Prenatal MRI of the fetal urinary tract: normal and abnormal anatomy with US and pathologic correlation


Purpose: Evaluate prenatal MR compared to US in the visualization of the normal and abnormal fetal urinary tract and to confirm the findings with pathologic correlation to determine the MR appearance of the normal urinary tract (UT) at different gestational ages, the MR appearance of the abnormal UT and if MR provided additional, valuable information in the evaluation of an abnormal pregnancy. The diagnosis of fetal renal anomalies has increased with improvements in US equipment. They range from transient nonobstructive dilation of the renal pelvis to severe obstructive uropathy or renal agenesis with oligohydramnios and pulmonary hypoplasia. This makes US evaluation of the fetus very difficult. As the use of prenatal interventional therapy increases in the fetus with an obstructed UT, the importance of accurate prenatal diagnosis of anomalies increases.

Methods: 14 pregnant women (gestational ages 17-26 wk) were referred for prenatal MR to evaluate an abnormality of the fetal UT diagnosed on prenatal US including suspected bladder outlet obstruction, renal cystic disease, and renal agenesis. These were compared to 50 prenatal MR (gestational ages 18-36 wk) in which the UT was normal by MR and US and in which no growth retardation was present by US standards. Scans were performed in a Siemens 1.5T vision magnet with the phase body array coil. The following sequences were performed: axial, coronal, and sagittal (relative to the fetus) HASTE (TR 4.4, TE 64, 6-mm, flip angle 120), coronal and sagittal 2D FLASH, and axial EPIFID. Pathologic specimens were available in 7 of abnormal and 10 of the normal UT.

Results: In the normal UT, the kidneys were easily visualized at all gestational ages. With HASTE, the renal cortex was intermediate in signal and higher in signal compared to muscle and liver. Fetal lobulations are seen at all ages. Corticomedullary differentiation was well defined until after 26 weeks. The high signal fluid in the renal pelvis was seen at all ages. With FLASH with T1 weighting the renal cortex was isoointense with muscle. With EPI, the renal cortex was significantly higher in signal compared to muscle. The cortex was best seen with HASTE sequences. The fetal urinary bladder was seen in all normal UT. In the abnormal UT, the fetuses with oligohydramnios were difficult to evaluate when oligo had been long standing resulting in severe deformity of the shape of the fetus. However, the UT could still be visualized. Renal agenesis was confirmed in two patients. In bladder outlet obstruction, posterior urethral valves, cloacal extrophy, and sacrococcygeal tumors were identified. Bladder wall thickening could be seen. Hydronephrosis with thinning of the renal cortex and mild to moderate cystic dysplastic changes were seen. Small to large amounts of uriniferous ascities were detected. MR was able to define the anatomy in all abnormal UT. It helped confirm or make the diagnosis in the cases where US diagnosis was difficult because of the oligohydramnios. MR helped change the diagnosis in one cloacal extrophy found associated with meningomyelocele. The MR was felt by the fetal surgery team to be helpful in directing counseling and interventional therapy. Changes seen in the renal cortex with

MR correlated well with those seen on pathology. Mild degrees of hydronephrosis were difficult to detect with MR.

Conclusion: The normal fetal kidney is easily demonstrated with MR and the normal MR anatomy is defined. MR can help to further define an abnormal UT identified on US. It may be especially valuable when the suspected anomaly may effect the viability of the pregnancy or when prenatal intervention is planned.