Lung maturity assessment in neonatal gastric aspirate by biochemical and biophysical investigation

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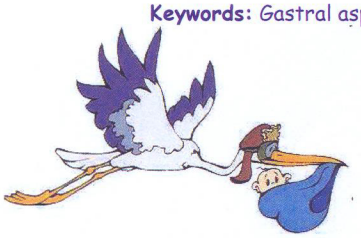
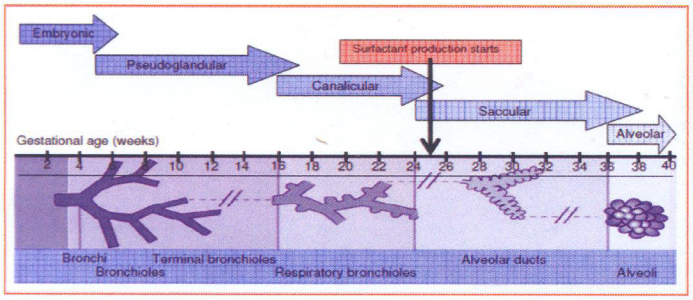
The **alveolar surfactant** in lungs is a lipoprotein complex, vitally necessary for the realization of the normal respiration. The main alveolar surfactant function *in vivo* is a reduction of alveolar surface tension (γ, mN/m) and maintaining the alveolar surface spread out during breathing, i.e. ensuring alveolar stability. The deficiency of "mature" alveolar surfactant in lungs is the main cause for development of **neonatal respiratory distress syndrome** (NRDS) .

The current approach to the infants with NRDS involves intubation and application of exogenous surfactant to substitute the surfactant deficiency. Therefore, for the assessment of the lung maturity of the premature newborns and the application of surfactant it is critically important to test the maturity of their alveolar surfactant at birth. With this regard we studied the surface properties of gastral aspirates (GA) from healthy full term infants and prematurely infants with NRDS to assess their surfactant maturity.

Keywords: Gastral aspirates, Neonatal respiratory distress syndrome, Pending drop method, Surface tension



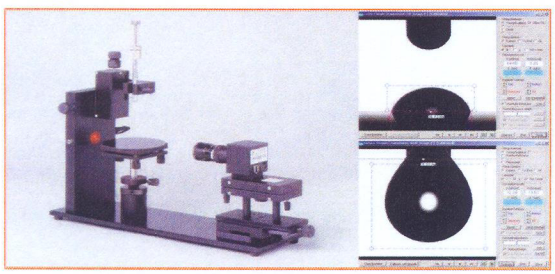
The aim of the present study was to estimate the lung surfactant maturity by analyzing biochemical and biophysical properties of gastric aspirates (GA) from infants with NRDS and healthy full term infants, and to find an approachable method for assessment of surfactant maturity at birth.



The study included forty-seven infants divided into two groups: 34 full-term healthy and 13 prematurely born infants developing clinical signs of NRDS and treated by assisted ventilation and exogenous surfactant. A biochemical analysis of the protein and lipid content of GA collected at birth was performed. The surface characteristics (equilibrium, maximal and minimal surface tension) were measured by the pending drop method.

1.The pending drop method allows the analysis of the surface behavior of small amounts (50μl) of the tested tracheal aspirates. A tensiometer KSV CAM 101 (KSV Instruments Ltd., Finland) was used for experimental Axisymmetric Drop Shape Analysis (ADSA).

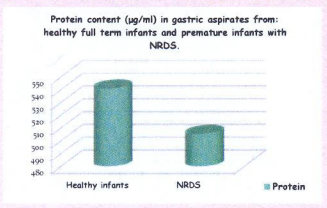
- Fifteen minutes were necessary after the formation of a symmetric drop for adsorption of surface-active molecules at the air-water interface and reaching an equilibrium value of the surface tension γ equilibrium (γ_{eq}, mN/m).
- After recording this value the drop was subjected to 10-fold compression and decompression, thus its surface changed 5 times, from 100% to 20%. In those dynamic conditions the following surface parameters were detected: maximal value of the surface tension at 100% drop surface (γ_{max}, mN/m) and minimal value of surface tension at 20% drop surface (γ_{min}, mN/m).

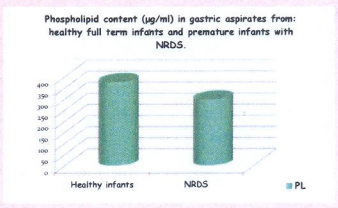


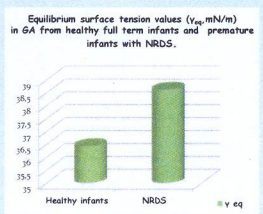
Tensiometer KSV CAM 101 (KSV Instruments Ltd., Finland)

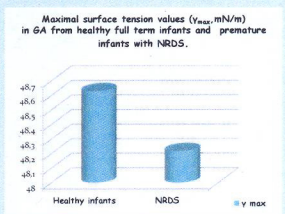
2.The biochemical analyses involve:

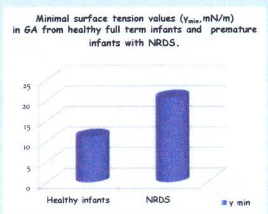
- Lowry protein assay for protein concentration determination
- Bligh & Dyer method for lipid extraction and Kahovkova & Odavic for phospholipids phosphorus determination











Conclusions: **Our findings revealed lower phospholipid and protein concentrations in GA from premature infants as compared to the healthy term infants. The dynamic surface characteristics of GA differed in the two groups, the minimal surface tension being the most important parameter for evaluation of surfactant maturity. Our results could find application into the clinical practice for fast surfactant maturity diagnostics in prematurely born children regarding lifesaving therapy with exogenous surfactants administration. However, further analyses of GA samples from newborn infants are needed to implement this method in the clinical practice.**

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