

Comparison of MRI fetal lung volume in normal and diseased fetuses.

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Introduction: The accurate evaluation of fetal lung volume and the detection of impaired lung growth and thoracic disorder or disease in utero is important in perinatal management. The usefulness of MRI has been previously suggested (1-2,3). The purpose of our study was 1: To establish an accurate curve of the normal fetal lung volume against gestational age, for normative reference. 2: To compare the lung volume of diseased fetuses to normals and to study the possible correlation between abnormal lung volume and survival rate.

Materials and methods: Between January 96 and December 98, 111 fetuses (gestational age: 21-38 weeks) referred for brain MRI because of suspected pathology (US, pregnancy at risk) underwent a complementary T2-weighted TurboSpinEcho (TSE) imaging of the lungs. 93 fetuses had no thoraco-abdominal abnormalities at MRI/US and after birth (follow-up, when relevant); all of them had biometry in-between percentiles 5 and 95. Among the 18 remaining fetuses, 5 had diaphragmatic hernia and 1 diaphragmatic eventration, 6 had intrauterine growth retardation, 3 had adenomatoid cyst malformation, 1 bronchogenic cyst, 1 sequestre, 1 severe lung malformation. This prospective multicentric study was performed at 1.5T with an abdominal synergy coil or a body coil (Gyrosan ACS NT, Philips, Netherlands or Signa, General Electrics, Milwaukee, USA). The TSE T2-weighted acquisitions consisted of 12-20 slices of 5-3 mm thickness, oriented at least in one of TRV, COR, SAG planes to the lungs. Images were acquired in 23-35 seconds without triggering with TR=5900 ms or 9600 ms, TE=140 ms, ETL=47, 70% halfscan, spatial resolution of 1.2 x 1.5 mm). The fetal lung volume was computed from the area of electronics IROIs following the lung boundaries and drawn on consecutive images, multiplied by the slice thickness. In each patient, the slice orientation corresponding to the best image quality was chosen for this measurement.

Results: Our results are given in figure 1. The measurements of normal fetal lung volume ranged from 20 ml to 150 ml and increased with gestational age, as did the spread of the values, as observed in preliminary MR studies (1,2) and in pathologic studies (4). The normal mean value and standard deviations are given for five age classes of equal range. Three fetuses with diaphragmatic hernia and one fetus with severe intrauterine growth retardation with a lung volume smaller than 20 ml died. MRI defined accurately the localization and extension of diaphragmatic defects and the content of the hernia. One case of diaphragmatic eventration was differentiated from herniation on MR images, which is of importance for subsequent surgery.

Conclusions: The measured lung volume that were below the standard deviation of normals, may be considered at great risk for pulmonary hypoplasia. Lung volume below 20 ml at third trimester seems to be a predictor of poor neonatal outcome.

References:

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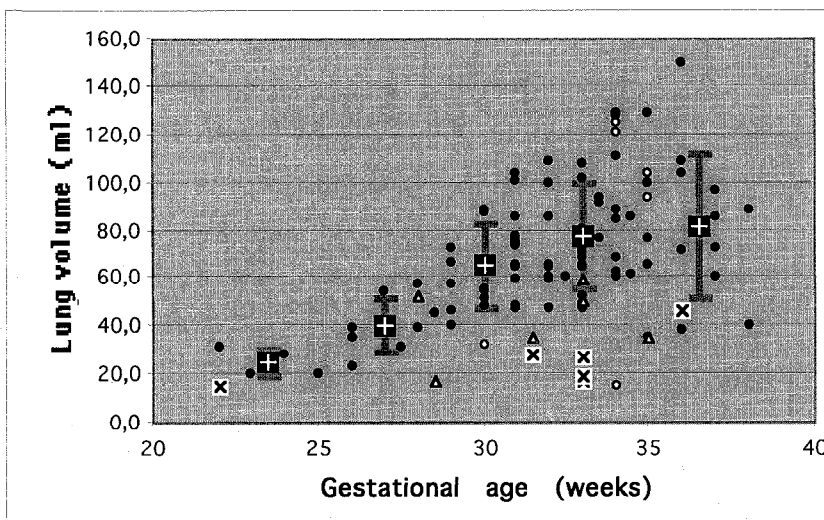


Figure 1: Fetal lung volume vs gestational age: Black dots: normals, white crosses: normal mean values; black x-crosses diaphragmatic hernia; open triangle: intrauterine growth retardation; open circle: other thoracic pathologies.