or 72 hours post partum. At day 10, an episiotomy suture infection was observed in 4 (1.5%) of 263 women in the MLE group and in 5 (1.7%) of 290 women in the LE group ($P = 0.85$) (Table 3). No difference in antibiotic use owing to infection was found (Table 3).

The cosmetic effect was rated with a mean of 76 points in the MLE group and 72 points in the LE group ($P = 0.12$). The overall satisfaction score was 76 points in the MLE group and 75 points in the LE group ($P = 0.62$) (Table 3).

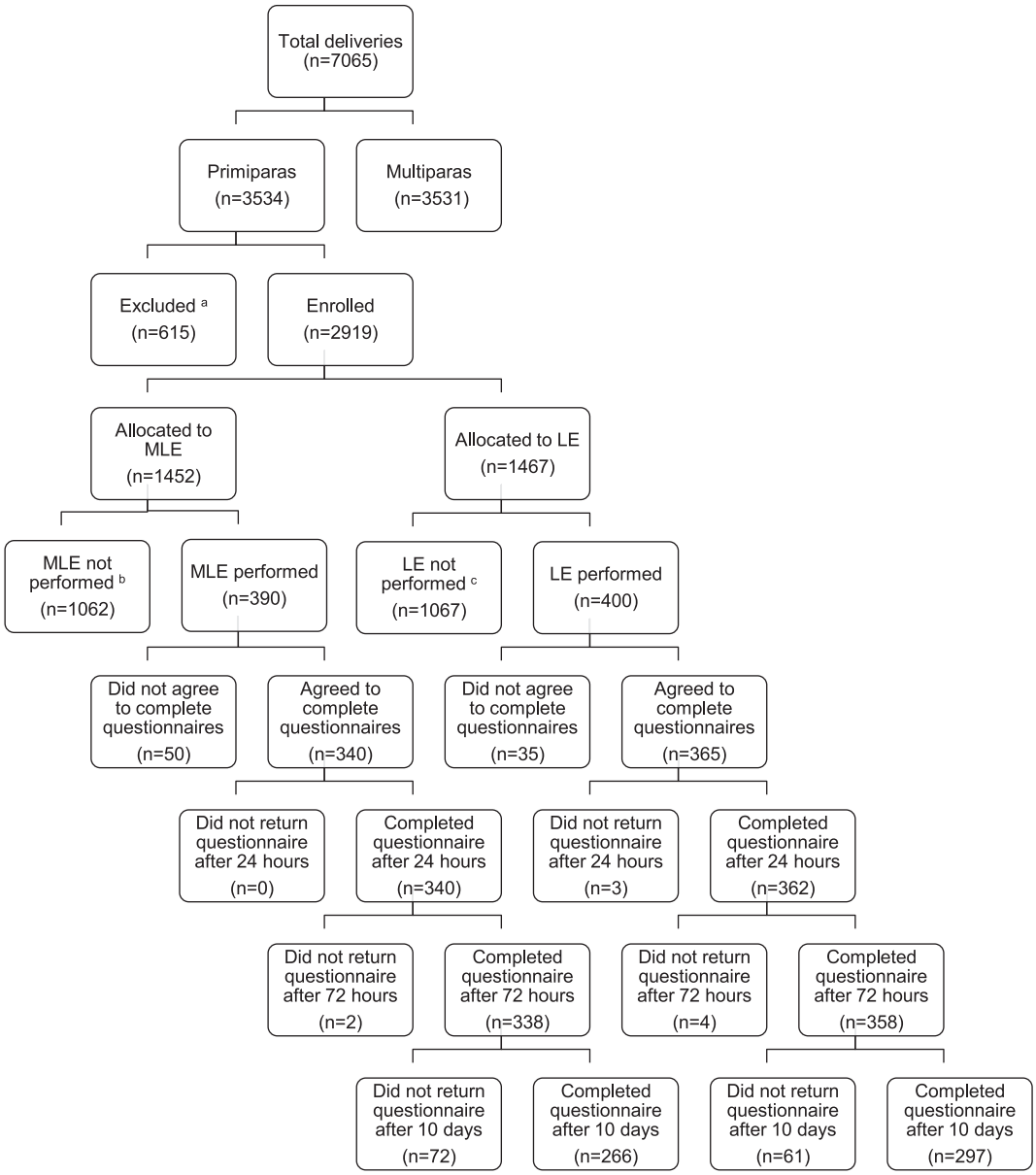

Fig. 1. Flow of patients through the study. Abbreviations: LE, lateral episiotomy; MLE, mediolateral episiotomy. [a] Scheduled cesarean delivery (n = 475), prematurity (n = 81), disagreement with the study (n = 32), precipitate delivery (n = 10), coinciding deliveries (n = 8), other reason (n = 8). [b] Labor resulting in cesarean delivery (n = 292), vaginal delivery without episiotomy (n = 766), incorrect type of episiotomy (n = 4). [c] Labor resulting in cesarean delivery (n = 289), vaginal delivery without episiotomy (n = 776), incorrect type of episiotomy (n = 2).

4. Discussion

The present prospective randomized study evaluated the short-term effects of MLE and LE on postpartum perineal pain and the healing process. There was no difference between the two groups in terms of perceived pain as rated on the VAS, VRS, and ADL pain scoring systems. In addition, healing complications, aesthetic perception, and overall satisfaction did not differ between the two groups up to 10 days post partum.

Studies evaluating and comparing the perineal pain associated with different types of episiotomy are not common. Most studies that have been done have compared the outcomes of episiotomy with those after spontaneous perineal tears [2,3], different techniques of repair [10,11], or different analgesic agents after episiotomy [12].

Considering the paucity of studies evaluating LE, the only one similar to the present study is a retrospective investigation by Fodstad et al. [15] comparing the associations of MLE, LE, and an unclassified type of episiotomy with perineal pain at 24 hours post partum. Overall, 23% of women with MLE and 15% of women with LE rated their pain between 7 and 10 on the VAS (range 0–10) [15]. In the present study, 29 (10.9%) women who had undergone MLE and 26 (8.8%) who had undergone LE rated their pain as 7–10 using the same scoring system. Fodstad et al. [15] found no significant differences between the different episiotomy types in terms of perceived pain 1 day post partum, which is in accordance with the present study's results.

Based on the results of the present study, the VRS seems to be more suitable for the evaluation of postepisiotomy pain than the VAS or the ADL scale because it provides information on pain in separate domains. At all follow-up points (1, 3, and 10 days post partum), the pain scores at sitting were highest, followed by pain during movement and finally pain at rest. However, Andrews et al. [3] found the VAS to be more sensitive than the VRS. However, these authors evaluated perineal

Table 1
Maternal and neonatal baseline characteristics among primiparous women with episiotomy.[a]

Characteristic	Mediolateral episiotomy (n = 340)	Lateral episiotomy (n = 365)	*P* value
Fetal lie and presentation			0.39[b]
Cephalic	334 (98.2)	361 (98.9)	
Breech	4 (1.2)	4 (1.1)	
Twins	2 (0.6)	0 (0.0)	0.34 [b]
Postpartum uterine atony	42 (12.4)	46 (12.6)	0.93[b]
Maternal age, y	28.1 (18–41)	28.1 (18–40)	0.79[c]
Education			0.76[b]
Elementary	19 (5.6)	16 (4.4)	
Vocational	43 (12.6)	43 (11.8)	
High school	165 (48.5)	195 (53.4)	
College/university	113 (33.2)	111 (30.4)	
Ethnicity			0.20[b]
White	332 (97.6)	361 (98.9)	
Romany	2 (0.6)	0	
Asian	1 (0.3)	0	
Unknown	5 (1.5)	4 (1.1)	
Marital status			0.77[b]
Single	16 (4.7)	19 (5.2)	
Married/with partner	322 (94.7)	346 (94.8)	
Unknown	2 (0.6)	0	
Body mass index[d]	28.2 (17.8–47.5)	28.0 (19.3–45.7)	0.93[c]
Epidural	1 (0.3)	2 (0.6)	0.94[b]
Instrumental delivery			
Forceps	2 (0.6)	2 (0.5)	0.68[b]
Vacuum extraction	18 (5.3)	19 (5.2)	0.96[b]
Occipito-posterior presentation	19 (5.6)	16 (4.4)	0.46[b]
Fetal distress	98 (28.8)	107(29.3)	0.89[b]
Execution of episiotomy			0.21[b]
Doctor	183 (53.8)	202 (55.3)	
Midwife	157 (46.2)	163 (44.7)	
Neonatal weight, g	3322 (2050–4860)	3358 (2460–4620)	0.24[c]
Maternal blood loss, mL	379 (150–1300)	385 (250–1100)	0.36[c]
Duration of second stage, min	25.1 (2–105)	24.8 (4–88)	0.72[c]
Shoulder dystocia	5 (1.5)	7 (1.9)	0.65[b]
Apgar score at 5 min <8	4 (1.2)	5 (1.37)	0.82[b]
Neonatal umbilical artery pH	7.3 (6.8–7.5)	7.3 (7.0–7.8)	0.37[c]
Third-/fourth-degree perineal tear	5 (1.5)	4 (1.1)	0.60[b]
Length of episiotomy, mm	37 (30–42)	38 (30–42)	0.28[c]
Shortest distance between episiotomy and anus, mm	34 (26–40)	40 (34–45)	<0.001[c]
Additional perineal trauma including OASIS	13 (3.8)	11 (3.0)	0.55[b]
Additional vaginal trauma	63 (18.5)	78 (21.4)	0.63[b]

Abbreviation: OASIS, obstetric anal sphincter injury.
[a] Values are given as number (percentage) or mean (range), unless otherwise stated.
[b] Nonparametric analysis of variance (two-sample Wilcoxon test).
[c] χ^2 test.
[d] Calculated as weight in kilograms divided by the square of height in meters.

Table 2
Postpartum perineal pain among primiparous women with episiotomy.[a]

Pain measure	Mediolateral episiotomy (n = 266)	Lateral episiotomy (n = 297)	*P* value [b]
24 hours			
VAS	39 (20–50)	37 (18–50)	0.30
VRS	4.4 (3–6)	4.2 (3–6)	0.44
ADL	3.7 (2–6)	3.5 (0–6)	0.16
Pain at rest	0.9 (0–1)	0.8 (0–1)	0.70
Pain while sitting	1.9 (1–3)	1.9 (1–2)	0.76
Pain while moving	1.6 (1–2)	1.5 (1–2)	0.26
Pain while voiding	0.8 (0–1)	0.8 (0–1)	0.73
Pain while sleeping	0.5 (0–1)	0.5 (0–1)	0.36
Number of women using analgesics in the previous 24 h	38 (14.3)	37 (12.5)	0.16[c]
72 hours			
VAS	24 (8–43)	22 (0–40)	0.25
VRS	2.4 (1–3)	2.4 (1–3)	0.94
ADL	2.0 (0–3)	2.0 (0–3)	0.62
Pain at rest	0.3 (0–1)	0.3 (0–1)	0.37
Pain while sitting	1.2 (1–2)	1.2 (1–2)	0.97
Pain while moving	1.0 (0–1)	0.9 (0–1)	0.55
Pain while voiding	0.4 (0–1)	0.5 (0–1)	0.55
Pain while sleeping	0.2 (0–0)	0.2 (0–0)	0.85
Number of women using analgesics in the previous 24 h	11 (4.1)	16 (5.4)	0.29[c]
10 days			
VAS	24 (6–40)	25 (6–50)	0.75
VRS	2.0 (1–3)	2.1 (1–3)	0.38
ADL	1.8 (0–3)	1.8 (0–3)	0.57
Pain at rest	0.3 (0–1)	0.3 (0–1)	0.10
Pain at sitting	1.0 (0–1)	0.9 (0–1)	0.55
Pain at moving	0.7 (0–1)	0.8 (0–1)	0.23
Pain while voiding	0.4 (0–1)	0.3 (0–1)	0.53
Pain while sleeping	0.1 (0–0)	0.1 (0–0)	0.06
Number of women using analgesics in the previous 24 h	7 (2.6)	5 (1.7)	0.64[c]

Abbreviations: VAS, visual analog scale; VRS, verbal rating scale; ADL, activities of daily living.
[a] Values are given as mean (interquartile range) or number (percentage), unless stated otherwise.
[b] Nonparametric analysis of variance (two-sample Wilcoxon test).
[c] Contingency tables and χ^2 test.

pain as a function of the degree of perineal trauma, not as a function of episiotomy type.

Complete relief of pain occurred in 17 (3.0%) women overall within 24 hours post partum and in 155 (27.5%) women within 10 days post partum. This result is in accordance with the findings of Macarthur et al. [2], who reported that 97% and 71% of women had perineal pain 1 day and 7 days post partum, respectively. However, the persistence of pain beyond 10 days post partum in more than 70% of women indicates that follow-up should be substantially longer.

There is also a paucity of scientific literature regarding the healing process after different episiotomy types [5,14]. In particular, there is no study evaluating the healing process after LE. Given that all episiotomies in the present study were repaired using the same recommended suturing technique and material [11], the impact of these two factors on the study outcomes was minimized. Only seven dehiscences required resuturing, and only skin defects and subcutaneous tissue had to be reapproximated.

The observed difference in the incidence of hematoma at the episiotomy site 24 hours post partum was not significant. Moreover, the number of women undergoing surgical reintervention was approximately eight times lower than the number of women with a reported hematoma. Given that the presence of hematoma was defined by visual parameters and no other intervention (e.g. palpation or ultrasound) was required if clinically unnecessary, it can be assumed that the majority of hematomas were superficial ecchymoses.

There are some limitations to the present study. First, the response rates (78.2% and 81.4% in the MLE and LE groups, respectively) were lower than expected. This—particularly the response rate on day 10—could be explained by the relatively short data collection period. Because the system of community midwives is underfunded in the Czech Republic, the majority of the mothers were not visited by medical personnel after discharge from the maternity hospital. Given that all mothers were primiparous, they might have faced unexpected caring, medical, or social problems, and these challenges might have been given priority over the completion of the study questionnaires. However, the total number of respondents in each group exceeded the number of women required according to the power calculation.

Second, no personal contact was arranged for day 10. The women completed the questionnaires by themselves with no consultation. Because some of the variables (e.g. infection, dehiscence, painful defecation, and aesthetic evaluation) might not have been discussed during hospitalization, the responses might have been influenced by subjective bias. Apart from aesthetic evaluation and overall satisfaction, the questionnaires were identical at all three timepoints and the women

Table 3
Healing complications among primiparous women with episiotomy.[a]

Episiotomy characteristics/variables	Mediolateral episiotomy	Lateral episiotomy	*P* value
24 hours			
Infection	0/263	0/290	N/A
Need for antibiotics	0/263	2/290 (0.7)	0.18[b]
Hematoma at the episiotomy site	10/263 (3.8)	25/290 (8.6)	0.09[b]
Need for surgical reintervention	1/264 (0.4)	2/292 (0.7)	0.62[b]
Dehiscence	0/263	0/291	N/A
Painful defecation	25/218 (11.5)	27/233 (11.6)	0.97[b]
72 hours			
Infection	0/264	0/292	N/A
Need for antibiotics	0/264	1/292 (0.3)	0.34[b]
Hematoma at the episiotomy site	12/264 (4.5)	16/291 (5.5)	0.61[b]
Need for surgical reintervention	1/264 (0.4)	0/292	0.29[b]
Dehiscence	0/264	0/292	N/A
Painful defecation	34/212 (16.0)	28/222 (12.6)	0.31[b]
10 days			
Infection	4/263 (1.5)	5/290 (1.7)	0.85[b]
Need for antibiotics	0/264	1/292 (0.3)	0.18[b]
Need for surgical reintervention	4/262 (1.5)	3/291 (1.0)	0.61[b]
Dehiscence	13/262 (5.0)	8/286 (2.8)	0.19[b]
Painful defecation	89/260 (34.2)	87/286 (30.4)	0.34[b]
Cosmetic appearance, VAS score[c]	76 (62–98)	72 (50–94)	0.12[d]
Overall satisfaction, VAS score [c]	76 (60–100)	75 (53–100)	0.62[d]

Abbreviations: N/A, not applicable; VAS, visual analog scale.
[a] Values are given as number/total number of respondents to the relevant question (percentage) or mean (interquartile range), unless otherwise stated.
[b] χ^2 test.
[c] Score on a modified VAS [17,23].
[d] Nonparametric analysis of variance (two-sample Wilcoxon test).

were therefore familiar with its layout because they had completed the questionnaire twice before.

The results of the present study show that the incidence and degree of pain and healing complications after properly performed LE correspond to those after adequately performed MLE. The frequency of painful defecation and scores for cosmetic effect and overall satisfaction did not differ between the MLE and LE groups. On the basis of these findings, it seems that LE should not be ruled out because of any general concern that this procedure might be more painful than MLE.

However, to evaluate the two types of episiotomy fully, other variables including dyspareunia and anal continence status would have to be studied in the mid and long term. Lateral episiotomy is defined as an incision starting 1–2 cm laterally from the midline and so concerns may be raised regarding injury to the Bartholin gland or starting the episiotomy through the labia majora. However, given that the transverse perineal deformation/strain is 177% (1 cm of the perineal tissue is transversely stretched to 2.77 cm when the fetal head crowns the perineum) [26], the labia and all adjoining structures will be dislodged laterally and therefore the risk of damage to important structures should be minimized. Further work needs to be done on the differences in peripartum MLE and LE outcomes to enhance the results of the present study.

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Conflict of interest

The authors have no conflicts of interest.

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Mediolateral versus lateral episiotomy and their effect on postpartum coital activity and dyspareunia rate 3 and 6 months postpartum

Pavlina Necesalova [a], Jaroslava Karbanova [a], Zdenek Rusavy [a], Zlatko Pastor [b], Magdalena Jansova [c], Vladimir Kalis [a,*]

[a] Department of Gynecology and Obstetrics, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic
[b] National Institute of Mental Health, Klecany, Czech Republic
[c] European Centre of Excellence NTIS – New Technologies for Information Society, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

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ABSTRACT

Objectives: Comparison of the effects of two episiotomy types on sexual activity, dyspareunia and overall satisfaction after childbirth.
Study design: A prospective follow-up study of a randomized comparative trial evaluating peripartum outcome of a vaginal delivery after mediolateral (MLE) or lateral (LE) episiotomy.
Main outcome measures: The participants completed questionnaires regarding sexual activity, dyspareunia, perineal pain, aesthetic appearance and overall satisfaction 3 (3M) and 6 months (6M) postpartum.
Results: A total of 648 women were available for the analyses (306 MLE, 342 LE). The groups showed no difference regarding resumption and regularity of sex, timing of resumption, frequency and intensity of dyspareunia, perineal pain, aesthetic appearance or overall satisfaction 3M or 6M postpartum. 98.0% of women after MLE and 97.7% after LE resumed sexual intercourse within 6M after delivery ($p = 0.74$). In the same period 15.6% of women after MLE and 16.1% after LE suffered from considerable dyspareunia ($p = 0.86$).
Conclusions: Quality of sexual life and perception of perineal pain after MLE is equivalent to LE.

Introduction

Vaginal delivery and consequent perineal trauma can have a detrimental effect on women's wellbeing. A common obstetric operation, episiotomy – an incision of the perineum during final phase of vaginal delivery – may contribute to impairment of postpartum sexual life [1–7].

Despite the general consensus that a restrictive approach to episiotomy is associated with a superior delivery outcome, data regarding the spectrum of indications and location of episiotomy are incomplete. Recent studies found that exact placement of episiotomy plays a significant role in the risk of subsequent adverse outcome, namely obstetric anal sphincter injury (OASIS) [8]. OASIS is an acknowledged risk factor for postpartum sexual dysfunction, mainly dyspareunia [2,5–7].

Lateralization of episiotomies decreases the risk of OASIS [9–12]. Based on previous studies [8,13,14], mediolateral episiotomy (MLE) has been defined as an incision beginning at the fourchette, directed at an angle of at least 60° from the midline [15]. Lateral episiotomy (LE) – beginning in the vaginal introitus 1–2 cm aside from the midline, directed towards the ischial tuberosity – was recently re-introduced [15]. Only anatomic outcomes of LE have been evaluated [11,12]. Only three studies evaluating short-term perineal pain and healing complications after MLE and LE have been published [11,16,17]. The effects of appropriately executed MLE or LE [13–15] on postpartum pelvic floor function [18] and quality of sexual life [5,16,19] are still unclear.

Two-thirds of women resumed vaginal sex by 3 months (3M) after vaginal delivery with MLE and 90% by 6 months (6M) [3,6,19,20]. Comparing different episiotomy types, no difference was observed in dyspareunia rates after MLE or midline episiotomy which varied between 8–73% at 3M [3,5,19] and 11–36% at 6M [3,5,14,19]. The only prospective observational study performed so far found no difference in dyspareunia or perineal pain after midline episiotomy, MLE and LE at 3M after delivery [16]. To our knowledge, no prospective randomized study comparing sexual activity and dyspareunia after vaginal delivery with MLE and LE in mid- and long-term follow-up has been performed.

The primary objective of this study was to compare resumption of postpartum coital activity and dyspareunia rate. The secondary aims were the evaluation of perineal pain, cosmetic outcome and overall satisfaction at 3M and 6M after delivery with MLE or LE amongst primiparous women.

* Corresponding author. Department of Obstetrics and Gynecology, University Hospital, Faculty of Medicine, Charles University, Alej Svobody 80, 304 60 Pilsen, Czech Republic. Tel.: +420 377 105 212 (work), +420 777 067 699 (mobile).
E-mail address: kalisv@fnplzen.cz (V. Kalis).

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The following hypotheses were tested:

Performance of LE does not lead to a delay in the resumption of the sexual intercourse, increase in the rate of dyspareunia or impairment of the quality of postpartum sexual life. Secondly, LE does not result in the increase of the incidence of perineal pain, reduction of the aesthetic appearance of episiotomy scar or overall satisfaction compared to MLE.

Methods

This is a prospective follow-up study of a previous randomized comparative trial evaluating peripartum outcome of a first vaginal delivery with MLE and LE [12]. All women delivered at the University Hospital Pilsen, Czech Republic, between April 1, 2010 and April 1, 2012. The study was approved by the local ethics committee and an informed consent was obtained from all participants prior to enrolment. Two previous studies evaluating peripartum and early postpartum outcomes have been published elsewhere [12,17].

A power analysis for 80% power at α-level of 0.05 to confirm equivalency was performed prior to the study commencement. At least 299 women per group were required for sexual intercourse resumption assessment with tolerance limit at ±5%, assuming 95% resumption in sexual intercourse [3,19]. For dyspareunia evaluation, a minimum of 252 women per group were required with tolerance limit at ±10% assuming 20% dyspareunia rate considering published variation in dyspareunia 6 months after delivery with MLE: 11% [3], 14% [15] and 36% [19].

Inclusion criteria were [12] vaginal birth, primiparity, episiotomy, completed 37 weeks of pregnancy, and signed informed consent. Exclusion criteria were maternal age <16 years, previous perineal surgery, stillbirth or delivery with extensive congenital abnormalities, severe condylomata or extensive varicose veins on the vulva, incomplete data regarding sexual intercourse resumption and dyspareunia at 3M and 6M postpartum and inability to communicate in Czech or English.

For the original randomized comparative trial evaluating peripartum outcomes, the patients were randomized into two study groups: primiparas with right-sided MLE and primiparas with right-sided LE [12]. MLE and LE were executed according to recently published international classification [15]. Episiotomy repair followed the same continuous, non-locking technique with subcuticular insertions of 2-0 short-term absorbable polyglactin 910 [21]. Women were blinded to the randomized episiotomy type.

Maternal and neonatal obstetric characteristics and variables recorded were identical to the two previous studies [12,17]: maternal age, education level, ethnic group, marital status, body mass index, number of fetuses, fetal presentation, epidural, duration of the second stage of labour, signs of fetal distress, instrumental delivery, shoulder dystocia, person performing the episiotomy (doctor/midwife), neonatal weight, episiotomy length, shortest distance of the episiotomy from the anus, OASIS, additional vaginal and perineal trauma in continuation of episiotomy (Table 1). All episiotomy parameters were measured after episiotomy repair in the lithotomy position with the parturients' legs flexed at 90–100° [13,22].

Questionnaires were self-completed by the participants at 3M and 6M postpartum, the last month was evaluated. The questionnaires surveyed sexual activity, pain, healing, cosmetic appearance and overall satisfaction with episiotomy.

Postpartum coital sexual activity was assessed by the timing of resumption of sexual intercourse and its regularity. Dyspareunia (defined as introital pain deemed related to episiotomy scar) was assessed regarding its presence, frequency and intensity using a 4-point scale (none, exceptional/mild, some/moderate, usual/high). A 5-point verbal scale (much lower, lower, same, higher, much higher) was used for evaluation of the degree of sexual arousal, satisfaction, ability to achieve orgasm and lubrication. Comparisons were made to the status before pregnancy.

Pain was scored using Visual Analogue Scale (VAS) [23], a 4-point Verbal Rating Score (VRS) [24], and according to interference with activities of daily life (ADL) [25]. In VAS, 0 point equalled no pain and 100 points highest pain. For VRS, pain in four domains: at rest, sitting, moving and during sex was recorded. For ADL, pain during sitting, walking, voiding and sleeping was recorded. Maximum pain scores for both VRS and ADL were 12 points. Regarding VRS, only women that resumed sexual intercourse were evaluated. Painful defection was evaluated separately.

Postpartum oral analgesic use was obtained for the preceding week. Ibuprofen (IBUPROFEN 400 LÉČIVA: Ibuprofenum 400 mg, Zentiva, Prague, Czech Republic) was used for the comparison.

The women assessed scar appearance aesthetically along with overall satisfaction with episiotomy. A modified Visual Analogue Scale (point scale – 0–100, 100 being most favourable) [14,23] was employed.

SAS (Cary, NC, USA) was used for statistical analysis. Basic statistical values (e.g. mean, median, standard deviation, variance, minimum, maximum, quantiles and frequencies) were calculated for study groups and subgroups. Comparison of variable distributions for given groups was performed by non-parametric ANOVA (2-sample Wilcoxon test or 2-sample median test). Categorical variables were analysed with the test and Fisher's exact test and described using contingency tables. The timescale to the end of post-delivery pain was calculated using Kaplan–Meier survival and tested using log-rank tests. A significance level of 0.05 was set throughout.

Results

Out of 3534 primiparous women, 2919 women were eligible for the original study [12] and divided into two groups: MLE (n = 1452) and LE (n = 1467). Three hundred ninety had MLE and 400 LE, matched inclusion criteria and agreed to record peripartum outcome [12]. A further consent to follow-up and to complete postpartum questionnaires as well was provided by 340 (87.2%) women with MLE and 365 (90%) with LE. 306 (90.0%) with MLE and 342 (93.7%) with LE returned both questionnaires and were included in the final analysis (Fig. 1).

The shortest distance between episiotomy and anus was the only significant distinction between the study groups. It was considerably longer in LE women due to episiotomy characteristics (Table 1).

Postpartum coital activity in all women

The MLE and LE groups did not differ in the timing of sexual intercourse resumption; 274 (89.5%) vs. 306 (89.5%) respectively at 3M (p = 0.98) and 300 (98.0%) vs. 334 (97.7%) respectively at 6M postpartum (p = 0.74). Coital activity was regular in 168 (54.9%) vs. 193 (56.4%) respectively at 3M (p = 0.70) and 221 (72.2%) vs. 260 (76.3%) respectively at 6M (p = 0.24) (Table 2).

Within the previous month, any postpartum dyspareunia occurred in 199/279 (71.3%) in MLE vs. 219/311 (70.4%) in LE at 3M (p = 0.81) and 153/302 (50.7%) in MLE vs. 186/336 (55.4%) in LE at 6M (p = 0.24).

Dyspareunia occurring sometimes or usually was registered in 137/279 (49.1%) in MLE vs. 152/311 (48.9%) in LE at 3M (p = 0.96) and 85/302 (31.5%) in MLE vs. 109/336 (32.4%) in LE at 6M (p = 0.24).

Considerable dyspareunia defined as dyspareunia of moderate or high intensity occurring at least sometimes was reported by 77/279 (27.6%) in MLE vs. 92/311 (29.6%) in LE at 3M (p = 0.59) and 47/302 (15.6%) in MLE vs. 54/336 (16.1%) in LE at 6M (p = 0.86) (Table 2).

No significant differences between the study groups in deterioration or improvement of sexual arousal, satisfaction, orgasm or

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Table 1
Maternal and neonatal baseline characteristics of the study groups[a].

		All women		
		Mediolateral episiotomy (n = 306)	Lateral episiotomy (n = 342)	p-value
Fetal lie and presentation	Cephalic [N] (%)	300 (98.0)	338 (98.8)	0.39[b]
	Breech [N] (%)	4 (1.3)	4 (1.2)	
Twins [N] (%)		2 (0.7)	0 (0.0)	
Postpartum uterine atony [N] (%)		42 (13.7)	39 (11.4)	0.37[c]
Maternal age [years] mean (range)		27.8 (18–41)	28.4 (18–40)	0.06[b]
Education	Elementary [N] (%)	18 (5.9)	13 (3.8)	0.51[c]
	Vocational [N] (%)	28 (9.1)	43 (12.6)	
	High school [N] (%)	161 (52.6)	174 (50.9)	
	College + University [N] (%)	99 (32.4)	112 (32.7)	
Ethnics	Caucasian [N] (%)	305(99.7)	342 (100.0)	0.30[c]
	Romany [N] (%)	0 (0.0)	0 (0.0)	
	Asian [N] (%)	1 (0.3)	0 (0.0)	
Marital status	Single [N] (%)	15 (4.9)	15 (4.4)	0.77[c]
	Married, with partner [N] (%)	291 (95.1)	327 (95.6)	
BMI[d] mean (range)		28.2 (17.8–47.5)	28.0 (20.0–45.7)	0.28[b]
Epidural [N] (%)		1 (0.3)	2 (0.6)	0.25[c]
Instrumental delivery	Forceps [N] (%)	2 (0.6)	2 (0.6)	0.91[c]
	Vacuum-extraction [N] (%)	16 (5.2)	18 (5.3)	0.98[c]
Occipito-posterior presentation [N] (%)		16 (5.2)	11 (3.3)	0.20[c]
Fetal distress [N] (%)		88 (28.8)	104 (30.4)	0.65[c]
Execution of episiotomy	Doctor [N] (%)	165 (53.9)	195 (57.0)	0.17[c]
	Midwife [N] (%)	141 (46.1)	147 (43.0)	
Neonatal weight [g] mean (range)		3321 (2300–4860)	3361 (2460–4620)	0.18[b]
Maternal blood loss [ml] mean (range)		384 (250–1100)	381 (250–1100)	0.91[b]
Duration of the 2nd stage [min] mean (range)		25.2 (4–105)	23.9 (4–88)	0.64[b]
Shoulder dystocia [N] (%)		5 (1.6)	4 (1.2)	0.41[c]
Apgar score at 5 min < 8 [N] (%)		4 (1.3)	5 (1.5)	0.29[c]
Neonatal umbilical artery pH mean (range)		7.25 (6.81–7.47)	7.25 (6.95–7.83)	0.96[b]
3rd/4th degree perineal tear [N] (%)		5 (1.6)	4 (1.2)	0.61[c]
Length of episiotomy [mm] mean (range)		37 (15–70)	38 (12–75)	0.13[a]
Shortest distance between episiotomy and anus [mm] mean (range)		33 (0–70)	40 (0–70)	<0.001[b]
Additional perineal trauma including OASIS [N] (%)		13 (4.3)	11 (3.2)	0.49[c]
Additional vaginal trauma [N] (%)		59 (19.3)	73 (21.4)	0.52[c]
Lactation at 3 months[e]		225/306 (73.5)	261/342 (76.3)	0.41[c]
Lactation at 6 months[e]		196/302 (64.9)	209/341 (61.3)	0.34c
Prepartal dyspareunia		30 (9.8)	21 (6.2)	0.09[c]

[a] Values are given as number (percentage) or mean (range), unless otherwise stated.
[b] Nonparametric analysis of variance (two-sample Wilcoxon test).
[c] χ^2 test.
[d] Calculated as weight in kilograms divided by the square of height in meters.
[e] Values are given as number/total number of respondents to the relevant question (percentage).

lubrication were observed (Table 2). Furthermore, no significant differences between the groups in VAS, VRS and ADL pain scores, painful defecation rate, or pain in individual domains, cessation of pain or the amount of analgesics used during the last week were found (Table 3). Cosmetic appearance and overall satisfaction with the episiotomy scar were also comparable (Table 3).

Discussion

This presented study is the first prospective study comparing randomized execution of MLE and LE with respect to female postpartum coital activity, perineal pain, cosmetic appearance and overall satisfaction post-episiotomy 3M and 6M after the first vaginal delivery.

In this study 98.0% of women with MLE and 97.7% with LE resumed sexual intercourse within 6M postpartum. Furthermore, 73.1% of women with MLE and 68.1% with LE re-initiated sex within the first 8 weeks. The results are comparable and/or better compared to other studies on mediolateral episiotomy. Buhling et al. [3] found that 48.2% of women resumed sexual intercourse within 8 weeks and Kalis et al. [14] registered 96% of women resuming sexual intercourse within the first 6M. In a study by Signorello et al. [5] where midline episiotomy was used, 91.5% women resumed sexual intercourse by 6M, at an average interval of 8.4 weeks postpartum [5].

In our study, the dyspareunia was evaluated based on the frequency of its presence and its intensity during previous month. Dyspareunia was found in 27.6–71.3% after MLE and 29.6–70.4% after LE at 3M and in 15.6–50.7% after MLE and in 16.1–55.4% after LE at 6M depending on the definition of dyspareunia selected (Table 2).

It is difficult to compare postpartum dyspareunia between studies as frequency and degree of dyspareunia are not commonly provided. Dyspareunia after midline episiotomy was reported in 41% in 3M and in 22% vs. 6M [5]. Barret et al. [18] found dyspareunia in 73% 3M and in 36% 6M after delivery, while Buhling [3] reported dyspareunia levels at 21% beyond 3M and in 11% it persisted more than 6M postpartum. In this study, for any of the considered definitions for introital dyspareunia, no significant difference was observed between the study groups.

In accordance with the presented study, the only other study evaluating 24 women with MLE and 78 women with LE 3M postpartum [16] found no difference in VAS score nor in resumption of sexual intercourse or coital pain. The only statistical difference found was pain during walking amongst women after LE [16]. In our study, there was no difference observed between the study groups for walking either at 3M or at 6M.

The main limitation of this study is that a sexual distress specific tool, e.g. the Female Sexual Function Index (FSFI) [26] where answers could provide total scores, was not used. However, at the time when the study was performed, FSFI was not validated in the Czech language. Furthermore, considering that participants had to complete social characteristics, a questionnaire evaluating defecatory

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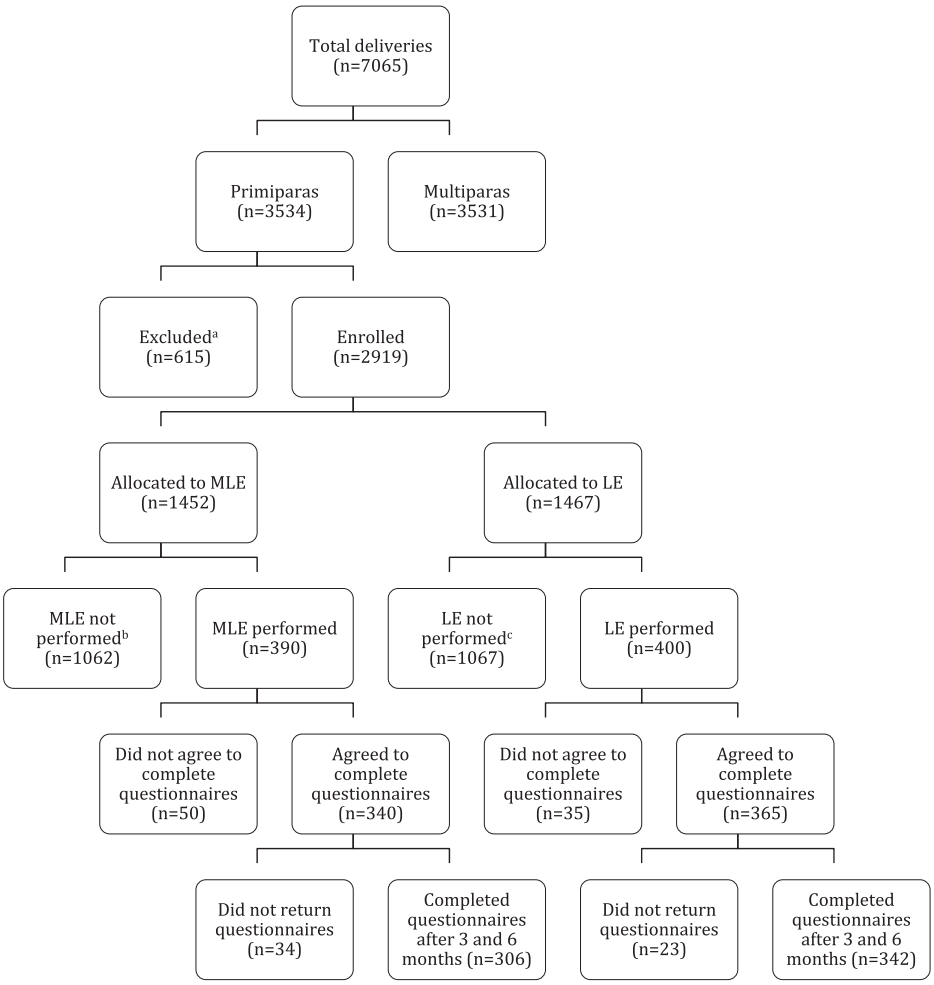

Fig. 1. Flow of patients through the study.
Abbreviations: MLE, mediolateral episiotomy; LE, lateral episiotomy.
[a]Scheduled Caesarean delivery (n = 475), prematurity (n = 81), disagreement with the study (n = 32), precipitate delivery (n = 10), coinciding deliveries (n = 8), other reason (n = 8).
[b]Labour resulting in Caesarean delivery (n = 292), vaginal delivery without episiotomy (n = 766), incorrect type of episiotomy (n = 4).
[c]Labour resulting in Caesarean delivery (n = 289), vaginal delivery without episiotomy (n = 776), incorrect type of episiotomy (n = 2).

disorders (data not yet published), several pain scores (containing eight questions) and nine questions evaluating sexuality, FSFI consisting of 19 questions seemed too long and potentially discouraging to participants.

The main advantage of this study is the prospective design and execution of episiotomies according to a new international classification which takes into account the exact location of the cut. This makes the results more reproducible and reliably comparable with other future studies.

In this prospective follow-up study the re-initiation and regularity of sexual intercourse, the frequency and intensity of dyspareunia and pain perception were consistent between groups with MLE and LE. The investigated episiotomy types did not differ, this being confirmed by the test of equivalence (two one-sided tests); the 90%CI was calculated within the pre-defined intervals ±5% (–2.25%; 1.49%) for resumption of sex and ±10% (–6.57%; 5.67%) for dyspareunia considering resultant rates of 31.5% and 32.4% amongst the MLE and LE groups respectively. Furthermore, perineal pain, cosmetic evaluation and overall satisfaction did not differ between the study groups within 6 months postpartum.

The long-term continence status of the women after MLE and/or LE has yet to be evaluated as well as further developments of dyspareunia persisting 6M after delivery. Future well designed studies need to be performed to support the results of the presented study.

Conflict of interest

All authors declare no conflicts of interest and no instances of plagiarism.

Authors' contributions

P Necesalova: data collection, manuscript writing; J Karbanova: data collection, manuscript editing; Z Rusavy: data collection; Z Pastor: project development, manuscript editing; M Jansova: project development; V Kalis: project development, data collection, manuscript writing/editing.

Ethics approval and informed consent

The study was approved by a local ethics committee and all participants signed a detailed informed consent prior to inclusion in the study.

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Table 2
Resumption of sexual activity and dyspareunia at 3 and 6 months postpartum[a].

				All women		
				Mediolateral episiotomy (n = 306)	Lateral episiotomy (n = 342)	p-value
Resumption an regularity of sexual intercourse	3M	Resumed		274/306 (89.5)	306/342 (89.5)	0.98[b]
		Regular sexual intercourse		168/306 (54.9)	193/342 (56.4)	0.70[b]
	6M	Resumed		300/306 (98.0)	334/342 (97.7)	0.74[b]
		Regular sexual intercourse		221/306 (72.2)	260/341 (76.3)	0.24[b]
Timing of first postpartum sexual intercourse	<6 weeks			22/301 (7.3)	25/335 (7.5)	0.90[b]
	6 weeks			77/301 (25.6)	78/335 (23.3)	0.26[c]
	7–8 weeks			121/301 (40.2)	125/335 (37.3)	
	9–12 weeks			45/301 (14.9)	60/335 (17.9)	
	>12 weeks			36/301 (12.0)	47/335 (14.0)	
Dyspareunia	3M	Frequency	No	80/279 (28.7)	92/311 (29.6)	0.99[b]
			Exceptional	62/279 (22.2)	67/311 (21.5)	0.95[c]
			Sometimes	65/279 (23.3)	71/311 (22.8)	
			Usual	72/279 (25.8)	81/311 (26.1)	
		Intensity	No	80/278 (28.8)	92/311 (29.6)	0.84[b]
			A little	115/278 (41.4)	124/311 (39.9)	0.99[c]
			Some	62/278 (22.3)	76/311 (24.4)	
			High	21/278 (7.5)	19/311 (6.1)	
		Any dyspareunia		199/279 (71.3)	219/311 (70.4)	0.81[b]
		Dyspareunia occurring sometimes or usually		137/279 (49.1)	152/311 (48.9)	0.96[b]
		Considerable dyspareunia		77/279 (27.6)	92/311 (29.6)	0.59[b]
	6M	Frequency	No	149/302 (49.3)	150/336 (44.6)	0.61[b]
			Exceptional	58/302 (19.2)	77/336 (22.9)	0.27[c]
			Sometimes	53/302 (17.6)	60/336 (17.9)	
			Usual	42/302 (13.9)	49/336 (14.6)	
		Intensity	No	149/302 (49.3)	150/336 (44.6)	0.19[b]
			A little	102/302 (33.8)	131/336 (39.0)	0.26[c]
			Some	38/302 (12.6)	48/336 (14.3)	
			High	13/302 (4.3)	7/336 (2.1)	
		Any dyspareunia		153/302 (50.7)	186/336 (55.4)	0.24[c]
		Dyspareunia occurring sometimes or usually		85/302 (31.5)	109/336 (32.4)	0.24[b]
		Considerable dyspareunia		47/302 (15.6)	54/336 (16.1)	0.86[b]
Sexual arousal	3M	Much lower		20/280 (7.1)	30/313 (9.6)	0.70[b]
		Lower		69/280 (24.6)	78/313 (24.9)	0.35[c]
		Same		156/280 (55.7)	175/313 (55.9)	
		Higher		29/280 (10.4)	25/313 (8.0)	
		Much higher		6/280 (2.1)	5/313 (1.6)	
	6M	Much lower		21/301 (7.0)	19/337 (5.6)	0.11[b]
		Lower		80/301 (26.6)	67/337 (19.9)	0.02[c]
		Same		170/301 (56.5)	208/337 (61.7)	
		Higher		28/301 (9.3)	35/337 (10.4)	
		Much higher		2/301 (0.6)	8/337 (2.4)	
Sexual satisfaction	3M	Much lower		19/279 (6.8)	20/311 (6.4)	0.32[b]
		Lower		57/279 (20.4)	85/311 (27.3)	0.10[c]
		Same		171/279 (61.3)	174/311 (56.0)	
		Higher		24/279 (8.6)	27/311 (8.7)	
		Much higher		8/279 (2.9)	5/311 (1.6)	
	6M	Much lower		18/301 (6.0)	18/337 (5.3)	0.43[b]
		Lower		64/301 (21.3)	54/337 (16.0)	0.06[c]
		Same		189/301 (62.8)	222/337 (65.9)	
		Higher		27/301 (9.0)	38/337 (11.3)	
		Much higher		3/301 (1.0)	5/337 (1.5)	
Achieving of orgasm	3M	Much lower		19/278 (6.8)	24/311 (7.7)	0.79[b]
		Lower		54/278 (19.4)	71/311 (22.8)	0.30[c]
		Same		180/278 (64.8)	188/311 (60.5)	
		Higher		20/278 (7.2)	24/311 (7.7)	
		Much higher		5/278 (1.8)	4/311 (1.3)	
	6M	Much lower		20/301 (6.6)	20/337 (5.9)	0.41[b]
		Lower		62/301 (20.6)	53/337 (15.7)	0.24[c]
		Same		187/301 (62.1)	233/337 (69.2)	
		Higher		29/301 (9.6)	27/337 (8.0)	
		Much higher		3/301 (1.0)	4/337 (1.2)	
Lubrication	3M	Much lower		25/279 (9.0)	37/311 (11.9)	0.75[b]
		Lower		88/279 (31.5)	96/311 (30.9)	0.60[c]
		Same		145/279 (52.0)	154/311 (49.5)	
		Higher		19/279 (6.8)	23/311 (7.4)	
		Much higher		2/279 (0.7)	1/311 (0.3)	
	6M	Much lower		33/301 (11.0)	19/335 (5.7)	0.15[b]
		Lower		81/301 (26.9)	97/335 (28.9)	0.33[c]
		Same		169/301 (56.1)	192/335 (57.3)	
		Higher		17/301 (5.7)	25/335 (7.5)	
		Much higher		1/301 (0.3)	2/335 (0.6)	

Abbreviations: 3M, 3 months; 6M, 6 months.
[a] Values are given as number/total number of respondents to the relevant question (percentage).
[b] Contingency tables and χ^2 test.
[c] Nonparametric analysis of variance (median two-sample test).

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Table 3
Perineal pain at 3 and 6 months postpartum[a].

Pain measure	Period	All women		
		Mediolateral episiotomy	Lateral episiotomy	p-value
VAS score	3M	6 (0–4)	7 (0–5)	0.71[b]
VRS score		0.8 (0.0–1.0)	0.9 (0.0–1.0)	0.94[b]
ADL score		0.1 (0.0–0.0)	0.2 (0.0–0.0)	0.68[b]
VAS score	6M	2 (0–0)	3 (0-0)	0.38[b]
VRS score		0.3 (0.0–0.5)	0.4 (0.0–1)	0.64[b]
ADL score		0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.49[b]
Persistence of pain	3M	65/306 (21.2)	76/342 (22.2)	0.76[c]
Persistence of pain	6M	13/306 (4.3)	22/342 (6.4)	0.22[c]
Number of women using analgesics (Ibuprofen) within previous week	3M	0/297 (0.0)	1/337 (0.3)	0.35[c]
Number of women using analgesics (Ibuprofen) within previous week	6M	0/299 (0.0)	0/337 (0.0)	N/A
Painful defecation	3M	48/305 (15.7)	54/342 (15.8)	0.98[c]
Painful defecation	6M	23/306 (7.5)	25/342 (7.3)	0.92[c]
Cosmetic appearance, VAS score[d]	3M	88 (80–100)	87 (80–100)	0.59[b]
Cosmetic appearance, VAS score[d]	6M	92 (90–100)	91 (88–100)	0.63[b]
Overall satisfaction, VAS score[d]	3M	89 (86–100)	88 (85–100)	0.61[b]
Overall satisfaction, VAS score[d]	6M	92 (90–100)	91 (89–100)	0.18[b]

Abbreviations: 3M, 3 months; 6M, 6 months; VAS, Visual Analogue Scale (0–100); VRS, Verbal Rating Scale (0–12); ADL, Activities of Daily Living (0–12).
[a] Values are given as number/total number of respondents to the relevant question (percentage) or mean (interquartile range), unless otherwise stated.
[b] Non-parametric analysis of variance (median two-sample test).
[c] Contingency tables and χ^2 test.
[d] Score on a modified VAS [14,23].

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Timing of episiotomy and outcome of a non-instrumental vaginal delivery

ZDENEK RUSAVY, JAROSLAVA KARBANOVA & VLADIMIR KALIS

Department of Obstetrics and Gynecology, Faculty of Medicine in Pilsen, Charles University in Prague, Pilsen, Czech Republic

Key words
Episiotomy, timing, crowning, delivery outcome, childbirth

Correspondence
Zdenek Rusavy, GPK FN Plzeň, Alej Svobody 80, Pilsen 304 60, Czech Republic.
E-mail: rusavyz@fnplzen.cz

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Abstract

Introduction. The aim of this study was to compare immediate delivery outcome as well as healing, pain, anal incontinence and sexuality in a short-term and a long-term follow up after episiotomy performed before or at crowning in nulliparous women. *Material and methods.* This cohort study is a comparison of prospectively collected data evaluating the importance of the timing of episiotomy. Patients with episiotomy performed before crowning (n = 86) and at crowning (n = 404) were compared. Obstetric anal sphincter injuries rate, additional perineal or vaginal trauma, neonatal outcome, episiotomy length, 2nd stage of labor duration, blood loss, infection, hematoma, dehiscence, need for resuturing, pain, painful defecation, resumption of sexual intercourse, dyspareunia, anal incontinence and constipation were assessed immediately after delivery or from responses to questionnaires 24 and 72 h, 10 days, 3 and 6 months postpartum. *Results.* The groups did not differ in age, body mass index, birthweight, occipito-posterior presentation, shoulder dystocia, or episiotomy type. Significant differences between before crowning and at crowning groups were observed in additional vaginal trauma [26 (30.2%) vs. 66 (16.3%), respectively, $p < 0.001$], mean episiotomy length (42 mm vs. 36 mm, $p < 0.001$), and mean estimated blood loss (367 mL vs. 344 mL, $p < 0.001$). Difference in obstetric anal sphincter injuries rate did not reach statistical significance [0 (0.0%) vs. 7 (1.7%), $p = 0.61$]. The groups did not differ in additional perineal trauma, pain (Visual Analogue Scale, Verbal Rating Scale and Activities of Daily Living scales), healing complications, sexual functions or anal incontinence in short-term or long-term follow up. *Conclusions.* Our results suggest that episiotomy performed at crowning is not associated with worse anatomical or functional delivery outcome, and support a restrictive approach to episiotomy. The effect of episiotomy timing on pelvic organ prolapse development remains to be determined.

Abbreviations: AC, at crowning; BC, before crowning; LE, lateral episiotomy; MLE, mediolateral episiotomy; OASIS, obstetric anal sphincter injuries.

Introduction

Episiotomy belongs to the most frequently practiced surgical interventions in women (1). It has therefore been studied from various points of view and regarding many aspects, including episiotomy types (2,3), indications (4–6), technique (7–9), repair (10) and consequences (11–13). However, no higher quality scientific evidence concerning the optimal timing of the procedure exists.

Key Message

Episiotomy performed at crowning is associated with comparable healing, pain, anal incontinence, dyspareunia and sexual intercourse resumption as before crowning in primiparous women. Postponing of cutting the episiotomy until crowning of the fetal head does not make the functional delivery outcome worse.

The majority of recommendations regarding the timing of episiotomy were published in the second half of the 20th century and were predominantly based on experience and expert opinions. In spite of the controversies over the optimal timing of the incision (14), early execution of episiotomy was advocated (15–17). Flew suggested that it was: "Far better to perform the episiotomy too early than too late; for the disadvantages of the former are slight, of the latter gross" (18). It was recommended to perform episiotomy before crowning, i.e. when the fetal head recedes into the pelvis in between the contractions and the delivery of the fetus is expected within the next three to four contractions (15), or once 3–4 cm in diameter of the fetal head is visible during a contraction (17). The practice of early episiotomy was supported at the time of its routine use, often in conjunction with prophylactic forceps (16,19).

However, an international consensus to abandon routine practice of episiotomy has been made on the basis of numerous studies comparing routine and restrictive episiotomy practice (20). Performing episiotomy before crowning (BC) is particularly useful for routine episiotomy practice. Prophylactic episiotomy BC may also be used to facilitate an operative delivery or to expedite delivery in the case of fetal distress. Nonetheless, when employing a restrictive approach to episiotomy, its indication often does not arise until the crowning of the fetal head, i.e. when no recession between the contractions is observed and the fetal head is in direct contact with the vulvar ring. Therefore, clinical practice has changed and episiotomy is nowadays frequently executed during crowning of the fetal head. Many authors suggest that when episiotomy is performed during crowning the damage has already been done and the procedure may be unnecessary or difficult (15–18). However, these opinions are not based on any quality scientific evidence, as no proper study concerning the timing of episiotomy in non-instrumental vaginal delivery has been published. Therefore, we decided to compare the effect of episiotomy performed before and at time of crowning during delivery in nulliparous women. We hypothesized that performing episiotomy BC would not be superior to episiotomy at the time of crowning regarding functional outcome in short-term, mid-term and long-term follow up. As the functional outcome is the most important, we wanted primarily to compare the postpartum pain, dyspareunia, resumption of sexual intercourse, and degree of anal incontinence. We also evaluated the blood loss, presence of additional perineal and vaginal trauma, painful defecation, number of analgesics needed, pain resolution, regularity of sexual intercourse and constipation after delivery among primiparous women. A further aim was to evaluate women after mediolateral (MLE) and lateral episiotomy (LE) separately.

Material and methods

A secondary analysis of prospectively collected data in a complex prospective randomized study (2) comparing outcome of MLE and LE was performed. The study included term primiparous women who delivered at the University Hospital in Pilsen from April 2010 till March 2012 (2). Inclusion criteria for the enrollment were: vaginal birth, nulliparity, episiotomy performed in accordance with the study protocol, gestational age of completed 37 weeks and later, and a signed informed consent. The exclusion criteria were: maternal age below 16 years, previous perineal surgery, stillbirth or delivery of an infant with extensive congenital abnormalities, perineal condylomata or extensive varicose veins, and inability to communicate in Czech or English.

All episiotomies were mediolateral or lateral, fulfilling the definitions of these episiotomy types (7). Episiotomy was performed in 27.1% of the enrolled participants when indicated based on the experience of the person attending labor and the current state of the parturient and fetus. The most frequent indications included signs of fetal distress (bradycardia, abnormal cardiotocography, meconium-stained amniotic fluid), obstetric operations and/or abnormal fetal positions (excluded from this secondary analysis), concerns about pelvic floor preservation (short perineum, rigid, scarified perineum), fetal macrosomia, deficient expulsive forces (weak abdominal muscles, maternal fatigue, weak uterine contractions non-responding to oxytocin augmentation, prolonged 2nd stage of labor, insufficiently pushing parturient) (21). None of these indications was absolute and the indication was frequently complex. The indication for the episiotomy was not recorded. Oral consent for episiotomy was obtained from all women prior to its performance. Although a large proportion of episiotomies were performed by midwives, a trained obstetrician was always present at the delivery to assess the trauma and suture the episiotomy. Manual perineal protection as previously described was practiced at each delivery (22).

Variables characterizing the immediate delivery outcome were recorded instantly after the delivery by the doctor, who attended the labor. The participants were subsequently questioned at 24 and 72 h postpartum regarding pain and healing complications. Personal contact with the investigators was possible, as the new mothers are always hospitalized with the neonates for at least 72 h after delivery in the Czech Republic. Upon discharge, the women were provided with questionnaires concerning pain, healing complications, sexual function and anal incontinence. These questionnaires were filled in and posted to the hospital by all participants 10 days, 3 and 6 months after the delivery. The

women were reminded about the questionnaire via email or telephone if they had not mailed them back in time. The original trial was approved by the local ethics committee (reference number 36/2010, approved 14 January 2010) and all participants signed an informed consent. All women who completed the 6-month follow up were included in the secondary analysis; women after breech, twins or operative delivery were excluded. Women in whom MLE or LE was performed BC, were compared with women in whom episiotomy was carried out at crowning (AC).

All data from the trial were analyzed, i.e. immediate delivery outcome as well as responses to the questionnaires obtained from the participants at 24 and 72 h, 10 days, 3 and 6 months postpartum. Only women who returned all the questionnaires were included in the secondary analysis. Those who did not fill in the questionnaires completely (e.g. omitted sexuality section or some questions only) were not excluded. Women with a missing value in a specific outcome measure were not evaluated for that measure. The numbers of missing answers are given in Tables 3 and 4 where applicable.

Sub-analyses of outcomes after LE and MLE were performed. The following variables were observed; obstetric anal sphincter injuries (OASIS) rate, additional perineal or vaginal trauma, 5-min Apgar score, arterial umbilical cord pH, episiotomy length, duration of the 2nd stage of labor, blood loss, infection, hematoma, dehiscence, need for resuturing, pain, painful defecation, attempt of sexual intercourse, regular sexual intercourse resumption, dyspareunia, anal incontinence and constipation.

The extent of the perineal trauma was evaluated by the doctor and the midwife attending labor in a standardized manner (2). The extent of blood loss at the delivery was estimated and women with atonic postpartum hemorrhage were excluded from the blood loss evaluation. The Visual Analogue Scale (range 0–100) (23), Verbal Rating Score (24) and Interference with Activities of Daily Living scales (25) were used for scoring postpartum pain. Anal incontinence was scored using the Wexner score as it is the most commonly used scoring system worldwide (26), and St. Mark's score as it was recommended for scoring anal incontinence after the delivery (27).

SAS 9.4 (http://www.sas.com) and STATISTICA v12 (http://www.statsoft.com) were used for the statistical analysis. Basic statistical values were calculated for study groups and subgroups. All data were checked for the assumption of normality. Categorical variables were analyzed using the chi-squared test and described by contingency tables. The comparison of variables in given groups with respect to their distribution was performed using non-parametric ANOVA (two-sample Wilcoxon test). Multivariate regression controlling for third degree tear in the case of painful defecation was used for multivariate analysis.

Results

A total of 790 women fulfilled the inclusion and exclusion criteria for the study (2) and a total of 577 (73.0%) participants completed the trial; the follow-up questionnaires were not provided in time by 213 participants (57 participants after 24 and 72 h, 154 participants after 10 days, and additional two participants after 3 and 6 months). In addition, the timing of episiotomy was not provided in 52 women, and 35 women had operative delivery, twin pregnancy or breech delivery and were therefore excluded from the analysis. In total, 490 women (84.9% of women with complete follow up) were available for the secondary analysis (86 BC, 404 AC). The groups did not differ in age, body mass index, neonatal weight, occipito-posterior presentation, shoulder dystocia or type of episiotomy performed. Episiotomy BC at our institution is performed mainly due to fetal distress. It was therefore significantly more common among deliveries by doctors, whereas episiotomy AC was equally frequent between midwives and doctors (Table 1). Furthermore, as expected, women in

Table 1. Patient characteristics.

	Before crowning (n = 86)	At crowning (n = 404)	p-value
Maternal age, years; mean ± SD	28.4 ± 3.8	27.9 ± 4.3	0.26[a]
Body mass index; mean ± SD	28.1 ± 4.0	27.9 ± 4.2	0.64[a]
Occipito-posterior presentation; n (%)	5 (5.8)	18 (4.5)	0.58[b]
Shoulder dystocia; n (%)	4 (4.7)	6 (1.5)	0.08[b]
Fetal distress; n (%)	66 (76.7)	54 (13.4)	<0.001[b]
Person performing the episiotomy; n (%)			
Doctor	77 (89.5)	171 (42.3)	<0.001[b]
Midwife	9 (10.5)	233 (57.7)	
Type of episiotomy; n (%)			
Mediolateral	41 (47.7)	182 (45.1)	0.72[b]
Lateral	45 (52.3)	222 (55.0)	
Apgar score at 5 min <8; n (%)	2 (2.3)	2 (0.5)	0.14[b]
Neonatal umbilical artery pH; mean (±SD)	7.2 (0.1)	7.3 (0.1)	<0.001[a]
Duration of the 2nd stage, min; mean ± SD	23.9 ± 14.5	25.9 ± 15.6	0.38[a]
Birthweight, g; mean ± SD	3 310 ± 347	3 364 ± 433	0.27[a]

[a]Non-parametric ANOVA (two-sample Wilcoxon test).
[b]Fisher's exact test.

the BC group had lower umbilical artery pH. See Table 1 for more details regarding patient characteristics.

The difference in the OASIS rate was not statistically significant; however, OASIS occurred only in the AC group (four after MLE and three after LE) (Table 2). Statistically significant differences in the incidence of additional vaginal trauma, length of episiotomy and estimated blood loss were observed (Table 2). On sub-analyses, the difference was significant only in the case of LE, whereas in MLE no statistically significant difference was found. In addition, no statistically significant differences between the groups in postpartum pain evaluated using Visual Analogue Scale, Verbal Rating Score, Activities of Daily Living scale or number of analgesics taken were observed at 24 and 72 h, 10 days, 3 and 6 months after delivery (Table 3). The rate of painful defecation 10 days after delivery was significantly increased in the BC group; this difference was significant also in the multivariate analysis controlling for OASIS ($p < 0.001$). Nonetheless, a sub-analysis showed that this difference was present only in the case of LE. Interestingly, this trend was not seen at 3 or 6 months after delivery (Table 3). The groups did not differ in the rate of infection, hematoma in episiotomy, need for resuturing or dehiscence. Regarding sexual functions, no statistically significant differences between the groups were observed in attempts at vaginal sex and resumption of regular sexual intercourse (Table 4). However, sub-analyses revealed a statistically significant difference in the resumption of sexual intercourse in women 6 months after MLE in both the BC and AC groups [37 (92.5%) vs. 173 (99.4%), respectively, $p = 0.02$]. This phenomenon was not observed in women after LE. The incidence of anal incontinence evaluated by St. Mark's and Wexner scores at 3 and 6 months postpartum were comparable (Table 4), including sub-analyses. Only one patient, after LE AC, had a Wexner score >9 at 3 months after delivery. BC and AC groups did not differ in constipation at 3 and 6 months postpartum, a sub-analysis showed a statistically significant difference in constipation at 3 months after LE between BC and AC [30 (66.7%) vs. 101 (46.5%), respectively, $p = 0.02$].

Table 2. Postpartum trauma.

	Before crowning ($n = 86$)	At crowning ($n = 404$)	*p*-value
Obstetric anal sphincter injury; *n* (%)	0 (0.0)	7 (1.7)	0.61[b]
Additional perineal trauma; *n* (%)	1 (1.2)	13 (3.2)	0.48[b]
Additional vaginal trauma; *n* (%)	26 (30.2)	66 (16.3)	0.01[b]
Length of episiotomy, mm; mean (±SD)	42 (11.1)	36 (8.4)	<0.001[a]
Estimated blood loss excluding uterine atony, mL; mean ± SD	366.7 ± 93.6	343.7 ± 45.4	0.01[a]
Duration of repair, min; mean ± SD	14.3 ± 6.1	12.9 ± 5.1	0.08[a]

[a]Non-parametric ANOVA (two-sample Wilcoxon test).
[b]Fisher's exact test.

Discussion

Our hypothesis that performing episiotomy BC of the fetal head is not superior to its performance at time of crowning regarding functional postpartum outcome was confirmed in most aspects. We were able to confirm that performing episiotomy BC is associated with higher blood loss, longer incision and more frequent additional vaginal trauma. This was true mainly in the case of lateral episiotomies. No statistically significant differences in the extent of trauma on the perineum, healing, pain, resumption of sexual intercourse and anal incontinence were found. However, in spite of the fact that the difference was not statistically significant, we were surprised to find that all OASIS occurred when the episiotomies were performed AC of the fetal head, regardless of its type.

The sub-analyses showed that the timing of the episiotomy is of particular importance in the case of LE, where early episiotomy was associated with worse immediate outcome of the delivery (additional vaginal trauma, increased length of the episiotomy, higher blood loss) and painful defecation after 10 days. In the case of the MLE the timing seems to be of less importance, as the differences in outcome were not significant.

The finding that the length of the second stage of labor was not significantly affected by the timing of episiotomy was surprising. Shortening the second stage of labor due to fetal distress is a frequent motivation for early episiotomy, as demonstrated by lower mean umbilical artery pH in the BC group. However, in spite of the fact that, according to our data, performing early episiotomy does not lead to significant shortening of the total length of the second stage of labor, often, shortening only the critical terminal part of the second stage of labor is important.

Albeit statistically significant, the difference was not clinically significant, as both mean values were above the physiological umbilical artery pH cut-off (i.e. above 7.2) and the groups did not differ in the number of newborns with a 5-min Apgar score below 8 (Table 1). The difference in the umbilical artery pH between the groups was likely due to the uneven distribution of episiotomies performed due to fetal distress. Therefore, from our data we

Table 3. Evaluation of postpartum pain.

Evaluation of pain Scores/domains	Time after childbirth	Before crowning (n = 86)	At crowning (n = 404)	Answer not provided: Before n (%)	Answer not provided: At n (%)	p-value
Visual Analogue Scale; mean ± SD	24 h	3.6 ± 2.2	3.7 ± 2.4	37 (43.0)	131 (32.4)	0.77[a]
	72 h	2.4 ± 2.2	2.2 ± 2.1	41 (47.7)	141 (34.9)	0.51[a]
	10 days	2.6 ± 2.4	2.4 ± 2.2	5 (5.8)	55 (13.6)	0.57[a]
	3 months	4.8 ± 10.5	5.2 ± 13.2	4 (4.7)	25 (6.2)	0.16[a]
	6 months	2.4 ± 7.6	2.7 ± 10.3	1 (1.2)	28 (6.9)	0.81[a]
Verbal Rating Scale; mean ± SD	24 h	4.4 ± 1.7	4.2 ± 2.0	20 (23.3)	65 (16.1)	0.54[a]
	72 h	2.6 ± 1.7	2.4 ± 1.8	23 (26.7)	75 (18.6)	0.27[a]
	10 days	2.1 ± 2.0	2.0 ± 1.9	0 (0.0)	1 (0.2)	0.40[a]
	3 months	0.8 ± 1.0	0.8 ± 1.1	1 (1.2)	9 (2.2)	0.59[a]
	6 months	0.5 ± 1.0	0.3 ± 0.7	1 (1.2)	14 (3.5)	0.32[a]
Interference with Activities of Daily Living scale; mean ± SD	24 h	5.1 ± 2.0	4.7 ± 2.3	20 (23.3)	68 (16.8)	0.11[a]
	72 h	3.0 ± 2.1	2.7 ± 1.9	23 (26.7)	75 (18.6)	0.39[a]
	10 days	2.3 ± 2.0	2.2 ± 2.1	1 (1.2)	6 (1.5)	0.47[a]
	3 months	0.1 ± 0.3	0.1 ± 0.5	0 (0.0)	6 (1.5)	0.46[a]
	6 months	0.1 ± 0.3	0.0 ± 0.2	1 (1.2)	14 (3.5)	0.81[a]
Painful defecation; n (%)	10 days	40 (48.8)	110 (28.1)	4 (4.7)	13 (3.2)	<0.001[b]
	3 months	14 (16.5)	61 (15.3)	1 (1.2)	6 (1.5)	0.74[b]
	6 months	4 (4.7)	28 (7.2)	1 (1.2)	14 (3.5)	0.63[b]
Number of analgesics within 10 days postpartum; mean ± SD		0.3 ± 2.3	0.1 ± 0.7	10 (11.6)	46 (11.4)	0.47[a]
Pain resolution within 10 days; n (%)		30 (55.6)	171 (62.4)	32 (37.2)	130 (32.2)	0.36[b]

The percentages are calculated from the total number of respondents. The number and percentage of participants who did not respond are provided.

[a]Non-parametric ANOVA (two-sample Wilcoxon test).

[b]Fisher's exact test.

cannot conclude that the type of episiotomy or its timing affects neonatal outcome.

The low number of episiotomies in the BC group and the uneven distribution between the two groups reflects the fact that the episiotomies were performed restrictively. There is a general consensus about restricting the use of episiotomy (20) and most unnecessary episiotomies are performed for prophylactic reasons BC of the fetal head (21). The Argentine Episiotomy Trial established that a restrictive episiotomy rate above 30% is not clinically justified (28). The current version of Cochrane database supports this opinion (20). The episiotomy rate of 27.1% among nulliparas observed in the present study should thus be considered to represent a restrictive approach.

The main limitation of the study is its very design, i.e. secondary analysis of a large prospective study. The timing of episiotomy was not randomized and reflects common practice at our institution. Consequently, the groups are not even in numbers. As a result, episiotomy BC was more commonly performed due to fetal distress by a doctor. This made it impossible to analyze multivariate regression of neonatal outcome controlling for fetal distress as the indication for performing episiotomy. However, the authors consider that designing a randomized controlled trial of such an extent aimed purely at the timing of episiotomy impractical and unethical, as it would require a routine approach to episiotomy. Therefore, properly prospectively collected data from a randomized controlled study were used.

Another limitation is inherent to the follow up using self-completed questionnaires. The highest drop-out rate was observed at 10 days after delivery. The new mothers are facing many challenges after discharge from the hospital, as the system of community midwives in the Czech Republic is generally scarcely available. As a result, 19.5% of participants did not send in the questionnaire 10 days after delivery. Although more than 90% of the mothers sent the questionnaires at 3 and 6 months after the delivery, having missed the 10-day follow up their data was considered incomplete and they were excluded from this secondary analysis.

The main strengths include the complex evaluation of the difference in the delivery outcome after episiotomy performed before and at crowning of the fetal head. Proper examination of all women in the study and detailed follow up allowed us to study the importance of

Table 4. Evaluation of sexuality and anal incontinence.

	Before crowning (n = 86)	At crowning (n = 404)	Answer not provided: Before n (%)	Answer not provided: At n (%)	p-value
Sexual intercourse after 3 months; n (%)	74 (86.1)	359 (90.9)	0 (0.0)	9 (2.2)	0.17[b]
Sexual intercourse after 6 months; n (%)	82 (96.5)	382 (98.2)	1 (1.2)	15 (3.7)	0.40[b]
Regular sexual intercourse after 3 months; n (%)	47 (56.6)	231 (60.3)	3 (3.5)	21 (5.2)	0.54[b]
Regular sexual intercourse after 6 months; n (%)	65 (77.4)	287 (74.6)	2 (2.3)	19 (4.7)	0.68[b]
De novo dyspareunia after 3 months; n (%)	51 (67.1)	225 (60.5)	10 (11.6)	32 (7.9)	0.30[b]
De novo dyspareunia after 6 months; n (%)	40 (48.2)	174 (45.0)	3 (3.5)	17 (4.2)	0.63[b]
St. Mark''s score >5 after 3 months; n (%)	6 (7.0)	20 (5.0)	0 (0.0)	7 (1.7)	0.44[b]
St. Mark's score >5 after 6 months; n (%)	0 (0.0)	10 (2.6)	1 (1.2)	14 (3.5)	0.22[b]
Mean Wexner score after 3 months; mean ± SD	0.7 ± 1.0	0.7 ± 1.3	0 (0.0)	7 (1.7)	0.43[a]
Mean Wexner score after 6 months; mean ± SD	0.4 ± 1.0	0.4 ± 0.9	1 (1.2)	14 (3.5)	0.94[a]
Constipation after 3 months; n (%)	47 (54.7)	180 (45.5)	0 (0.0)	8 (2.0)	0.12[b]
Constipation after 6 months; n (%)	37 (43.5)	147 (37.7)	1 (1.2)	14 (3.5)	0.33[b]

The percentages are calculated from the total number of respondents. The number and percentage of participants who have not responded are provided.

[a]Non-parametric ANOVA (two-sample Wilcoxon test).

[b]Fisher's exact test.

the timing of an episiotomy regarding numerous outcome measures. The data were collected prospectively in a controlled manner and the episiotomies were properly and uniformly performed and sutured.

To our knowledge this is the first study concerning timing of episiotomy and its immediate short-term and long-term outcome. Although there are no studies concerning the timing of episiotomy in a non-instrumental vaginal delivery, studies regarding timing of the episiotomy in a forceps delivery have been published (16,19,29). Nonetheless, women with operative delivery were excluded from our statistical analysis. Our data suggest that performing episiotomy BC is associated with significantly higher blood loss. Although the difference is not clinically significant (23 mL), this result is not surprising and is in agreement with the expert opinion and studies published previously (14,15,17,30).

When evaluating the maternal outcome of an obstetric intervention, the functional outcome and long-term consequences which may decrease the quality of life of the new mother are of highest importance. It has been recognized that restrictive episiotomy use is associated with better functional outcome postpartum (20,28). This practice requires avoiding prophylactic episiotomy BC and waiting to see whether episiotomy is needed until the crowning of the fetal head. Our data show that this practice is not associated with worse maternal functional outcome. The differences in blood loss, length of episiotomy or the statistically insignificant difference in OASIS are not clinically significant in light of the comparable functional outcome in the short-term and long-term follow up.

Conclusion

The evidence regarding the optimal timing of episiotomy published so far is outdated and consists mainly of expert opinions. The results of this study suggest that episiotomy performed AC is associated with less additional vaginal trauma, shorter length, lower estimated blood loss and lower incidence of painful defecation 10 days after delivery. However, no statistically significant differences in functional outcome, i.e. incidence of complications, pain, attempt at vaginal sex, resumption of sexual intercourse, dyspareunia and anal incontinence, were observed in short-term and long-term follow up. The sub-analyses have shown that the timing of the episiotomy is of particular importance in the case of LE, where episiotomy BC was associated with more frequent additional vaginal trauma, increased length of the episiotomy, higher blood loss and painful defecation after 10 days. Episiotomy AC is not associated with a deteriorated anatomical or functional delivery outcome. If early episiotomy is necessary, MLE should be preferred. The effect of episiotomy timing on levator ani injury and pelvic organ prolapse development remains to be determined.

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CLINICAL ARTICLE

Anal incontinence severity assessment tools used worldwide

Zdenek Rusavy [a,*], Magdalena Jansova [b], Vladimir Kalis [a]

[a] Department of Obstetrics and Gynecology, Medical Faculty in Pilsen, Charles University, Prague, Czech Republic
[b] NTIS - New Technologies for the Information Society, Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic

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ABSTRACT

Objective: To conduct an international survey of anal incontinence assessment tools and the need to evaluate frequency of occurrence of fecal urgency. *Methods:* A questionnaire on the use of anal incontinence assessment tools was distributed between May and December 2012 among clinicians and researchers dealing with anal incontinence, primarily in North America, Europe, and Asia. *Results:* A total of 143 responses were collected from 56 (39.2%) obstetricians, gynecologists, and urogynecologists; 71 (49.7%) colorectal surgeons, proctologists, and general surgeons; and 16 (11.2%) physiotherapists, theoretical scientists, and gastroenterologists. Fourteen different tools were reported—most commonly Wexner score (n = 78; 48.8%) and St Mark's score (n = 29; 18.1%). No scoring system was used by 24 (16.8%) respondents. Thirty-four (28.6%) used multiple tools. There was variation in the reasons given for scoring the frequency of fecal urgency as 4 points when using St Mark's score. Of 96 respondents responding to a query about modifying the St Mark's score, 88 (91.7%) agreed that fecal urgency should be scored according to the frequency of occurrence. *Conclusion:* Although the Wexner score neglects fecal urgency, it is the most commonly used scoring system. The study contributes to the standardization of terminology and reproducibility of results in research and clinical management of anal incontinence.

1. Introduction

Anal incontinence is the involuntary loss of flatus, or liquid or solid stool through the anal sphincter, and is a serious and distressing condition. It can have a devastating effect on quality of life, including occupational, social, and sexual aspects [1].Childbirth is an important risk factor for the development of anal incontinence. Brincat et al. [2] reported that fecal incontinence was experienced by 6.4% of women 6 weeks after delivery and 5.3% of women 1 year after delivery. The cumulative incidence rate of anal incontinence during pregnancy and after delivery in previously continent nulliparous women was 10.3% in Europe [3].In a study from South Africa, 6-week postpartum incidence of anal incontinence was reported in 61.1% of women, with a 6-month persistence of 6.4% [4]. Some 54% of women with urinary incontinence, pelvic organ prolapse, or both, reported anal incontinence, suggesting a significant relationship between anal incontinence and other pelvic floor disorders [5]. Diagnosis of anal incontinence requires a symptom-based approach rather than a traditional disease-based approach, making subjective assessment of the severity of anal incontinence superior to objective examinations [6]. Fecal urgency is the inability to suppress the sensation to defecate. It is a particularly important and bothersome aspect of anal incontinence, which may be as limiting to an individual as frank incontinence. For this reason, the evaluation of fecal urgency has been incorporated into numerous tools for the assessment of anal incontinence [7–13].

Designing and evaluating the most effective scoring systems for anal incontinence are continuing goals. One of the first evaluation systems ever described used a scale from 1 to 4 to differentiate a normal condition, gas incontinence, liquid fecal incontinence, and solid fecal incontinence [14]. Pescatori et al. [15] included a scoring system to account for the frequency of episodes of anal incontinence. This system was further elaborated, and weightings were introduced into the anal incontinence severity evaluation in the Anal Incontinence Severity Score [16]. Subsequently, the Cleveland research group developed the Wexner score—a point system ranging from 0 to 20—that considers other relevant factors such as change in quality of life and use of incontinence pads [17].This system has been widely accepted by specialists despite the omission of fecal urgency. More recently, Vaizey et al. [7] devised a modification to the scoring system (St Mark's score) that takes into consideration fecal urgency and coping behavior such as taking constipating medicines. In this system, fecal urgency is defined as the inability to defer defecation for 15 minutes; however, the frequency of fecal urgency episodes is not considered—absence of fecal urgency is scored as 0 points and any sign of fecal urgency is scored as 4 points [7]. The St Mark's score is recommended for the follow-up of women with obstetric anal sphincter injury [18].

* Corresponding author at: Department of Gynecology and Obstetrics, Medical Faculty and University Hospital in Pilsen, Alej Svobody 80, Plzen, 304 60, Czech Republic. Tel.: +420 377 105 240; fax: +420 377 105 290.
E-mail address: rusavyz@fnplzen.cz (Z. Rusavy).

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Although fecal urgency has been neglected in many scoring systems, it can affect quality of life considerably—by its frequency as well as its presence. Quality of life may be unaffected by rare urgency episodes, and yet the final score would be altered considerably. This may be why the Wexner score was found to be more reliable despite the lack of fecal urgency assessment [19]. Similarly, the Fecal Incontinence Severity Index (FISI), as a weighted score, was recommended in cases of high-frequency incontinence; however, its applicability may be limited owing to the lack of fecal urgency assessment [6].

Under the aegis of the International Urogynecological Association (IUGA) we conducted an international survey of anal incontinence severity scoring systems and evaluation tools used by specialists. The primary objective of the survey was to determine which scoring systems are used most frequently. In addition, we proposed a modification to the St Mark's scoring system by dividing the scores for fecal urgency according to the frequency of occurrence (0 = never, 1 = rarely, 2 = sometimes, 3 = weekly, 4 = daily). We sought the opinions of the surveyed experts on this modification to assess the need to evaluate the frequency of occurrence of fecal urgency.

2. Materials and methods

A simple questionnaire was distributed between May and December 2012 among international experts who conduct research or clinically manage anal incontinence, primarily in North America, Europe, and Asia (obstetricians, gynecologists, urogynecologists, colorectal surgeons, proctologists, general surgeons, physiotherapists, theoretical scientists, and gastroenterologists). The questionnaire provided a brief introduction to the topic, an explanation of the reasoning behind the proposed modification to the St Mark's score, and three simple questions. The experts were asked which scoring system they used to assess the severity of anal incontinence in their hospital. The respondents using the St Mark's score were asked to record the frequency of fecal urgency episodes they scored as 4 points for fecal urgency. All experts were then asked for their opinion of the modification to the St Mark's score to assess the frequency of occurrence of fecal urgency.

The questionnaire was disseminated via email, the IUGA weekly newsletter, and in print format. Email addresses were obtained from published studies on anal incontinence. PubMed, Medline, and Google scholar databases were used to search for the publications. The following keywords were used: anal, ano-rectal, fecal, incontinence, fecal urgency, anal sphincter tear, injury, trauma, and OASIS. In addition, a web-based survey was created, and a link was sent to IUGA members via the IUGA weekly newsletter. The responses were compiled, analyzed separately, and are expressed as numbers and percentages. No statistical significance calculations were necessary because the study was a survey and purely descriptive. No ethical committee approval or informed consent was necessary owing to the nature of the study.

3. Results

A total of 143 responses were received. The composition of participants was 56 (39.2%) obstetricians, gynecologists, and urogynecologists; 71 (49.7%) colorectal surgeons, proctologists, and general surgeons; and 16 (11.2%) physiotherapists, theoretical scientists, and gastroenterologists. The geographical distribution of the responses is presented in Fig. 1. According to the survey, 24 (16.8%) respondents did not use any scoring system for the evaluation of anal incontinence and these were excluded from the analysis. Responses from the remaining 119 participants on the spectrum of evaluation tools used are presented in Table 1. A total of 34 (28.8%) respondents used multiple tools for the evaluation of anal incontinence. Respondents reported using 14 different tools for assessing anal incontinence, totaling 161 responses. The most commonly used tools were the Wexner score used by 79 (49.1%) respondents, the St Mark's (Vaizey) score used by 29 (18.0%) respondents, and the Fecal Incontinence Quality of Life (FIQL, Rockwood) score used by 21 (13.0%) respondents. Common tools for assessing anal incontinence were distributed evenly among experts, except for the FIQL, which was used less frequently by obstetricians and gynecologists. The FIQL scale is a tool for assessing quality of life rather than the severity of anal incontinence, and was used predominantly in combination with an anal incontinence severity scoring system. The FIQL alone was used by only one respondent.

Specific aspects of anal incontinence covered by the assessment tools are presented in Table 2. Asubanalysis of the responses of specialists who used the most common scoring systems (Wexner, St Mark's score, or both) was then carried out to consider the combination of scoring systems with quality-of-life assessment tools (Table 3). A total of 19 (19.6%) responders used a quality-of-life assessment tool in addition to an anal incontinence severity scoring system, and this was highest among surgeons (n = 15; 24.6%). Most obstetricians and gynecologists used a severity scoring system alone (n = 25; 96.2%).

The responses of participants who reported using the St Mark's score to record frequency of fecal urgency episodes as 4 points are presented in Table 4. No unequivocal answer was given to this question; 4 points was scored for occurrence of regular episodes by 11 (37.9%) respondents, as well as for any recent episode irrespective of frequency by 10 (34.5%) respondents. Inconsistent responses were given by individual specialties on the frequency of fecal urgency episodes (Table 4). The answer "when it affects quality of life" was given five times and always in association with frequency of fecal urgency episodes (three times with regular episodes, once with a recent episode of urgency regardless of frequency, and once with daily occurrence). We assumed that effect on quality of life was superior to frequency here and assigned these answers to this specific response (Table 4).

Ninety-six (67.1%) respondents commented on the modification proposed to the St Mark's tool to score fecal urgency based on the frequency of occurrence. Most respondents (n = 88; 91.7%) agreed with the suggested modification (Table 5).

4. Discussion

Anal incontinence is a severe condition that can have a substantial impact on the quality of life of affected individuals. Despite increased scientific interest in developing a reliable and widely used instrument to evaluate anal incontinence, significant variability exists in the way these patients are assessed. Owing to its nature, anal incontinence is frequently neglected by physicians who are not directly involved in its treatment. Despite its potential association with pregnancy and delivery, gynecologists and even urogynecologists often tend to neglect anal incontinence in the follow-up of patients post partum.

Fecal urgency was proven to be closely associated with external anal sphincter dysfunction irrespective of rectal sensitivity and internal anal sphincter dysfunction [20]. Its evaluation is therefore particularly important in the follow-up of individuals with obstetric anal sphincter injury. The St Mark's score has been recommended for this purpose [18]. In the present study, use of the St Mark's score was not higher among obstetricians and gynecologists compared with colorectal surgeons, proctologists, and general surgeons. Other anal incontinence assessment tools that take fecal urgency into account include the FIQL (Rockwood), Manchester Health Questionnaire, Birmingham Bowel and Urinary Symptoms Questionnaire, Australian Pelvic Floor Questionnaire, Colorectal-Anal Distress Inventory, and Rintala score [8–13]. All of these are more complex tools for assessing quality of life with anal incontinence. According to the results of the present study, 24.6% of surgeons used a tool for quality-of-life assessment in conjunction with the Wexner or St Mark's score, whereas this practice was rare among obstetricians and gynecologists (3.8%), including urogynecologists.

A survey conducted among surgeons and gastroenterologists in Spain also showed the dominance of the use of the Wexner score in both groups [21]. The present study was designed to assess the scoring of anal incontinence among obstetricians and gynecologists. As patients

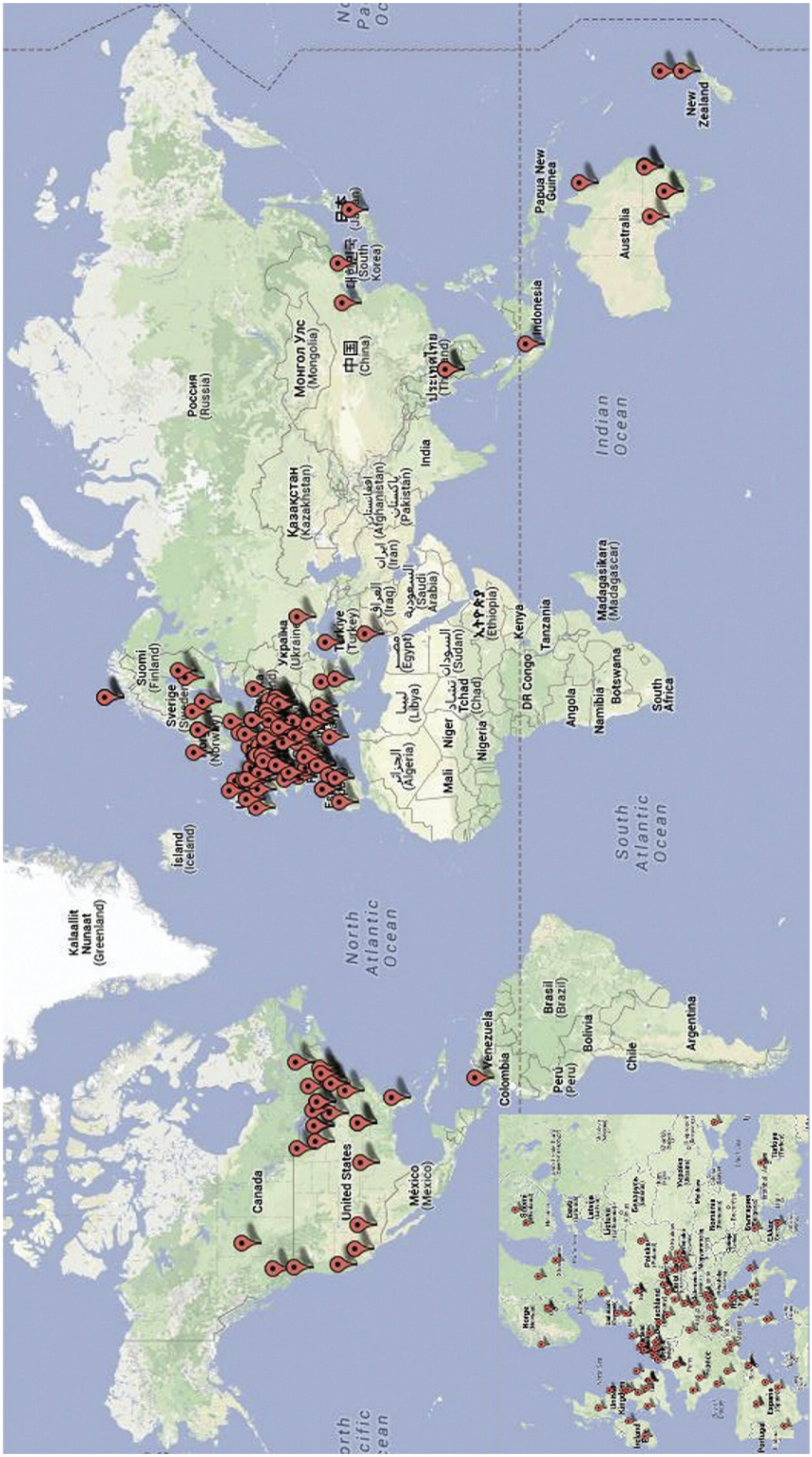

Fig. 1. Geographical distribution of responses.

Table 1
Frequency of use of the individual anal incontinence scoring systems.[a]

Scoring system	Ob/Gyn[b] (n = 42)	Surgeon[c] (n = 99)	Other[d] (n = 20)	Total (n = 161)
Wexner score [17]	20 (47.6)	51 (51.5)	8 (40.0)	79 (49.1)
St Mark's (Vaizey) score [7]	6 (14.3)	17 (17.2)	6 (30.0)	29 (18.0)
FIQL Scale (Rockwood) [8]	2 (4.8)	16 (16.2)	3 (15.0)	21 (13.0)
FISI system [16]	5 (11.9)	9 (9.1)	2 (10.0)	16 (9.9)
AMS score [7]	0	3 (3.0)	0	3 (1.9)
Australian Pelvic Floor Questionnaire [11]	1 (2.4)	0	1 (5.0)	2 (1.2)
Pescatori score [15]	1 (2.4)	1 (1.0)	0	2 (1.2)
Manchester Health Questionnaire [9]	2 (4.8)	0	0	2 (1.2)
BBUSQ-22 [10]	1 (2.4)	0	0	1 (0.6)
CRADI - included in PFDI [12]	1 (2.4)	0	0	1 (0.6)
ePAQ [24]	1 (2.4)	0	0	1 (0.6)
Rintala score [13]	0	1 (1.0)	0	1 (0.6)
DDI [23]	1 (2.4)	0	0	1 (0.6)
Parks score [14]	0	1 (1.0)	0	1 (0.6)
Not specified	1 (2.4)	0	0	1 (0.6)

Abbreviations: FIQL, Fecal Incontinence Quality of Life; FISI, Fecal Incontinence Severity Index; AMS, American Medical Systems; BBUSQ-22; Birmingham Bowel and Urinary Symptoms Questionnaire; CRADI; Colorectal-Anal Distress Inventory; PFDI, Pelvic Floor Distress Inventory; ePAQ, electronic Personal Assessment Questionnaire; DDI, Defecatory Distress Inventory.
[a] Values are given as number (percentage). Answers are not mutually exclusive.
[b] Ob/Gyn: obstetrician, gynecologist, urogynecologist.
[c] Surgeon: colorectal surgeon, proctologist, general surgeon.
[d] Other: physiotherapist, theoretical scientist, gastroenterologist.

Table 2
Overview of anal incontinence severity assessment tools.[a]

Scoring system	Leakage		Lifestyle alteration	Use of incontinence pads	Taking constipating medicines	Fecal urgency	Specific QoL measures	Other symptoms (UI, POP)
	Type	Frequency						
Wexner score [17]	X	x	x	X				
St. Mark's (Vaizey) score [7]	X	x	x	X	x	x		
FIQL Scale (Rockwood)[8]							x	
FISI system[16]	X	x						
AMS score [7]	X	x	x					
Australian Pelvic Floor Questionnaire [11]	X	x	x			x		x
Pescatori score [15]	X	x						
Manchester Health Questionnaire [9]	X	x	x	X		x	x	
BBUSQ-22 [10]						x		x
CRADI – included in PFDI [12]	X		x			x		x
ePAQ [24]	X		x	X		x		x
Rintala score [13]		x	x	X		x		
DDI [23]	X							
Parks score [14]	X							

Abbreviations: QoL, quality of life; POP, pelvic organ prolapse; UI, urinary incontinence; FIQL, Fecal Incontinence Quality of Life; FISI, Fecal Incontinence Severity Index; AMS, American Medical Systems; BBUSQ-22; Birmingham Bowel and Urinary Symptoms Questionnaire; CRADI; Colorectal-Anal Distress Inventory; PFDI, Pelvic Floor Distress Inventory; ePAQ, electronic Personal Assessment Questionnaire; DDI, Defecatory Distress Inventory.
[a] Aspects covered by individual tools f are marked "x."

with anal incontinence are frequently treated by urogynecologists, the International Urogynecology Association (IUGA) was asked for assistance.

A major limitation of the survey is that the respondents' level of expertise was not taken into consideration. In addition, despite a thorough search of the literature and cooperation with IUGA, not all specialists in the field were surveyed. The survey was conducted predominantly among specialists involved in research, clinical evaluation, and treatment of anal incontinence. We surveyed a large number of specialists and assumed that those who did not respond to the survey either did

Table 3
Subanalysis of the use of the Wexner and St Mark's scores.[a]

	Ob/Gyn[b] (n = 26)	Surgeon[c] (n = 61)	Other[d] (n = 10)	Total
Wexner score	20 (76.9)	35 (57.4)	3 (30.0)	58 (59.8)
Wexner + QoL assessment tool[e]	0	9 (14.8)	1 (10.0)	10 (10.3)
St Mark's score	5 (19.2)	7 (11.5)	2 (20.0)	14 (14.4)
St Mark's + QoL assessment tool	1 (3.8)	3 (4.9)	0	4 (4.1)
St Mark's + Wexner	0	4 (6.6)	2 (20.0)	6 (6.2)
St Mark's + Wexner + QoL assessment tool	0	3 (4.9)	2 (20.0)	5 (5.2)

[a] Values are given as number (percentage).
[b] Ob/Gyn: obstetrician, gynecologist, urogynecologist.
[c] Surgeon: colorectal surgeon, proctologist, general surgeon.
[d] Other: physiotherapist, theoretical scientist, gastroenterologist.
[e] QoL assessment tool = Fecal Incontinence Quality of Life Scale (Rockwood scale) or Birmingham Bowel and Urinary Symptoms Questionnaire.

Table 4
Frequency of urgency resulting in a score of 4 points using the St Mark's score.[a]

	Ob/Gyn[b] (n = 6)	Surgeon[c] (n = 17)	Other[d] (n = 6)	Total (n = 29)
Any recent episode of urgency regardless of frequency	2 (33.3)	6 (35.3)	2 (33.3)	10 (34.5)
Regular episodes	2 (33.3)	7 (41.2)	2 (33.3)	11 (37.9)
Daily occurrence	1 (16.7)	2 (11.8)	0	3 (10.3)
When it affects quality of life[e]	1 (16.7)	2 (11.8)	2 (33.3)	5 (17.2)
Other	0	0	0	0

[a] Values are given as number (percentage).
[b] Ob/Gyn: obstetrician, gynecologist, urogynecologist.
[c] Surgeon: colorectal surgeon, proctologist, general surgeon.
[d] Other: physiotherapist, theoretical scientist, gastroenterologist.
[e] This response was always given in combination with a response about frequency.

Table 5
Opinion of the responders regarding modification of the St Mark's score to evaluate frequency of fecal urgency episodes.[a]

	Ob/Gyn[b] (n = 36)	Surgeon[c] (n = 50)	Other[d] (n = 10)	Total (n = 96)
Agree	34 (94.4)	44 (88.0)	10 (100.0)	88 (91.7)
Disagree	2 (5.6)	6 (12.0)	0	8 (8.3)

[a] Values are given as number (percentage).
[b] Ob/Gyn: obstetrician, gynecologist, urogynecologist.
[c] Surgeon: colorectal surgeon, proctologist, general surgeon.
[d] Other: physiotherapist, theoretical scientist, gastroenterologist.

not consider themselves experts in the field, or did not have an interest in anal incontinence. The responses of those who did not use any system for anal incontinence severity evaluation were excluded from the analysis. This was because we hypothesized that most of the specialists who were surveyed and who did not respond, also did not use any scoring system for evaluation of the severity of anal incontinence.

The development and use of tools for the assessment of anal incontinence is in its infancy [22]. A simple and fast tool to assess the severity of anal incontinence, which could be combined with a more comprehensive questionnaire on quality of life, is still needed. The most frequently used tools (Wexner score and St Mark's score) fulfill these criteria; however, they do not take into account fecal urgency or they overemphasize its importance by ignoring its frequency. As the St Mark's score does not provide any options to score the frequency of fecal urgency, inconsistency and ambiguity exist among specialists regarding the frequency of episodes scored as 4 points in the scoring system.

In conclusion, the results of the present study confirm that although the Wexner score neglects fecal urgency, it is currently the most commonly used anal incontinence scoring system. In addition, most of the specialists dealing with anal incontinence in their clinical or scientific practice agreed that fecal urgency and its frequency should be considered when scoring anal incontinence severity.

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Conflict of interest

The authors have no conflicts of interest.

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