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The Correlation of Ultrasound and Magnetic Resonance Imaging in the Thoracic Anomalies: Case Series

Talat Umut Kutlu Dilek[1], Arzu Doruk[1], Sevgül Köse[2], Filiz Çayan[1], Saffet Dilek[1]

[1]*Mersin Üniversitesi Tıp Fakültesi, Kadın Hastalıkları ve Doğum Anabilim Dalı, Mersin, TR*
[2]*Mersin Üniversitesi Tıp Fakültesi, Radyodiagnostik Anabilim Dalı, Mersin, TR*

Abstract

Objective: To discuss, the correlation of ultrasound and magnetic resonance imaging (MRI) for the differantial diagnosis of pulmonary anomalies.

Case: Two cases of pulmonary anomalies including congenital cystic adenomatoid malformation, bronchopulmonary sequestration and one case of congenital diaphragmatic hernia which diagnosed at 2nd trimester ultrasound were evaluated by MRI.

Conclusion: Differantial diagnosis of bronchopulmonary sequestration and congenital cystic adenomatoid malformation could be done succesfully by MRG. Also, mediastinal shift and pulmonary hypoplasia due to diaphragmatic hernia could be evaluated correctly.

Keywords: Ultrasound, magnetic resonance imaging, bronchopulmonary sequestration, congenital diaphragma hernia, congenital cystic adenomatoid malformation.

Fetal toraks anomalilerinde ultrasonografi ve manyetik rezonans görüntülemenin korelasyonu: olgu serisi

Amaç: Pulmoner anomalilerin ayırıcı tanısında manyetik rezonans görüntüleme (MRG) ve ultrasonografi korelasyonunu tartışmak.

Olgu: İkinci trimesterde ultrasonografisinde tanı alan, Konjenital kistik adenomatoid malformasyon ve bronkopulmoner sekestrasyon olan 2 pulmoner anomali vakası ve konjenital diafragmatik herni olgusu MRG ile değerlendirilmiştir.

Sonuç: Bronkopulmoner sekestrasyon ve konjenital kistik adenomatoid malformasyon arasındaki ayırıcı tanı MRG ile başarılı bir şekilde yapılabilir. Buna ek olarak diyafragmatik herniye bağlı mediastinal şift ve akciğer hipoplazisi doğru olarak değerlendirilebilir.

Anahtar Sözcükler: Ultrasonografi, manyetik rezonans görüntüleme, bronkopulmoner sekestrasyon, konjenital diyafragma hernisi, konjenital kistik adenomatoid malformasyon.

Introduction

By the inclusion of ultrasonography into antenatal follow-up for the last three decades, it has become possible to do prenatal early diagnosis of many pulmonary and thoracic congenital anomalies. Within this group, there are congenital cystic adnomatoid malformation, pulmonary sequestration and bronchogenic cysts. Another anomaly which can be added into this group is the congenital diaphragm hernia which may lead to serious decrease in pulmonary volumes that is not actually caused by lung and airways. Early diagnosis of these lesions provides obstetricians following cases to move coordinately with pediatric surgery

Correspondence: Talat Umut Kutlu Dilek, Mersin Üniversitesi Tıp Fakültesi, Kadın Hastalıkları ve Doğum Anabilim Dalı, Mersin
e-mail: umutdilek@gmail.com

team by detecting patients who may need transfer to appropriate centers when required or newborn care and surgery at postnatal early period.[1] It is possible to diagnose and follow up most of these cases by ultrasonography. However, magnetic resonance imaging (MRI) can be used when differential diagnosis cannot be performed or details of changes in anatomy cannot be presented. Within last decade, latest developments in MRI technology such as obtaining faster cross sections, decreasing the effect of fetal movements in this way, getting clearer images has helped MRI to be in especially diagnosis and differential diagnosis of central nervous system anomalies.[2,3] In this article, we aimed to report ultrasonography and MRI correlation in thoracic anomalies.

Cases

Case 1

Twenty-two years old case with gravida 2 and para 1 was referred to our center by the pre-diagnosis of thoracic cystic mass on her 25th gestational week. The patient had a history of spontaneous term vaginal delivery without any characteristic in her medical background. In her ultrasonography, single alive fetus complied with 25th gestational week was observed. During the same evaluation, it was observed that stomach and duodenum were herniated to left hemithorax due to left hemidiaphragm defect, mediastinum was pushed rightward and herniated organs were on the posterior of heart. No additional structural anomaly was detected in ultrasonography, amniotic fluid index was normal (Fig. 1). Diaphragm contours on the left were not seen in the obstetric MR examination of the patient clearly and stomach was observed as supradiaphragmatically (Fig. 2). The case was observed with these findings up to 39th gestational week and she delivered a boy with 8/9 apgar score and 2760g of weight by cesarean. In the postoperative period, the patient confirmed for left diaphragm hernia diagnosis was operated at postnatal 2nd day and the defect on her left diaphragm was fixed primarily. Two-month and 20 day old baby continued to live without any problem.

Figure 1. Mediastinal shift caused by stomach herniated to left hemithorax, and heart observed on right hemithorax.

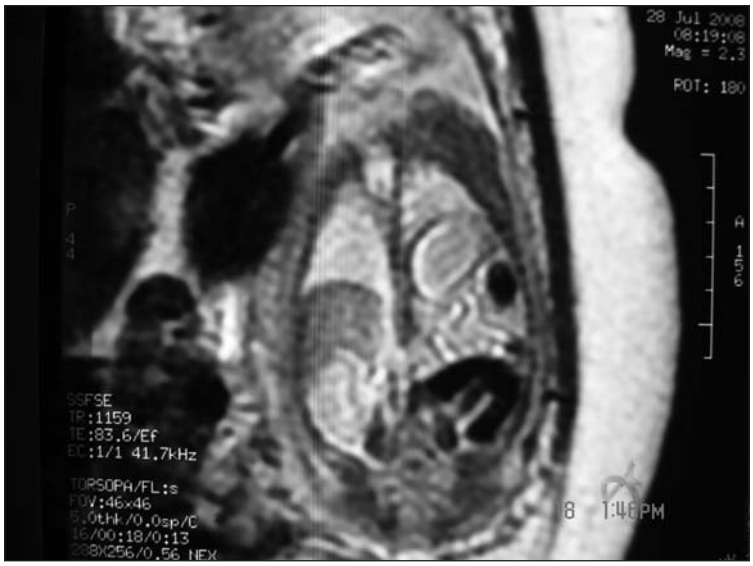

Figure 2. In T2 weighted coronal section, it is observed that the volume of left lung decreases and there is an area just on the inferior of lung parenchyma conforming to stomach.

Case 2

Twenty-one years-old case with primigravida applied to our polyclinic for routine pregnancy follow-up. Biochemical scanning test of patient at second trimester was reported as low risky, and it was observed at the ultrasonographic examination of the patient performed at 22nd gestational week that there were slight rightward push in heart and well-confined formation at left lung posterobasal and left lung hyperechogenic with 35x26 mm dimensions (Fig. 3). In the power Doppler examination per-

Figure 3. Well-confined formation causing hyperechogenic in left lung posterobasal and rightward push in heart.

Figure 4. It is observed in power doppler scanning that the bleeding of sequestrum segment is received from aorta.

formed, it was observed that arterial bleeding was received from aorta (Fig. 4). In the obstetric MR evaluation of the patient, the structure observed more intensely as to adjacent lung parenchyma in T2 weighted sections was evaluated as pulmonary sequestration (Fig. 5). The patient whose pregnancy follow-ups continued without any problem applied to initiate delivery while she was pregnant for 40 weeks and 4 days. A boy with 9/10 apgar score and 3190g weight was delivered by normal spontaneous vaginal delivery. It was observed in the thorax

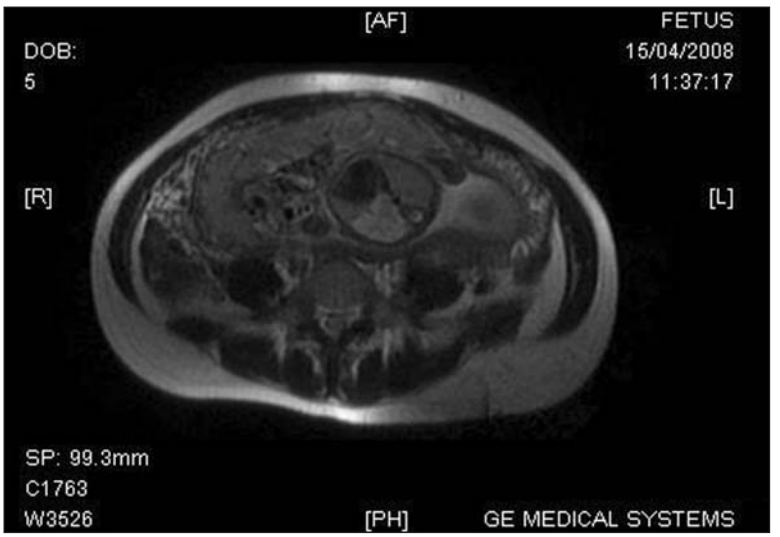

Figure 5. In T2 weighted axial images, homogenous triangular solid lesion with approximately 1.5-2 cm diameter on inferior lobe of left lung is observed which has higher signal intensity than normal lung parenchyma.

computerized tomography scanning in postnatal period that the lesion was regressed.

Case 3

A twenty-six years-old patient with gravida 2, para 1 and living 1 applied to our clinic for a routine pregnant follow-up at 17th gestational week. Biochemical scanning test of the patient at 2nd trimester was reported as low risky. In the anatomical scanning, 2.54 cm^3 mass lesion with 20x12x18 mm dimension was observed which was including some cystic and solid areas on right lung posterobasal and not causing a push towards mediastinum (Figs. 6 and 7). In the

Figure 6. 2.54 cm^3 mass lesion with 20x12x18 mm dimension including some cystic and solid areas on right lung posterobasal.

Figure 7. No push is observed on mass dependent mediastinum.

Figure 8. In T2 weighted coronal section, multiple cystic area is observed with hyperintense signal which settled on right lung posterobasal.

obstetric MR examination done by these findings, mass lesion formed of multiple cysts observed as hyperintense in T2 weighted sections were found in right lung basal (Figs. 8 and

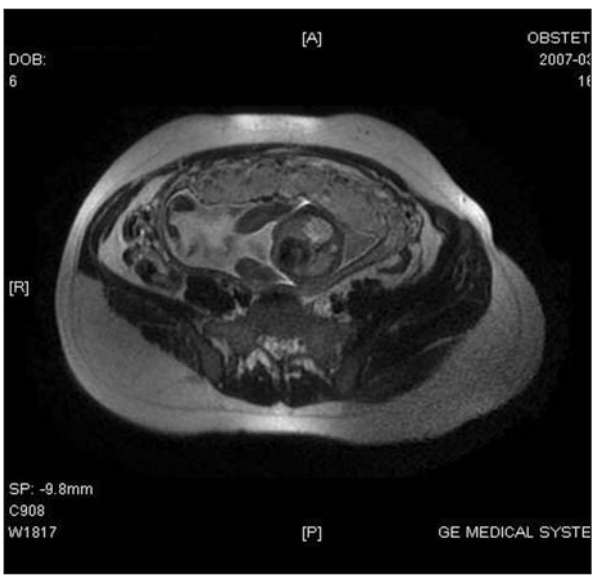

Figure 9. In T2 weighted axial section, multiple cystic area is observed with hyperintense signal which settled on right lung posterobasal.

9). By these findings, amniosynthesis was applied as an invasive prenatal diagnosis test. Routine pregnancy follow-up of the patient was maintained after karyotype outcome was reported as 46 XX. In the evaluations performed in following gestational weeks, it was observed that there was no increase in dimensions and volumes of the lesion. The patient was taken into cesarean since she had a previous cesarean history while she was pregnant for 38 weeks and 5 days, and a 3620g girl with 8/9 apgar score was delivered alive. It was seen in the thorax computerized tomography evaluated in the postnatal period that the dimensions of lesion regressed. The follow-up has still been carried on.

Discussion

Developments in ultrasonography technology and more systematic and effective use of ultrasonography in antenatal follow-up made possible to detect solid or cystic lesions occupying a place within thorax at the end of first trimester or in the beginning of second trimester. In this way, the association of diagnosed lesions with other accompanying structural anomalies or aneuploidies can be detected earlier and it can be accordingly possible to end pregnancy before it gains viability, to postpone treatment to neonatal period or to apply intrauterine interventions in experienced reference centers as in congenital diaphragm hernia.

Lung development at intrauterine period is affected negatively by lesions within thorax, oligohydramnios, occlusive anomalies on main airways or neurological problems decreasing fetal respiratory movements.[3] Primary technique for evaluating thorax and lungs is ultrasonography. Non-inclusion of air by airways and lungs in prenatal period makes fetal thorax and lungs a suitable anatomical structure for both ultrasonography and MRI. In this way, mass lesions found in lungs or anatomical definitions of extrathoracic masses within thorax, and their effects on lung volume and diaphragm contour can be detected by ultrasonography.

As a result of compresson due to intrathoracic mass lesions, pulmonary hypoplasia and mediastinal replacement can be met. The severity of hypoplasia is related with occurrence time and dimensions of lesion. An advantage of MRI compared to ultrasonography in congenital diaphragm hernia is the possibility of displaying whether liver is herniated or not, and of anatomical localization of herniated liver lobe.[4] In cases where amniotic fluid decreases, as a result of decreased fetal movements, it may be possible to display fetal anatomy in detail by MRI when movement artifacts decrease in MRI. Although findings of diaphragm hernia were presented by ultrasonography in our case, MRI was used to be able to detect reduce in lung volume sonographically since the patient was obese. Following this, the family was informed together with pediatric surgery team for current situation and possible method of management. Compression and mediastinal shift in left lung confirmed on MRI was followed by ultrasonography for the whole remaining pregnancy period.

While it is seen as a hyperintense lesion in MRG T2A sections in congenital adenomatoid cystic malformation cases, it has lower signal intensity according to adjacent liver tissue in T1 and FLAIR sequences.[4,5] The greatest contribution of FLAIR sequence in the diagnosis of congenital adenomatoid cystic malformation is to be able to determine whether macrocystic or microcystic component is dominant. In the distinction of bronchopulmonary sequestration from microcystic cases, MRI may contribute to ultrasonography. It was reported that approximately 19-56% of cases followed by ultrasonography regressed during follow-up period. In these cases, MRI is more successful than ultrasonography for determining residual lesions.6 In this case; MRI was referred to confirm the diagnosis found by ultrasonography.

Bronchopulmonary sequestration is followed as well-confined ecodense and homogenous masses in ultrasonography. By Doppler ultrasonography, feeding artery can mostly be presented. On the other side, in cases where

feeding artery cannot be presented by ultrasonography, it may be difficult to distinguish from type 3 adenomatoid cystic malformation. In such cases, borders of lesion, determining other accompanying lesions and presentation of feeding artery can be provided by ultrafast MRI. While the follow-up in ultrasonography in question is in favor of adenomatoid cystic malformation, it is in favor of bronchopulmonary sequestration to follow up solidly. Both in bronchopulmonary sequestration and congenital cystic adenomatoid malformation, as gestational week proceeds, the possibility of detecting in MRI decreases as signal intensity of lesions and the rate of lesion in growing lungs relatively decrease.5 It was observed that it became hard to distinguish from normal lung tissue in progressive gestational weeks due to the decrease in echogenicity of lesion and acoustic shading caused by costas during the follow-up of last two cases by ultrasonography.

There are inconsistent outcomes about additional data of MRI provided for patient management for intrathoracic lesions. Levine et al.5 reported that MRI provided data in addition to ultrasonography in 38% of cases and they changed patient management in 8% of patients. This contribution was reported as 33% in the study of Coakley et al.7 and as 17% in the study of Hubbard et al.8 In all these three studies, MRI was used to confirm diagnoses of ultrasonography and to put out the effects of lesions on lung hypoplasia. On the other hand, MRI did not change ultrasonographic diagnosis and management way in all three cases.

Conclusion

Main advantages of MRI are the possibility of multi-planar evaluation free of fetus position when presenting pulmonary hypoplasia and the possibility of evaluating in the presence of oligohydramnios. Except limited cases, MRI does not provide data to ultrasonography which may cause changes in patient management. Ultrasonography for diagnosis of cases and evaluation of cases with hydrops diagnoses as well as the diagnosis of cases is the first option since it can be obtained cheaply and easily and it provides an evaluation opportunity free of artifacts caused by fetal movements.

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