Summary

The aim of the study was the application of new immunoassay procedures in the respiratory failure diagnosis in children based on aspirations. Risk of aspiration, especially in children of the lowest age group, is significantly higher than in those of the other age groups. In some cases, the aspiration may be a fatal incident as sudden infant death syndrome. Currently, there is no exact diagnosis, which would allow to distinguish, when the aspiration is the cause and when it is the result of the respiratory failure. The problem remains also a diagnosis of bacterial contamination during aspiration. This prevents rational deployment of antibiotic treatment.

The theoretical part deals with individual biomarkers and their potential contribution to the diagnosis of aspiration. In the current availability of multiplex analysis methodology biomarkers were selected and their dynamics in serum and tracheal aspirate in patients fulfilling the criteria have been analyzed. The biomarkers include cytokines (TNF-α, IL-6, BNP), adhesion molecules (ICAM-1, VCAM-1, fractalkine) and signal molecules (MMP9 and TIMP1).

The group included 15 patients aged under 18 years with lung failure requiring mechanical ventilation based on aspirations. The severity of the clinical condition of the patient was assessed according PRISM score, the severity of lung injury according to the LIS score. Mortality of patients in the study group was 13.3%. Examination of biomarkers was carried out by the multiplexed immunoassays on the device Magpix®. Blood and tracheal aspirate taking were carried out in 1, 24, and 48 hours after initiation of mechanical ventilation in all patients. Three groups of questions were determined for the study – the existence of a correlation between the dynamics of the concentration of analytes in plasma and tracheal aspirate, the statistical significance of the rise (fall) of biomarkers in serum and bronchoalveolar lavage fluid and the dependency of the biomarker dynamics on lung injury severity and the overall condition of the patient. The results were statistically evaluated using the nonparametric correlation coefficients and the Wilcoxon matched pairs test.

Measurement results have not shown a correlation between changes in concentrations of analytes and serum and tracheal aspirate. Statistically significant were changes in serum levels of TNF-α, MMP9, VCAM and TIMP1. For the first three of these markers, a significant decrease in serum levels occurred in 24 hours. In the following 24 hours, there was a statistically significant decrease only for VCAM. For markers in bronchoalveolar aspirate, there was a statistically significant decrease only for TIMP1 in the 24^{th} hour. In evaluating the relationship between changes in levels of individual markers and severity of a clinical condition and a degree of lung damage no statistical significance has been demonstrated.

Pathophysiology of aspiration has a different pathophysiologic mechanism. Lower serum levels of MMP9 are shown in the results than in patients with other types of respiratory failure. A substantial contribution to the diagnosis of aspiration could be a demonstration of high levels of MMP9 in the bronchoalveolar fluid. The measured values were significantly increased in the introduction of respiratory failure and are significantly greater than previously reported values. This result also explains the lack of increase of levels in the further course of treatment.

The results presented, especially the values of MMP9, could represent a promising step toward more accurate diagnosis of aspiration and it is appropriate to verify them in a larger cohort of patients. Conversely, we did not prove a correlation between the level of biomarkers and severity of lung

injury. The prediction of severity using multiplexed immunoassays remains open for further use in clinical practice.