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Fetal lung hyperechogenicity: prenatal ultrasonographic diagnosis, natural history and neonatal outcome

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ABSTRACT

The ultrasonographic appearance of fetal lung hyperechogenicity is most commonly associated with congenital bronchopulmonary abnormalities, such as cystic adenomatoid malformation or pulmonary lobar sequestration. Spontaneous disappearance of echogenic lung lesions has rarely been reported, mainly due to in utero *resolution of cystic adenomatoid malformation. We describe four fetuses with echogenic lungs detected prenatally, none of them having been proved to have adenomatoid malformation or pulmonary sequestration of the lungs. Color Doppler sonography was used prenatally in all cases to rule out pulmonary sequestration. Three of the four fetuses showed complete resolution of the lung lesions during gestation, with normal neonatal outcome, but in one where the lesion decreased in size, intrauterine demise occurred at 28 weeks' gestation before complete resolution, and pneumonia was found at autopsy. We suggest that fetal lung hyperechogenicity may result from* in utero *bronchial tree obstruction with retention of mucoid fluid distal to the obstruction. With advancing gestation, in some cases the relative obstruction may be relieved, and the sonographic appearance of the lungs may return to normal. A retention of mucus in the bronchial tree should be added to the differential diagnosis of hyperechogenic lung lesions detected by antenatal ultrasound examination.*

INTRODUCTION

Prenatal detection of echodense pulmonary lesions is considered an ominous finding, due to the possibility of underlying pathology, such as cystic adenomatoid malformation (type III), lung sequestration and atelectasis secondary to bronchial atresia[1]. The overall prognosis for a fetus with an echogenic lung mass depends on the size of the mass, its effect on the lungs and predominantly its pathological type. A large bulky mass can cause mediastinal shift, pulmonary hypoplasia, polyhydramnios and cardiovascular compromise, leading to fetal hydrops and death[2]. Because of the expected poor outcome, various *in utero* therapeutic measures, including placement of cystoamniotic shunts and even open fetal surgery, have been performed[3]. On the other hand, the natural history of echogenic lung lesions is obscure, and a number of reports have described the *in utero* disappearance of such lesions[4–8]. These observations on changes in the *in utero* sonographic appearance of echogenic lung masses, even up to complete resolution, challenge the counselling physician to establish an accurate diagnosis and predict the prognosis on the basis of lesion type[5].

The aims of the present study were to report on a series of fetuses with prenatally diagnosed hyperechogenic lungs, and to examine the association between these prenatal findings and prognosis at birth.

METHODS

Cases of echogenic lung lesions were collected from records of antenatal ultrasonographic screening performed over a 2-year period at The Chaim Sheba Medical Center, Tel Hashomer. Sonograms were performed with high-resolution real-time scanners (Elscint ESI 3000, Haifa, Israel; Acuson-128 XP10, Mountain View, California). Four fetuses were identified with prenatal sonographic documentation of hyperechogenic lungs and adequate postnatal follow-up. In each case, a series of initial and follow-up obstetric sonograms were available. Color Doppler ultrasound examination was performed to assess the blood flow to the echogenic lesion. A complete anomaly survey of other fetal organs was performed on each fetus. Specific lung observations included the location, size and appearance of the lesion,

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and the absence or presence of mediastinal shift. In all cases, a detailed investigation for possible *in utero* infection was performed, in particular maternal serological tests for toxoplasma, rubella, cytomegalovirus and herpes (TORCH). Pregnancy outcome was assessed, including birth weight, gestational age, Apgar score, cord blood pH and neonatal mortality and morbidity. Chest radiographs were performed on all newborns, and a long-term follow-up was available.

RESULTS

All fetuses were scanned routinely at mid-gestation to exclude congenital malformation. The earliest gestational age of sonographic diagnosis was 17 weeks (Table 1). Over 5000 routine fetal scans were performed during the above period at the Obstetric Ultrasonographic Unit. All cases were diagnosed by a single observer (R.A.), who scanned only a fraction of the patients, and therefore the true incidence of echogenic white lung lesions unfortunately cannot be calculated. Similarly, the false-negative rate was also impossible to ascertain. In three fetuses, the echogenic lesion occupied the lower and middle lobe of the right lung (Figure 1), and in one fetus only the lower lobe of the right lung was involved. In all cases, biochemical screening by the triple markers was found to be normal. Neither mediastinal shift or fluid accumulation, nor additional malformations, were observed on thorough anatomical survey, including fetal echocardiography. Color Doppler flow imaging failed to demonstrate any feeding systemic artery to the lung lesion (Figure 2). All cases had a negative TORCH investigation. In three cases, disappearance of the lesions was confirmed at 28 weeks of gestation. All three infants had normal-term spontaneous delivery with Apgar scores of 9 and 10 at 1 and 5 min, respectively. Negative chest radiograph and normal follow-up to the age of 18 months was found in these cases. In case number 4, following decreased size of the lesion, intrauterine demise occurred at 28 weeks' gestation. A female stillborn weighing 1200 g was delivered. No macroscopic anomalies were noted. However, histological examination of the fetal lungs revealed pneumonia, with mucoid fluid retention in the air spaces. A large retroplacental hematoma was found, compatible with placental infarction.

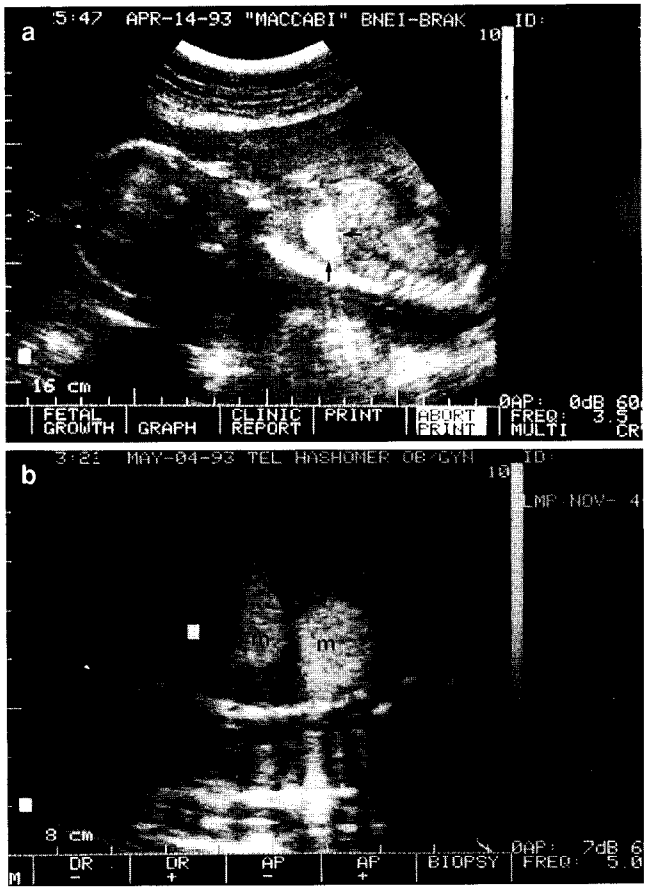

Figure 1 Prenatal ultrasound scan at 21 weeks' gestation of longitudinal section through fetal thorax (a). Note hyperechogenicity at the right lower lobe (arrows). Oblique transverse scan (b) in another case shows two echogenic masses (m) occupying the lower and middle lobe of the right lung

DISCUSSION

When a hyperechogenic lesion is identified within the fetal chest, a number of pathologies should be considered in the differential diagnosis. Cystic adenomatoid malformation, pulmonary sequestration and upper airway obstruction are the most likely[6]. Although a large pulmonary lesion diagnosed *in utero* might seem to be an ominous finding, the natural history of prenatally diagnosed lung lesions is variable. Some fetuses will develop non-immune hydrops fetalis, whereas in others the lesion

Table 1 Summary of four fetal case histories with lung hyperechogenicity

Case number	*Maternal age* (years)	*Gestational age at scan* (weeks)	*Location of lesion*	*Color Doppler finding*	*Follow-up finding*	*Postnatal finding*
1	24	17	middle and lower right lobes	no evidence of systemic supply	resolved at 24 weeks	normal radiogram
2	30	20	middle and lower right lobes	no evidence of systemic supply	resolved at 26 weeks	normal radiogram
3	26	21	middle and lower right lobes	no evidence of systemic supply	resolved at 25 weeks	normal radiogram
4	25	20	lower right lobe	no evidence of systemic supply	decreased	IUFD* at 28 weeks

IUFD, intrauterine fetal death; *, autopsy revealed pneumonia and distended air spaces with retained mucoid lung secretions

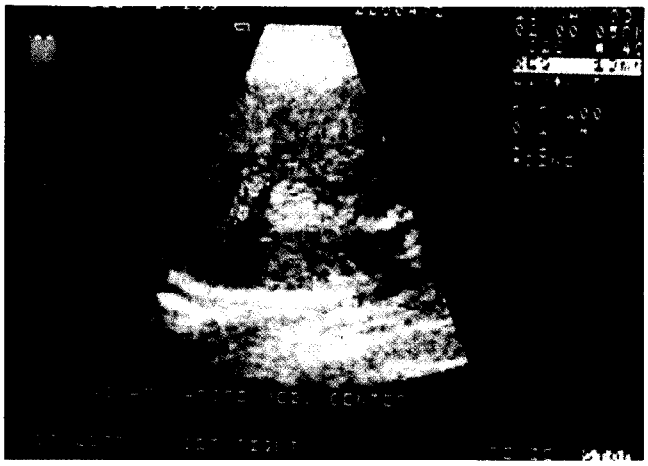

Figure 2 Color Doppler study failed to show a supplying artery of the mass which helped to rule out the diagnosis of lung sequestration

may disappear *in utero*[4]. Spontaneous improvement of intrathoracic masses diagnosed *in utero* has been attributed to shrinkage of echodense lung lesions arising from congenital cystic adenomatoid malformation or pulmonary sequestration[7]. However, the disappearance of hyperechogenic lungs unrelated to congenital cystic adenomatoid malformations or pulmonary sequestration in otherwise normal fetuses has, to the best of our knowledge, been reported only once in the English literature[8].

Since all the masses that disappeared in our series and in that reported by Sands and Lilford[8] resulted in the birth of normal infants without a histological examination to explain the ultrasonographic findings, we can only postulate on their origin. The hyperechogenic appearance of the fetal lung on ultrasonography is due to the large number of tissue–fluid interfaces. There is a possibility that stenosis along the bronchial tree secondary to a mucus plug with retention of mucoid lung secretion distal to the obstruction may create an echogenic sonographic appearance indistinguishable from congenital cystic adenomatoid malformation or pulmonary sequestration[9]. The appearance of echogenic lung distal to different sites of obstruction in the tracheobroncheal tree has been reported previously in cases with upper airway obstruction, such as laryngeal and main-stem bronchial atresia[9,10]. In our fourth case, pneumonia and distended air spaces found at autopsy reinforced the view that echogenic lungs may result from mucoid fluid retention within the bronchial tree. Furthermore, Choong and colleagues[11], in an *in utero* fetal lung biopsy, showed hyperechogenicity and distension of air spaces by lung secretions. This histological finding was erroneously interpreted as cystic adenomatoid malformation in a fetus with unrecognized laryngeal obstruction. It can be hypothesized that, in some cases with advancing gestation, the relative obstruction or the mucous plug may be relieved, and the appearance of the echogenic lung thereby may improve[12]. The observation that hyperechogenic lungs may be a transient benign phenomenon has immediate practical importance for prenatal counselling.

With the widespread use of prenatal sonographic examinations performed by current high-resolution equipment, small lung lesions previously unrecognized will become more evident during early stages of gestation. As our knowledge increases regarding the natural course of these findings, we should not overestimate the significance of minor abnormalities with a good prognosis that would otherwise have gone undetected. Therefore, parents should be told that the appearance of echogenic areas detected in the fetal chest at routine ultrasound examination is not necessarily associated with poor prognosis, and is not an indication for immediate neonatal surgery. Moreover, in some cases with no other anomalies, mediastinal shift, placentomegaly, polyhydramnios, or hydrops, there is a reasonable chance of spontaneous resolution with good neonatal outcome. In every case, prenatal investigation should include maternal serological status, thorough anatomical ultrasonographic survey and color Doppler examination to rule out feeding vessels.

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