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IS THE MEASUREMENT OF STATIC COMPLIANCE DIFFERENT IN MECHANICAL AND SPONTANEOUS BREATHING?
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A recent report demonstrated that the values of dynamic compliance measured in mechanical breaths are lower than those evaluated in spontaneous ones (Mammel, Ped Pulmonol 8:222,1990). To evaluate the influence of mechanical and spontaneous ventilation on respiratory function values we measured and compared static compliance of the respiratory system (Crs) in these two different states, performing 44 studies in 33 stable intubated infants (age 3 days±1 SD, weight 2000 g±400 SD). All infants had acute or chronic lung disease, no sedation was given. We used the single breath occlusion technique and a computerized system (SensorMedics 2600); compliance measurements (at least 7 breaths) were performed during mechanical (CrsV) and spontaneous (CrsS) breaths (after a brief disconnection of the infant from the ventilator). In both situations the exalation is external to the ventilator circuit. The mean values of CrsV resulted 0.46±0.06 ml/cmH20/kg (mean coefficient of variation, cv: 9.35±3.8%, range 3.3-16%) and there was no significant difference (p=NS, paired t-test) from the values of CrsS (0.43±0.07 ml/cmH20/kg, cv: 9.85±3.5%, range 4-17%). Assuming that the lung is on the same part of the pressure-volume curve, we conclude that measuring static compliance by the single breath occlusion technique is not necessary to obtain measurements performed both during mechanical and spontaneous breaths as suggested for dynamic compliance.

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EFFECT OF INTRATRACHEAL INSTALLATION OF SURFACTANT ON LUNG FUNCTION AND FUNCTIONAL RESIDUAL CAPACITY (FRC) IN PREMATURE INFANTS WITH RESPIRATORY DISTRESS SYNDROME (RDS). Teresa Farstad, Dag Bratlid. Neonatal Research Laboratory, Department of Pediatrics, Rikshospitalet, University Hospital, University of Oslo, Norway.

To understand the mechanism behind improved oxygenation after surfactant in infants with RDS we analysed changes in lung compliance (C_L, ml/cmH_2O), lung resistance (R_L, cmH_2O/l/s/cm), overdistention (C_{20}/C_L), FRC (ml) and oxygen need (FiO_2). Data were collected serially in nine infants (Curosurf^R two, Exosurf^R seven)(BW: 1389 ± 540 g) prior to and post surfactant treatment. Lung mechanics were determined by a differential pressure transducer and pneumotachography (PEDS^R). FRC was measured by a helium dilution technique (PANDA^R) with correction for gas leakage. Ventilator settings (except FiO_2) were if possible kept constant during the study. (Data given as mean±SEM).

	FiO_2	FRC	C_L/kg	C_{20}/C_L	R/cm
PRIOR	.80±.04	9.6±2.4	.269±.09	.912±.08	119±23
POST	.62±.05*	15.8±2.4*	.260±.05	.825±.02	88±11

(*p<0.05, t-test)

Surfactant significantly increases FRC, while lung compliance and resistance (during mechanical breath) do not improve. The improved oxygenation after surfactant treatment is probably related to increased lung volume.

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EFFECTS OF DEXAMETHASONE (DXM) ON CHEMOTACTIC ACTIVITY AND INFLAMMATORY INDICATORS IN TRACHEAL ASPIRATES OF PRETERM INFANTS AT RISK FOR CHRONIC LUNG DISEASE(CLD).
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To evaluate the effect of Dxm on the inflammatory process in the early phase of CLD (postnatal age 10-16 days), tracheal aspirate fluid (TAF) from 16 preterm infants (BW 891 ± 46 gms, GA 27.1 ± 0.4 wks, mean ± SEM) was assessed for chemotactic activity and indicators of inflammation. After Dxm therapy chemotactic response of blood neutrophils exposed to TAF decreased (migratory distance before Dxm 150 ±10µm,after Dxm 91 ±11µm,p<0.001); additionally the influx of TAF-neutrophils was reduced (before Dxm 492 ±165 cells/µl effluent,after Dxm 77 ±22, p<0.01) Elastase-alpha-1-Proteinaseinhibitor(a-1-PI)-complex decreased after treatment (before Dxm 534 ± 154, after Dxm 65 ±18 ng /ml,p<0.01).Before Dxm,free elastolytic activity was only present in one infant, 15/16 had a protective activity of a-1-PI.Concentrations of albumine were lower after Dxm(before Dxm 29 ±6,after Dxm 7 ±1 mg/dl ,p<0.001), Interleukin-1 similary decreased.The reported effects could not be observed in untreated control infants (n=8). We conclude that Dxm reduces the pulmonary inflammatory reaction of preterm infants during the early phase of CLD

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FRACTAL DIMENSION OF AIRSPACES OF PRETERM RABBIT LUNGS.
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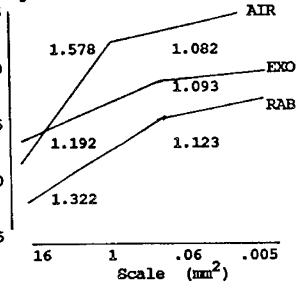
The fractal dimension (D_f), defined as the ratio of the variability of a measured quantity to the scale over which the quantity is measured, describes its self-similarity and spatial heterogeneity I computed D_f of the airspaces in the lungs of rabbits (27d gest.) treated with air, Exosurf (EXO), or rabbit (RAB) surfactant (n=4 each). The left lung was video imaged at 40X in situ through a window cut in the chest wall. Images were captured at end-insp. during ventilation (PIP/PEEP=25/0 cmH_2O). Contrast was enhanced so that air was white on a black field. The coeff. of variability (COV) of white pixels was computed for successively smaller parts of the image from 16 to 0.005mm^2. Log COV was plotted vs. the scale to obtain D_f values (slope of plot). D_f was dependent on the scale of measurement: without surfactant only larger airways were seen on a scale of 1.5mm^2. D_f significantly decreased above an anatomic scale of 0.05mm^2- approximately the size of the unit saccules. D_f was greater for RAB than for EXO over both ranges, indicating a more complex surfactant distribution and structure in the saccules. D_f quantifies the heterogeneity of surfactant-lung interaction.



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HOW EFFICIENT ARE NEONATAL HEAT MOISTURE EXCHANGERS (HME).
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In 1988 a heat moisture exchanger (HME) was introduced for neonatal use. We tested this in the laboratory for efficiency of heat and moisture retention at typical neonatal ventilator settings.

Methods: A manifold was built which contained the HME with either side, a thermistor, pressure transducer and relative humidity (RH) sensor. All six probes were connected to a computerised monitoring system that continuously displayed the variables.

Results: The HME increased the dead space of the circuit by 1.2 mls. 1 hour experiments showed a temperature gradient of 4°C and a RH gradient of 90% with no significant alteration at flow rates between 2-10 L/min. There was no pressure gradient and the airway pressure rise time did not increase when the HME was present. 16 hour experiments showed no significant water loss from the water saturated artificial lung used in the tests.

Conclusion: The HME is highly efficient in this system and would be useful at least in situations where infants are ventilated with unhumidified gas (eg. transportation).

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EXOSURF VERSUS CUROSURF; COMPARISON OF SURFACE PROPERTIES, RESISTANCE TO INHIBITION, AND PHYSIOLOGICAL EFFECTS IN PRETERM RABBITS.
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Exosurf^R (Wellcome) and Curosurf^R (Chiesi) are two widely used exogenous surfactants. We compared their physical and physiological properties by image analysis of microbubble stability in surfactant suspensions (1 mg/ml), mixed with various concentrations of albumin (0-40 mg/ml), and by evaluating lung structure and function in ventilated immature newborn rabbits receiving clinical treatment doses of either surfactant (Exosurf, 67.5 mg/kg; Curosurf, 160 mg/kg).

Results: Bubbles in Curosurf were significantly smaller than those in Exosurf (diameter, mean±SEM: 19±2 vs. 106±19 µm;P <0.001). Both surfactants were inhibited by albumin ≥2 mg/ml, as reflected by in- creasing microbubble diameter, but Curosurf bubbles remained smaller than Exosurf bubbles at albumin concentrations ≤4 mg/ml. Lung-thorax compliance after 1 h was significantly greater in Curosurf-treated animals (mean±SEM: 0.62±0.05 ml/cmH2O.kg) than in littermates receiving Exosurf (0.45±0.01) or controls (0.44±0.06)(P <0.05). Airway epithelium of Curosurf-treated animals was mostly intact, whereas Exosurf-treated and control animals had widespread epithelial injury.

Conclusions: Curosurf stabilizes microbubbles better than Exosurf, even in the presence of low concentrations of albumin. Curosurf is more effective than Exosurf when given in clinical treatment doses to ventilated immature rabbits.