Summary

Mini-invasive surgical techniques are currently replacing the standard open techniques. The advantages of these techniques consist of minimal surgical stress (small surgical wounds, integrity of the rib cage, better wound healing, and shorter time spent on mechanical ventilation), quicker convalescence periods and a return to ordinary life.

The delicate and precise operating techniques in mini-invasive procedures require long-term preparation and training of the whole surgical team and a good visualization of the operation field with the aid of specialized surgical and optical instruments.

In cardiac surgical patients, selected surgical techniques are carried out via a thoracotomy incision, preferably with selective ventilation, i.e., “one lung ventilation” with a collapsed lung allowing for better visualization.

This method assures comfort to the operating surgeon, albeit this can lead to complications such as atelectasis and pneumonia. The administration of antibiotics minimizes the perioperative infection risk before every invasive cardiac procedure.

Interstitial microdialysis is the preferred method to ascertain if the administered prophylactic antibiotic penetrates the pulmonary tissue. Microdialysis is a mini-invasive method that monitors exogenic and endogenic molecules in the extracellular space.

In ten selectively ventilated pigs, we prophylactically administered the antibiotic cefuroxime (20 mg/kg) in one 30-minute infusion. For 240 minutes, via the microdialysis method, we monitored the antibiotic concentration in the interstitial fluid in the ventilated and non-ventilated lungs. Simultaneously, we took blood samples to measure the concentration of the given antibiotic in blood plasma.

Blood and lung microdialysate samples were analyzed by high-performance liquid chromatography with detection carried out in a tandem mass spectrometer. Pharmacokinetic characteristics were subsequently evaluated from antibiotic concentrations using non-compartmental and compartmental processes.

The transfer of cefuroxime from the plasma into the interstitial fluid (ISF) was lower in the non-ventilated lung than in the ventilated lung and thus indicative of a penetration factor of 47% compared with 63% ($p < 0.05$, the average value between the maximum concentration

(C_{max}, 65 %, $p < 0.05$) and the average value within the levels below the trace concentration-time (AUC, 78 %, $p = 0.12$). The time required to reach the minimal inhibitory concentration (MIC) was 30 – 40 % longer in the non-ventilated lung than in the ventilated lung. The MIC in both lungs took 10 - 40 minutes longer than in the plasma. The results of the values and the comparison of the mean residence time (MRT) of cefuroxime in the non-ventilated lung (109 min) which was greater than in the ventilated lung *(92 min)* which in turn was greater than in the plasma *(45 min),* helped to explain the absence of any significant differences in the duration of the time interval with the concentration of cefuroxime exceeding the MIC of the susceptible bacteria (≤ 4 mg/l) in the non-ventilated lungs (155 min), the ventilated lungs (160 min) and in the plasma (131 min).

The concentration of cefuroxime in the ISF in the non-ventilated pig lung was lower than in the ventilated lung. Also, the distribution of the antibiotics between the plasma and the ISF was slower. Regarding the pharmacokinetics of cefuroxime in the non-ventilated lung, it is justified to administer the first dose of cefuroxime before or in a higher concentration and to intensify the dosage for the intraoperative prophylaxis of pneumonia caused by pathogens with high MIC values.