PICTORIAL ESSAY

Fetal kidneys: normal sonographic appearance and red flags

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The images below demonstrate the minimum sections that should be obtained in order to assess the fetal urinary system, according to the ISUOG guidelines. At the 20+2 planes approach for the routine anatomy scan, plane 13 refers to the kidneys.

The 20 + 2 planes

Anatomical area	Plane	Description
Abdomen	11 12 13	Transverse section of abdomen with stomach & umbilical vein* Transverse section of abdomen at cord insertion Transverse section(s) of left kidney & pelvis, right kidney & pelvis
Pelvis	14	Transverse section of pelvis, bladder, both umbilical arteries
Limbs	15 16 17	Femur diaphysis length* 3 bones of both legs, both feet & normal relationships to both legs 3 bones of both arms, both hands & normal relationships to both arms
Face	18 19 20	Coronal view of upper lip, nose & nostrils Both orbits, both lenses Median facial profile
Overview 2	Sweep 2	Transverse sweep of body from neck to sacrum, one vertebra at a time

Requirements from each plane

Plane	Description	Structures to be evaluated[2,3,4]	Measurement & criteria for referral	Abnormalities that can be excluded from the normal appearances of the section
13	Transverse section of left kidney & pelvis, right kidney & pelvis	Both kidneys & pelves	Refer if one or both renal pelves >7 mm AP	Bilateral renal agenesis Renal pelvic dilatation (upper limit of normal = 7 mm AP) Cystic renal dysplasia (unilateral/bilateral)
14	Transverse section of pelvis, bladder, both umbilical arteries	Bladder & umbilical arteries, genitalia*		2 vessel cord Lower urinary tract obstruction

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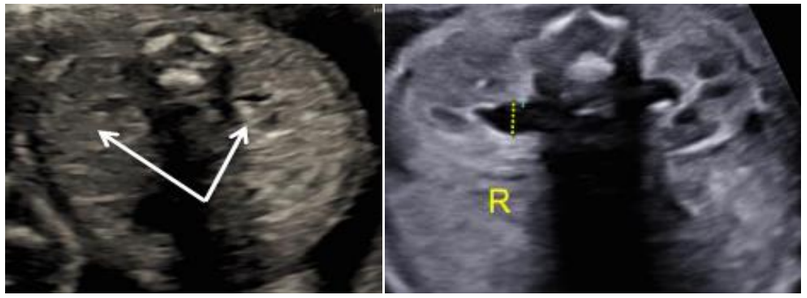
The main section that is always required is the spine up transverse section where both renal pelvises can be clearly seen and measured (antero-posterior diameter, AP). Measurement above 7mm is an indication for referral for further evaluation and follow-up by a specialist. Fetal kidneys are usually spotted via their pelvises.

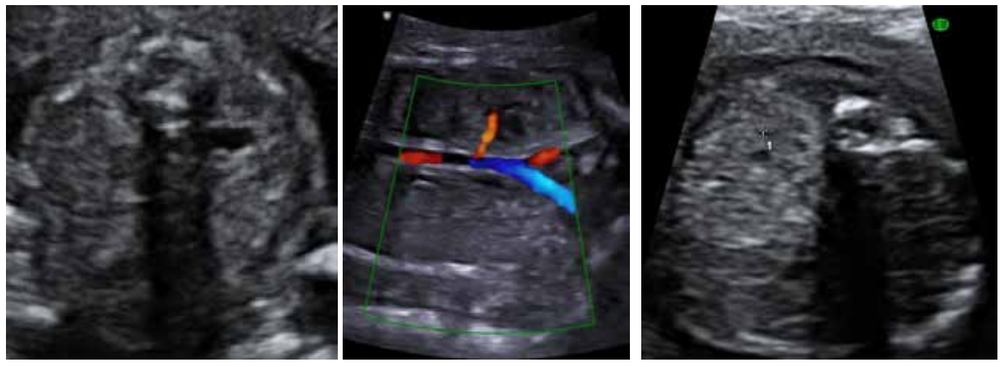


The correct measurement of the renal pelvis includes the inner to inner placement of the calipers at the most clear section.

The main structural abnormalities that are diagnosed or excluded are renal agenesis (bilateral or unilateral), hydronephrosis, cystic renal dysplasia.

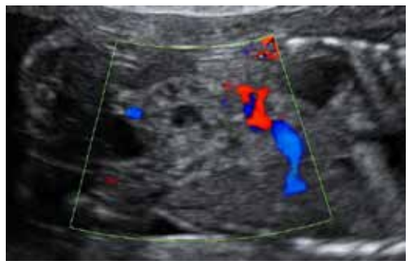
Renal agenesis red flags

1. Failure to visualize one or both fetal kidneys
2. The adrenal gland appears rounder than normal and fills the renal fossa in what has been termed the "lying down" adrenal sign
3. Color Doppler demonstrates single or no renal arteries (horizontal coronal view)
4. In bilateral renal agenesis (Potter sequence) the fetal bladder is empty and cannot be clearly visualized
5. In case of single renal agenesis compensatory hypertrophy of the contralateral kidney can be detected



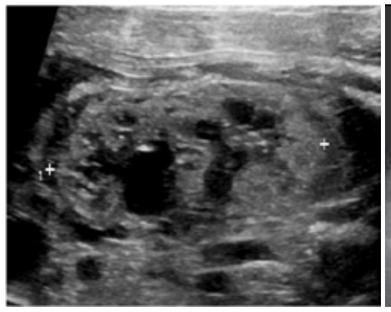
Renal ectopia red flags

1. Failure to visualize one or both fetal kidneys at the normal renal fossa
2. The adrenal gland appears rounder than normal and fills the renal fossa in what has been termed the "lying down" adrenal sign
3. Kidney structure visualized in the fetal pelvis
4. Color Doppler demonstrates single or no renal arteries (horizontal coronal view), vascular supply may be seen branching from the abdominal aorta in a more acute angle, oblique and caudally oriented, or directly from the iliac arteries
5. A horseshoe kidney may be demonstrated at the coronal or transverse planes (renal tissue crossing the mid-line due to fusion of the lower poles of both kidneys in front of the descending aorta)




Duplex ureters red flags

1. Double renal pelvises, non communicating, one or both dilated
2. Ureterocele




Hydronephrosis red flags

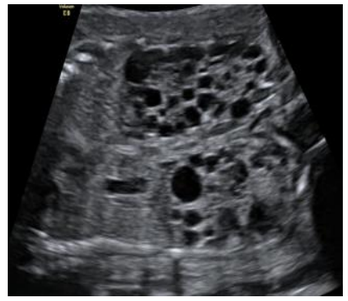
1. In case of a uretero-pelvic junction obstruction, there is pelvicalyceal dilatation without ureteral dilatation
2. Normal or slightly increased AFI
3. Pelvicalyceal communication (vs MCDK)
4. In severe cases, renal cortex thinning (calyces cannot be distinguished)


Lower urinary tract obstruction red flags

1. Reduced AFI
2. Dialated, thick-walled (>2mm) bladder
3. "Key hole" sign
4. In severe cases there is also ureter dilatation and subsequently renal hydronephrosis


Multicystic dysplastic kidney (MCDK)

1. Kidney with polycystic appearance or totally replaced by multiple irregular cysts of variable size with intervening hyperechogenic stroma
2. Renal cysts non communicating with renal pelvis (vs hydronephrosis)
3. Renal pelvis usually not visible
4. Echogenic renal cortex




Polycystic kidneys red flags

1. Symmetrically enlarged and hyperechogenic kidneys (when cysts are relatively small in size)
2. Kidneys are generally larger in autosomal recessive form of the disease
3. Renal pelvises cannot be visualised in autosomal recessive form of the disease and there is gradual onset of oligohydramnios from the second trimester (small bladder)
4. Difficulty to differentiate renal cortex to renal stroma ■