Ultrasonography for Fetal Genitourinary Abnormalities: The Essentials

Alka S. Karnik, MD*, Anjumara Bora, DMRE, DNB

KEYWORDS

• Antenatal ultrasound • Oligohydramnios • Pelvicaliectasis
• Vesicoureteric reflux • Cystic dysplasia • Renal masses
• Adrenal masses • Ambiguous genitalia

Embryologically the urogenital system develops from a common mesodermal ridge; however, functionally and structurally there are two distinct systems, the urinary system and the genital system. Ultrasonography is an excellent modality for detection and characterization of urinary tract abnormalities, which occur in 3% to 4% of the population and form 30% of the abnormalities detected on a routine antenatal ultrasonography.[1] Lethal urinary tract abnormalities account for 10% of pregnancy terminations. Early antenatal detection and serial follow-up help in obstetric and neonatal management.[2] The typical morphology of various abnormalities helps in accurate prenatal diagnosis and in selected cases MR imaging gives valuable information.[3] Genital evaluation and determination of gender is important in cases of several morphologic anomalies. In ambiguous genitalia, there is often inability to assign fetal gender in a second- or third-trimester sonographic examination.

URINARY TRACT—NORMAL SONOGRAPHIC ANATOMY

Fetal kidneys can be visualized in the first trimester. On a combined transabdominal/transvaginal scan at 12 to 13 weeks, kidneys are seen in 99% of cases as oval structures in the paravertebral region and appear relatively hyperechoic compared with the liver and spleen (**Fig. 1**A). In second trimester, kidneys are well seen on transabdominal sonography as iso/hypoechoic oval structures with an echogenic renal sinus and echogenic borders due to perinephric fat (see **Fig. 1**B). Corticomedullary distinction becomes apparent in the second trimester and is well marked in third-trimester scans (see **Fig. 1**C). A central lucency due to presence of fluid in the renal pelvis is often seen. Under normal conditions, the ureters are not visible.[4–6] The renal length in millimeters is equal to gestational age in weeks from 24 weeks and onwards. Renal growth can also be normally evaluated by measuring length and comparing it to available normograms.[5]

The urinary bladder is visualized on a transabdominal examination at 12 to 13 weeks of gestation. The bladder volume is normally 1 mL at 20 weeks and increases to 36 mL at 41 weeks, with bladder emptying observed at approximately every 25 minutes.[4,5] On a color Doppler examination, two umbilical arteries are seen, one on each side of the urinary bladder (**Fig. 2**).

Amniotic fluid is an important indicator of fetal renal and placental function. After 16 weeks, fetal urine production is the major source of amniotic fluid.[7] Oligohydramnios is often the first sign of a renal anomaly when there is significantly compromised function. When there is a detected renal abnormality, the presence of normal amniotic fluid indicates good prognosis.

Radiology, Department of Ultrasound, Dr Balabhai Nanavati Hospital and Research Center, Vileparle West, Mumbai 400057, Maharashtra, India
* Corresponding author.
E-mail address: drakarnik@rediffmail.com

Ultrasound Clin 5 (2010) 409–425
doi:10.1016/j.cult.2010.08.003
1556-858X/10/$ – see front matter

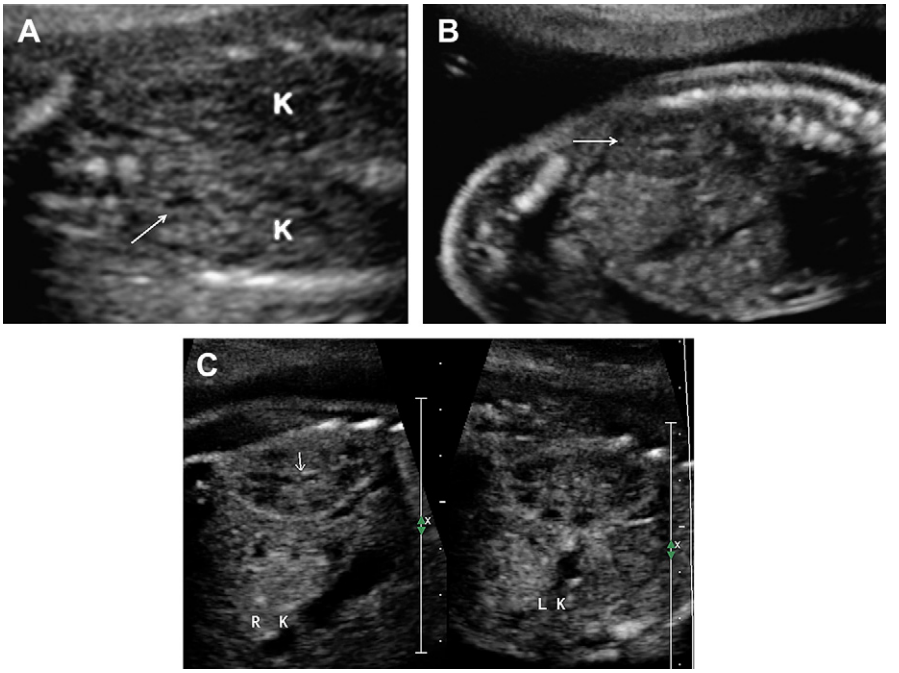

Fig. 1. (*A*) At 14 weeks' gestation, coronal image shows fetal kidneys (K) as oval structures in the paravertebral region relatively hyperechoic as compared with the liver (*arrow*). (*B*) In the second trimester, the kidneys are iso/hypoechoic with an echogenic renal sinus and echogenic border due to perinephric fat (*arrow*). Corticomedullary differentiation is seen. (*C*) Third-trimester sagittal image shows good renal corticomedullary differentiation. A central lucency due to fluid in the renal pelvis is often seen (*arrow*). LK, left kidney; RK, right kidney.

ULTRASONOGRAPHY DIAGNOSIS OF URINARY TRACT ABNORMALITIES—WHAT TO LOOK FOR

Box 1 details the assessment protocol for the diagnosis of urinary tract abnormalities.

Empty Renal Fossa

Failure of ureteric bud to induce metanephric blastema leads to renal agenesis. On careful

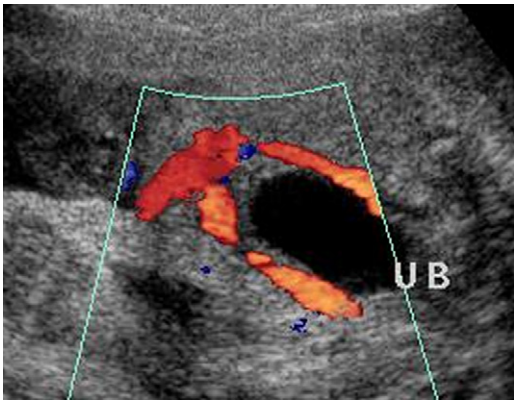

Fig. 2. Axial color Doppler image demonstrates the normal urinary bladder (UB) flanked by umbilical arteries.

Box 1
Ultrasonography diagnosis of urinary tract abnormalities—What to look for

1. Assessment of amniotic fluid volume
2. Localization and characterization of urinary tract abnormalities

   Bladder seen earlier than the kidneys

   - Presence
   - Appearance and size

   Kidneys sagittal/transverse

   - Presence
   - Number
   - Position
   - Size
   - Appearance (echogenicity and cysts)
   - Unilateral or bilateral

   Collecting system

   - Dilatation
   - Level of obstruction
   - Cause of obstruction
   - Unilateral or bilateral

3. Fetal gender
4. Two-vessel umbilical cord often seen with renal anomalies
5. Search for associated abnormalities