ROLE OF MAGNETIC RESONANCE IMAGING IN EVALUATION OF NON-CENTRAL NERVOUS SYSTEM FETAL ANOMALIES

Essay

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List of abbreviations

3D	: Three Dimension
CDH	: Congenital Diaphragmatic Hernia
FLASH	: Fast Low Angle Shot
FOV	: Field Of View.
GER	: General Electric
GI	: Gastro Intestinal.
HASTE	: Half Fourier Acquisition Turbo Spine Echo
IVC	: Inferior Vena Cava.
RARE	: Rapid Acceleration With Relaxation Enhancement
SSFSE	: Single Shot Fast Spine Echo
TE	: Time Echo
TR	: Time Repetition.
US	: Ultra Sound

INTRODUCTION

Sonography is the primary technique for fetal imaging because of its proven utility, widespread, availability, and relatively low cost. However, limitations included a small field of view, limited soft-tissue contrast, beam attenuation by adipose tissue and poor image quality in oligohydraminos ***(Garel et al., 1998)***.

Accordinaly, sonograhpic findings are occasionally inconclusive or insufficient to guide treatment choices ***(Sonigo et al., 1998)***.

Over the past decade, fetal MRI has emerged as a clinically useful supplement to sonography and is rapidly moving from the realm of select academic medical centers into community practice. Advances in fetal medicine and surgery have also driven the development of fetal MRI ***(Coakley et al., 2001)***.

Fetal MRI has been increasingly used as an adjunct to sonography to provide secondary information regarding fetal anatomy, which may alter the antenatal diagnosis and management of the pregnancy ***(Zaretsky et al., 2003)***.

It is particularly useful in evaluating the anatomic details of complex anomalies. The additional information beyond that

obtained on fetal sonography can be useful for prenatal counseling, planning for delivery and planning for prenatal or postnatal intervention ***(Cassrt et al., 2004)***.

The use of ultrafast scanning technique, such as single-shot fast spin-echo and HASTE sequences has allowed excellent resolution of fetal anatomy by reducing motion artifact ***(Kubik- Huch et al., 2000)***.

Accordingly, accurate diagnosis of a fetal anomaly by MRI has the potential to improve parental counseling regarding prognosis and treatment options, assist clinicians with fetal postnatal management decisions and plan for delivery at an appropriate center for treating the diagnosed anomaly ***(Richard et al., 2007)***.

AIM OF THE WORK

The objectives of this study are to evaluate the contribution of using MRI findings when assessing fetal neck, pulmonary, genitourinary, and abdominal anomalies, to determine how this procedure may affect the management of pregnancy.

NORMAL ANATOMY OF RELEVANT NON-CNS FETAL ANOMALIES.

Fetal lung

The lungs are described as having costal, mediastinal, apical and diaphragmatic surfaces. The right lung has three lobes and the left has two, with the lingual of the left upper lobe corresponding to the right middle lobe.

One terminal bronchiole with lung tissue forms an acinus which, together with vessels, lymphatic and nerves, forms the primary lobule. Three to five primary lobules form a secondary lobule ***(Shinmoto et al., 2000)***

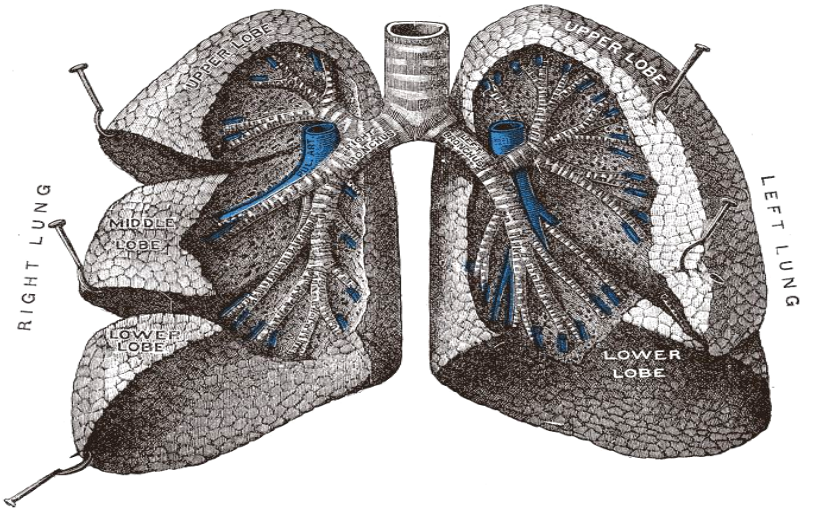

Figure (1): Normal lung anatomy
(Gray's anatomy at Bartley web site 2005),

Lung maturation and MRI anatomy

An important determinate of postnatal survival is the extent of lung development. The bronchi and bronchioles are developed by 16 to 20 weeks of gestational age with the appearance of a significant number of alveolar ducts and blood vessels by 24 weeks of gestation. The normal fetal lung is homogenous and has a moderately high signal intensity of T2 weighted images. With maturation of the lungs, the signal intensity of the lungs increases with increasing production of alveolar fluid ***(Fig 2) (Hubbard et al., 2002)***.

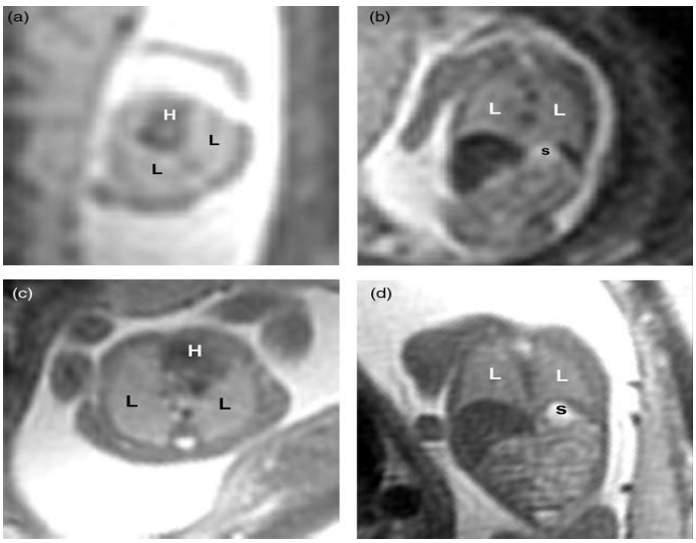

Figure (2): Normal lungs in early- to midsecond trimester. Axial and coronal T_2-weighted images at 14 (a and b) and 18 (c and d) weeks gestational age show the lungs (L) and the heart (H). The pulmonary vasculature is difficult to assess at these early gestational ages. ***(Hubbard et al., 2002)***

Lung volume changes

Standards for normal lung volumes have been reported by MRI. With echo planar imaging showed exponential growth of the lungs with increasing gestational age. Another larger study using fast spin-echo T2 Weighted images showed that the normal fetal lung volume increased with age. There was constant relation between size of the right and left lungs throughout gestation, the volumes of normal lungs on MRI were 10 % less than volumes obtained on pathologic specimen. Other MR- related changes associated with increasing gestational age and maturation of the lungs are a progressive decrease in T1signal and an increase in T2signal. ***(Shinmoto et al., 2000)***.

MR appearance of fetal lung

The fetal lung as seen by MRI has a quite distinct appearance. The characteristic shape facilitates its location, and where T2W sequences are employed has high signal intensity. This distinguishes the lungs from central low intensity area representing the fetal heart. Maturation of the lung commences around 24 weeks gestation ***(Rypens et al., 2001)***.

As the lung develops there is increase in water content and a rise in the phospholipids concentrations that relate to surfactant production**.** This would result in a shortening of both the T1 and T2 relaxation times of the lung tissue.