

## Case Report

# Fetal magnetic resonance imaging in the assessment of arachnoid cysts: Case series

Raziye Keskin Kurt<sup>1</sup>, Nesrin Atci<sup>2</sup>, Hanifi Bayarogullari<sup>2</sup>, Dilek Benk Silfeler<sup>1</sup>, Serdar Kenan Dolapcioglu<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology and <sup>2</sup> Department of Radiology, Mustafa Kemal University Medical School, Hatay, Turkey

### Abstract

Arachnoid cysts, fluid-filled benign cysts between the dura and the brain substance, are rare developmental anomalies of the central nervous system. Although ultrasonography is used mostly in the diagnosis of arachnoid cysts, there is a paucity of information related to the fetal magnetic resonance imaging assessment of arachnoid cysts in prenatal period. Magnetic resonance imaging might be a useful imaging modality in diagnosis as well as in the assessment of concomitant other abnormalities in the antenatal period. We presented four cases of arachnoid cysts which were assessed by magnetic resonance imaging in the prenatal period.

### Key words:

Arachnoid cyst, antenatal diagnosis, fetus, magnetic resonance imaging

## Introduction

Primary arachnoid cysts are congenital anomalies which contain cerebrospinal fluid mostly and localize in the cranial-spinal region within the arachnoid space [1]. Rarely they contain xanthochromic fluid and constitute approximately 1% of intracranial masses. In most cases arachnoid cysts localize on the surface of the brain at the level of main brain fissures, such as sylvian, rolandic, interhemispheric fissures, sella turcica. Although ultrasonography (US) is used mostly in the diagnosis of arachnoid cysts, there is a paucity of information related to the fetal magnetic resonance imaging (MRI) assessment of arachnoid cysts. Here we reported the diagnostic efficacy of fetal MRI in the assessment of four arachnoid cysts.

## Case presentation

**Case 1:** Twenty nine week pregnant woman was referred to our hospital for prenatal US screening. In the US examination sonoluscent, cystic lesions were discovered with a thin regular outlines which caused significant mass effect and displaced the adjacent brain tissue (Figure 1a-b). After US findings, the fetal MRI performed and arachnoid cyst was localized in the interhemispheric fissure. It com-

presses right lateral ventricle and adjacent brain tissue. The size of the cyst was 58.53x39.40 mm and homogenous signal intensity on T1, T2 weighted sequence (Figure 2a-d). The corpus callosum was fully formed and no additional anomalies were found. Patient was followed and the treatment of arachnoid cyst was planned after birth.

**Case 2:** Twenty one years old pregnant women was referred for antenatal screening US at 28 weeks of gestation. US revealed a cyst at 37.57x31.98 mm in diameter and localized anterior to the cerebellum and also in the left middle cranial fossa (Figure 3a-b). After US examination, the fetal MRI performed to make better visualization and differentiation of arachnoid cysts from the other intracranial lesions. According to MRI, the cyst localized at inter-peduncular cistern and in the left middle cranial fossa (Figure 4a-d). The cyst compresses the right temporal lobule and adjacent brain tissue. There were no additional anomalies. Patient was followed and the treatment of arachnoid cyst was planned after birth.

**Case 3:** Thirty six years old pregnant women was referred to our hospital. During prenatal US examination at 32 weeks of gestation, frontal encephalocele was detected with frontal bone defect (Figure 5a-b) and hypoechoic homogenous cystic lesion which has a well-defined encapsulating wall on the right side of midline in the middle cranial fossa was also observed. Fetal MRI was performed after US examination. Frontal encephalocele with frontal bone defect into nasal cavity was seen in binocular region and was 28x18 mm diameter. The right arachnoid cyst was also seen in the right cranial fossa. The size of cyst was 43.49x27.50 mm

### Article history:

Received 26 March 2014

Accepted 28 May 2014

\*Correspondence: Raziye Keskin Kurt

Mustafa Kemal Üniversitesi Tıp Fakültesi, Kadın Hastalıkları ve Doğum

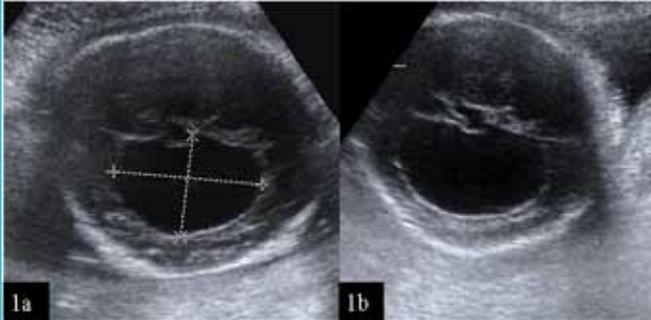
Anabilim Dalı, Hatay, 31005, Turkey

Phone and Fax: +90 326 214 61 70, +90 326 245 53 057

E-Mail: drraziyeeskinkurt@yahoo.com

and homogenous signal intensity on T1, T2 weighted sequence (Figure 6a-d). The cyst was displacing the right temporal lobe into superior and medial direction. Frontal encephalocele was surgically repaired after birth. During a year following period of the baby has shown no additional problem.

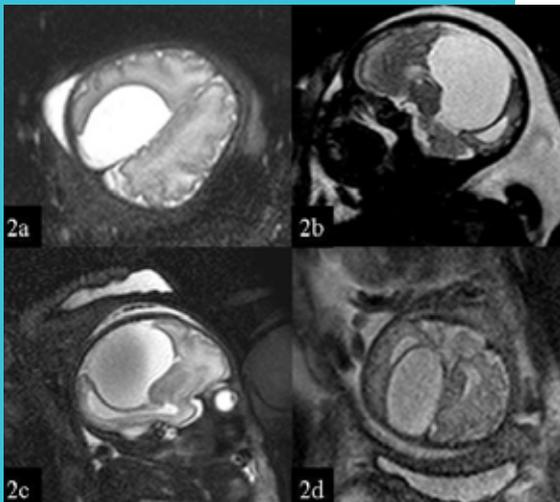
**Figure 1a-b**



*Prenatal ultrasound image on the axial views at 28 gestational weeks shows a large interhemispheric arachnoid cyst compressing the right ventricle and adjacent brain parenchyma.*

Case 4: Twenty three years old pregnant women was referred to hospital. In routine prenatal US at 23 weeks gestation, sonolucent cystic lesions with a thin regular outline was discovered.

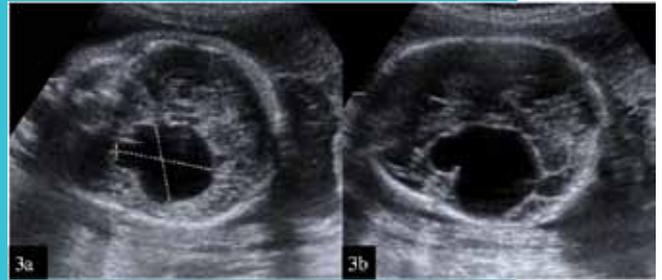
**Figure 2a-d**



*Prenatal MRI of the fetus with axial, sagittal, sagittal coronal T2-weighted images showing a large interhemispheric arachnoid cyst compressing the right ventricle and adjacent brain parenchyma.*

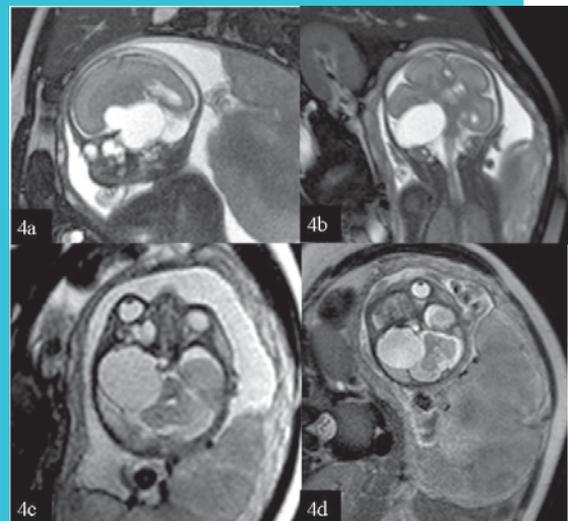
The cyst caused significant mass effect and displaced the adjacent brain (Figure 7a-b). After US findings, the fetal MRI performed and arachnoid cysts was localized in the intercerebellar fissure. It compressed adjacent brain tissue.

**Figure 3a-b**



*Prenatal ultrasound image on the axial views at 28 gestational weeks showing arachnoid cyst located anterior to the cerebellum and in the left middle cranial fossa*

**Figure 4a-d**



*Prenatal MRI of the fetus with sagittal, coronal, axial, axial T2-weighted images showing a large arachnoid cyst located interpeduncular cistern and in the left middle cranial fossa.*

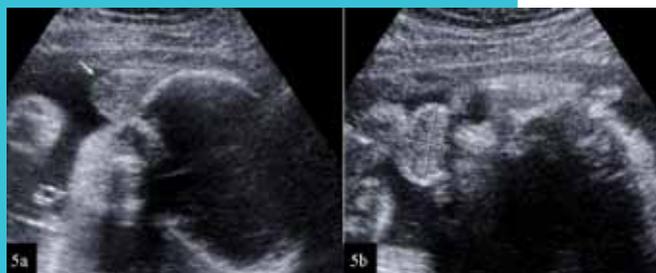
The cyst size was 26x13 mm and homogeneous signal intensity on T1, T2 weighted sequence (Figure 8a-d). No other anomalies were found. The patient was offered genetic investigation; however, she did not want to perform any genetic investigation. Patient was followed and the treatment of arachnoid cyst was planned after birth.

## Discussion

Arachnoid cysts are usually benign, congenital, space-occupying lesions and are collections of cerebrospinal fluid [1]. They are located within the arachnoid space which is created by the expansion of the extracellular space of the loose primitive mesenchyme. Early in fetal

life, primitive mesenchymes surround the neural tube. While arachnoid membrane is formed by the outer layer of cells, the pia mater membrane is formed by the inner layer cells [2]. Arachnoid cysts occur due to abnormal splitting of the cell layers. The space created by entrapment of cerebrospinal fluid enlarges to form the arachnoid cysts. They are classified as primary and secondary arachnoid cysts [3]. There is benign accumulation of clear fluid between the dura and the brain tissue in the primary (congenital) form which does not communicate with subarachnoid space [4]. Primary arachnoid cysts are developmental malformations of splitting of the arachnoid membrane in antenatal period. They are approximately 1% of intracranial masses [5, 6]. However, secondary (acquired) arachnoid cysts result from meningitis, hemorrhage, trauma, surgery and infection and communicate with subarachnoid space [3, 4, 7].

**Figure 5a-b**



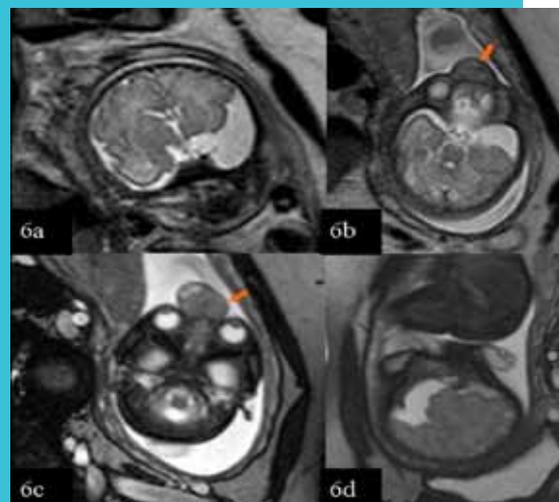
*b Prenatal ultrasound image at 28 gestational week gestational age shows frontal encephalocele*

Although arachnoid cysts are most commonly asymptomatic, they may progressively enlarge in utero resulting in brain compression and ventriculomegaly. Symptoms are usually vary with location and they may cause nausea, vomiting, lethargy, headache, seizures and focal neurological disorders postnatally [8]. Hemorrhage into the cyst, subdural compartment or cyst rupture may cause sudden deterioration.

The majority of arachnoid cysts are supratentorial and 50-65% of them are located in sylvian fissure in the middle cranial fossa and mostly on the left side. The other locations might be quadrigeminal cistern (5-10%), suprasellar cistern (5-10%), cerebral convexity (5%) and posterior fossa (10%) [5]. In two of our cases, it was located at right sylvian fissure in the middle cranial fossa and one at interhemispheric fissure. Complete or partial agenesis of the corpus callosum is often associated with interhemispheric cysts. However we have not observed agenesis of corpus callosum. Adjacent structures were compressed in three of our cases due to mass effect. Prenatal arachnoid cysts may be confused with epidermoid cyst, porencephalic cyst, gliependymal cyst, Galen vein aneurysms, schizencephaly, cystic teratoma, cystic astrocytoma, large cisterna magna and Dandy Walker

syndrome [3, 9, 10]. Prenatal diagnosis of intracranial hypoechoic lesions should include a differential diagnosis of arachnoid cysts and instant genetic investigations should be done.

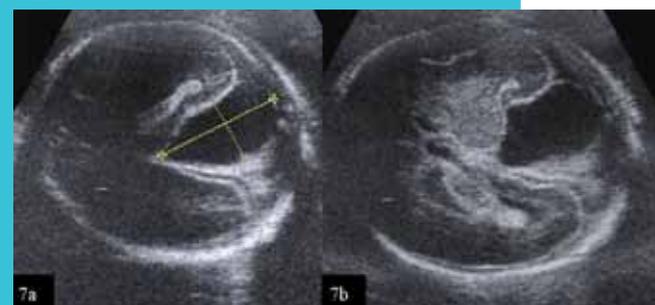
**Figure 6a-d**



*Prenatal MRI of the fetus with coronal, axial, axial and sagittal T2-weighted images showing the arachnoid cyst located in the left middle cranial fossa.*

Arachnoid cysts may be associated with ventriculomegaly and dysgenesis [11]. The prognosis of fetal arachnoid cysts is dependent on the presence or absence of the corpus callosum or other congenital malformations.

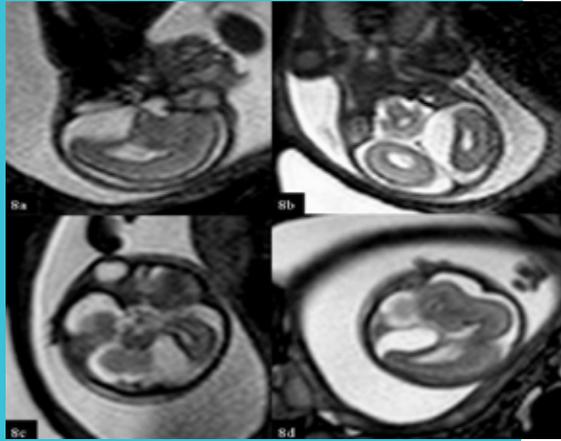
**Figure 7a-b**



*Prenatal ultrasound image on the axial views at 25 gestational weeks showing arachnoid cyst located in the intercerebellar fissure and compressing the adjacent brain parenchyma.*

Presence of parenchymal hemorrhages, the size and location of cyst, gestational age at diagnosis, the rate of the cyst growth and progression of ventriculomegaly are the other prognostic factors. The brain integrity is more important than the cyst volume or cyst location for the prognosis [12-14]. Fetal arachnoid cysts in association with other structural anomalies should be investigated for cytogenetic disorders. Fetal arachnoid cysts may be also associated with chromosomal abnormalities [3].

**Figure 8a-d**



*Prenatal MRI of the fetus with sagittal, coronal, axial and oblique axial T2-weighted images showing a large arachnoid cyst located in the intercerebellar fissure and compressing the adjacent brain parenchyma.*

Arachnoid cysts are usually diagnosed in the third trimester [3]. US are the primary imaging modality for antenatal period. Arachnoid cysts appear as sonolucent lesions with a thin regular outline on antenatal US. There are pitfalls in the evaluation of the fetal structures with US, due to maternal obesity, oligohydramnios, or poor fetal position [15, 16]. Whereas, MRI has been shown less affected from these pitfalls [16, 17]. Fast scan time and high resolution of MRI provide the application for fetal imaging. Besides, MRI might provide significant addi-

tional information that improves diagnostic accuracy in evaluation of the fetal brain. By accurate determination of fetal anatomy, MRI can guide for optimizing neonatal management [15, 18-20]. It has been reported that MRI has changed the diagnosis in % 40 of fetuses and changed the management in % 46 of cases [21]. On MRI, arachnoid cysts appear as well-defined nonenhancing intracranial masses that are isointense to cerebro-spinal fluid. MRI also demonstrates the exact location and extent of the cysts as well as their relationship to brain. On MRI, the arachnoid cysts are confused more often with the epidermoid cyst; because both lesions have similar characteristics on T1 and T2 weighted images. Both of lesions have no enhancement with gadolinium. Fluid attenuated inversion recovery (FLAIR) and diffusion weighted images could be used for differentiation of two entities. FLAIR imaging demonstrates tissue contrast similar to that of T2-weighted images; whereas, it shows no signal arising from the cerebro-spinal fluid. FLAIR demonstrates suppressed signal intensity in arachnoid cysts which contains cerebro-spinal fluid, but higher signal intensity in epidermoid cyst. Primary arachnoid cysts are developmental intracranial malformations which could be encountered in the antenatal period. MRI might be a useful imaging modality in diagnosis as well as in the assessment of concomitant other abnormalities in the antenatal period.

**Conflict of interest statement**

The authors declare no conflict of interest.

**References**

1. Westermaier T, Schweitzer T, Ernestus RI: Arachnoid cysts. *Advances in experimental medicine and biology* 2012; 724:37-50.
2. Vega-Sosa A, de Obieta-Cruz E, Hernandez-Rojas MA: Intracranial arachnoid cyst. *Cirugia y cirujanos* 2010; 78:551-556.
3. Chen CP: Prenatal diagnosis of arachnoid cysts. *Taiwanese journal of obstetrics & gynecology* 2007; 46:187-198.
4. Pascual-Castroviejo I, Roche MC, Martinez Bermejo A, Arcas J, Garcia Blazquez M: Primary intracranial arachnoidal cysts. A study of 67 childhood cases. *Child's nervous system : ChNS : official journal of the International Society for Pediatric Neurosurgery* 1991; 7:257-263.
5. Rafferty PG, Britton J, Penna L, Ville Y: Prenatal diagnosis of a large fetal arachnoid cyst. *Ultrasound in obstetrics & gynecology : the official journal of the International Society of Ultrasound in Obstetrics and Gynecology* 1998; 12:358-361.
6. Ghay R, Thaman D, Kahlon N: Bilateral temporal lobe agenesis with bilateral arachnoid cysts - a rare congenital anomaly. *Journal of basic and clinical physiology and pharmacology* 2013; 24:159-161.
7. Rao G, Anderson RC, Feldstein NA, Brockmeyer DL: Expansion of arachnoid cysts in children: report of two cases and review of the literature. *Journal of neurosurgery* 2005; 102:314-317.
8. Robertson SJ, Wolpert SM, Runge VM: MR imaging of middle cranial fossa arachnoid cysts: temporal lobe agenesis syndrome revisited. *AJNR American journal of neuroradiology* 1989; 10:1007-1010.
9. Glastonbury CM, Osborn AG, Salzman KL: Masses and malformations of the third ventricle: normal anatomic relationships and differential diagnoses. *Radiographics : a review publication of the Radiological Society of North America, Inc* 2011; 31:1889-1905.
10. Pilu G, Falco P, Perolo A, Sandri F, Cocchi G, Ancora G et al. Differential diagnosis and outcome of fetal intracranial hypoechoic lesions: report of 21 cases. *Ultrasound in obstetrics & gynecology : the official journal of the International Society of Ultrasound in Obstetrics and Gynecology* 1997; 9:229-236.
11. Blaicher W, Prayer D, Kuhle S, Deutinger J, Bernaschek G: Combined prenatal ultrasound and magnetic resonance imaging in two fetuses with suspected arachnoid cysts. *Ultrasound in obstetrics & gynecology : the official journal of the International Society of Ultrasound in Obstetrics and Gynecology* 2001; 18:166-168.
12. Gedikbasi A, Palabiyik F, Oztarhan A, Yildirim G, Eren C, Ozyurt SS et al. Prenatal diagnosis of a suprasellar arachnoid cyst with 2- and 3-dimensional sonography and fetal magnetic resonance imaging: difficulties in management and review of the literature. *Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine* 2010; 29:1487-1493.
13. Haino K, Serikawa T, Kikuchi A, Takakuwa K, Tanaka K: Prenatal diagnosis of fetal arachnoid cyst of the quadrigeminal cistern in ultrasonography and MRI. *Prenatal diagnosis* 2009; 29:1078-1080.
14. Kusaka Y, Luedemann W, Oi S, Shwardfegar R, Samii M: Fetal arachnoid cyst of the quadrigeminal cistern in MRI and ultrasound. *Child's nervous system : ChNS : official journal of the International Society for Pediatric Neurosurgery* 2005; 21:1065-1066.
15. Levine D, Barnes PD, Robertson RR, Wong G, Mehta TS: Fast MR imaging of fetal central nervous system abnormalities. *Radiology* 2003; 229:51-61.
16. Levine D: Magnetic resonance imaging in prenatal diagnosis. *Current opinion in pediatrics* 2001; 13:572-578.
17. Levine D: Ultrasound versus magnetic resonance imaging in fetal evaluation. *Topics in magnetic resonance imaging : TMRI* 2001; 12:25-38.
18. Coakley FV, Hricak H, Filly RA, Barkovich AJ, Harrison MR: Complex fetal disorders: effect of MR imaging on management—preliminary clinical experience. *Radiology* 1999; 213:691-696.
19. Alamo L, Laswad T, Schnyder P, Meuli R, Vial Y, Osterheld MC et al. Fetal MRI as complement to US in the diagnosis and characterization of anomalies of the genito-urinary tract. *European journal of radiology* 2010; 76:258-264.
20. Griffiths PD, Paley MN, Whitby EH: MR imaging of the fetal brain and spine: a maturing technology. *Annals of the Academy of Medicine, Singapore* 2003; 32:483-489.
21. Glenn OA, Barkovich AJ: Magnetic resonance imaging of the fetal brain and spine: an increasingly important tool in prenatal diagnosis, part 1. *AJNR American journal of neuroradiology* 2006; 27:1604-1611.