Fetal Abdominal Ultrasound

The Plan

- Show the normal
  - Technique
  - What we SHOULD see

- Introduce the abnormal
  - Abdominal Wall
  - Stomach
  - Masses
  - Renal

Ultrasound technique

What are we checking?
- Is the situs correct?
- Is expected anatomy present?
  - Stomach / Bladder / Kidneys
  - KNOW THE NORMAL
- Is the AC a normal size?

- Abdominal circumference
  - Transverse plane
  - Spine at 3:00 or 9:00
  - Symmetrical ribs
  - Stomach, umbilical vein
  - No kidneys

Part 1

- Stomach
- Cord insert
- Bowel
- Kidneys
- Bladder

Ultrasound technique

- Bladder
  - Is there fluid in the bladder?
  - If not seen, come back to the bladder later on during examination
  - Normal size and shape?

- 3 vessel cord
  - Colour Doppler to show a 3 vessel cord
  - Look out for a 2VC
  - IUGR
  - Congenital and karyotypic abnormalities

Ultrasound technique

- Cord insertion
  - Spine at 3:00 or 9:00
  - Move Superiorly from Bladder or inferiorly from the AC plane
- Cord should insert perpendicular and midline to the abdomen
  - Have fluid on each side of cord insertion
- Look for:
  - Correct cord insertion site
  - Is the abdominal wall intact?
  - Any masses protruding from insertion site
Ultrasound technique

- Kidneys
  - Three plane assessment: transverse, sagittal and coronal
  - Transverse: spine at 12:00 (or 6:00)
    - Right kidney situated slightly lower than left kidney
    - May need to rotate transducer slightly

- Transverse: spine at 12:00 (or 6:00)
  - Right kidney situated slightly lower than left kidney
  - May need to rotate transducer slightly

- Sagittal: From the transverse plane, turn the transducer 90°
  - Pan from left to right
  - Length of kidney approx. equals gestational age
    - e.g. 20/40 fetus should have approx. 20mm length kidneys

- Coronal: Transverse plane with spine at 3:00 or 9:00, then turn the transducer 90°
  - Can apply colour Doppler to check there are 2 renal arteries

Part 2

- Stomach
- Cord insert
- Bowel
- Kidneys
- Bladder

Pathology

Ultrasound technique - Summary

What are you asking yourself?

- Kidneys: present? Normal size and appearance?
  - Correct number and position?
  - Look at their echogenicity
  - Any cysts or masses? If yes, is it unilateral or bilateral
  - Dilation of collecting system?
    - unilateral or bilateral?
    - What level?
    - Can a cause be identified?


- Bladder: is it present? Normal size and appearance?

- Cord insertion: Fluid either side? Masses? Asymmetry?
Pathology

- Survey Abdomen in transverse S-I
- Anatomy (Tick)

Anything else?
- Masses?
- Asymmetry
- Calcifications?
- Dilated or echogenic bowel?
- Ascites?

Pathology: Abdominal Wall

Gastroschisis

- Free floating loops of bowel
- Full thickness defect in the anterior abdominal wall immediately right of the umbilical cord insertion
  - Very rarely on left side
- NOT commonly associated with aneuploidy
- Associated GIT anomalies are common
- Increased risk of PTB and FGR

Pathology: Abdominal Wall

Gastroschisis:

Ultrasound findings:
- Hyperechoic mass attached to abdominal wall immediately right of normal umbilical cord insertion
- No covering membrane
- Thickened, echogenic and nodular bowel wall
- Measure the width of intra- and extra-abdominal bowel loops

Pathology: Abdominal Wall

Omphalocele

- Increased risk of aneuploidy and other non-GIT anomalies
- Membrane covered midline abdominal wall defect with herniation of abdominal contents
- The umbilical cord inserts into this sac
- Membrane rupture is a complication and can mimic gastroschisis
Pathology: Abdominal Wall

**Omphalocele**
- Must look for another abnormalities
  - Commonly associated with cardiac abnormalities
- **Ultrasound Findings:**
  - Smooth, midline abdominal wall mass with umbilical cord inserting into it
  - Liver and SB are common contents of this mass
  - Herniated bowel generally has normal appearance because it is covered by the membrane and has no contact with amniotic fluid

Pathology: Stomach

- **Small or absent**
  - Absent stomach is very rare
  - Allow time to see if stomach fills with fluid
  - Increases risk of fetal abnormality
- **Dilated fetal stomach**
  - Persistently dilated fetal stomach
  - May be normal or associated with a GI atresia

Pathology: Bowel

- **Echogenic bowel**
  - must be as bright as ossified bone
- **Duodenal atresia**
  - Congenital duodenal obstruction
  - Most common bowel obstruction in fetus
  - Persistent fluid in duodenum
  - “double bubble” sign – fluid filled stomach AND duodenum
  - Echogenic bowel

Pathology: Stomach

- **Midline or right sided stomach**
  - Malpositioned stomach
  - Check fetus’ situs
    - ?heterotaxy ?CDH

- **Esophageal atresia**
  - Incomplete differentiation of respiratory and GI tracts
  - Small stomach, polyhydramnios, IUGR
  - “Pouch sign” – transient filling of esophagus with swallowing
  - Can be part of VACTERL sequence

Pathology: Abdominal Masses

- **Congenital Hepatic haemangiomia**
  - Benign vascular neoplasm occurring in viscera
  - Common in liver
  - Well defined, solid mass, peripheral vascularity
  - Areas of necrosis
- **Mesenchymal hamartoma**
  - Benign liver tumour composed of large cysts surrounded by mesenchymal tissue
  - Multiloculated, cystic liver mass
  - Has thin or thick septations
  - Avascular
Pathology: Abdominal Masses

- **Hepatoblastoma**
  - Most common malignant liver tumour
  - Well defined, solid, echogenic mass
  - Displaces adjacent structures
  - Disorganised vascularity

- Follow up these fetuses with MCA and DV to predict fetal anaemia

Pathology: Renal

- **Ectopic kidney**
  - Abnormal position of kidney/s
  - Pelvis is the most common location
  - Hypoplastic or dysplastic
  - Empty renal fossa → ?ectopic kidney

Pathology: Renal

- **Duplex kidney**
  - Two separate pelvicalyceal systems
  - Complete or partial duplication of ureters
  - UP obstructs and LP refluxes

- **Horseshoe kidney**
  - Fusion of LP of kidneys
  - Difficult to diagnosis antenatally

Pathology: Renal

- **Renal agenesis**
  - Unilateral
    - AFI and bladder may be normal
    - Empty renal fossa (check it is not ectopic)
    - Compensatory hypertrophy of contralateral kidney
    - Isolated → good prognosis

Pathology: Renal

- **Renal agenesis**
  - Bilateral – incompatible with life
    - Failure of ureteric bud and nephrons to develop
    - Severe oligohydramnios
    - Non-visualisation of fetal bladder
    - “lying down” adrenal sign bilaterally
    - Potter syndrome
Pathology: Hydronephrosis

• Measure the transverse renal pelvis diameter
  ▫ T2: >4mm
  ▫ T3: >7mm

Renal cystic disease

Multicystic Dysplastic Kidney (MCDK)

• Most common
• Kidney replaced by cysts of variable size
• No normal renal parenchyma
• Non-functioning
• Most are unilateral
• Ultrasound: multiple cysts seen in kidney
  ▫ Kidney can appear hyperechoic
  ▫ If bilateral, severe oligohydramnios, non-visualization of bladder

Pathology: Hydronephrosis

• PUJ obstruction
  ▫ Most common cause of neonatal hydronephrosis
  ▫ Usually unilateral
  ▫ Ultrasound: dilated renal pelvis +/- calyceal dilation; No ureter or bladder distension

• VUJ obstruction
  ▫ Structural anomaly of distal ureter causing obstruction
  ▫ Ultrasound: dilated ureter +/- dilated renal pelvis

Autosomal Recessive Polycystic Kidney Disease (ARPKD)

• Single gene disorder
• Bilateral, symmetrical, cystic renal disease
• Numerous tiny cysts

Pathology: Hydronephrosis

• PUV
  ▫ Most common cause of lower urinary tract obstruction
  ▫ Males
  ▫ Persistently dilated bladder and proximal ureter, known as “keyhole” sign
  ▫ Trabeculated and thick bladder wall
  ▫ Can cause hydronephrosis

Renal cystic disease

Autosomal Recessive Polycystic Kidney Disease (ARPKD)

• Ultrasound:
  ▫ Hyperechoic and enlarged kidneys
  ▫ Decreased C-M differentiation
  ▫ Can be difficult to diagnose antenatally
Renal cystic disease

**Autosomal Dominant Polycystic Kidney Disease (ADPKD)**
- Hereditary
- Cysts form in kidneys and liver
- Antenatally, the kidneys may appear normal
- Normal AFI and bladder
- FHx is critical to diagnosing ADPKD

Adrenal Glands

**Neuroblastoma**
- Most common abdominal malignancy
- Ultrasound appearance:
  - No normal adrenal gland
  - Solid, cystic, or mixed
  - Fetal hydrops can develop

Renal Masses

**Mesoblastic Nephroma**
- Most common
- Benign hamartoma
- Ultrasound appearance:
  - Solid renal mass
  - Polyhydramnios
  - Iso to hyperechoic compared with renal parenchyma
  - Peripheral and internal vascularity

**Wilm’s Tumour**
- Rare malignant tumour
- Indistinguishable from mesoblastic nephroma
- Ultrasound: echogenic, solid mass
  - Can replace entire kidney
  - Marked internal vascularity
  - May have cystic spaces

Take Home - Technique

1. Assess in real time
2. Systematic
   - Planes / Mental Checklist
3. Measure carefully
   - Correct Plane / Remeasure

Take Home

1. Have to see Stomach / Bladder!
   - Get Pt to go for a walk / reassess
2. Look for the Normal
3. Look for the Pathology
   - Don’t assume normal