

Post-natal outcomes of renal conditions diagnosed antenatally

Rebecca Hawkes

Paediatric Lead Sonographer

CUH NHS Foundation Trust

From Obstetric Team to Paediatric Team

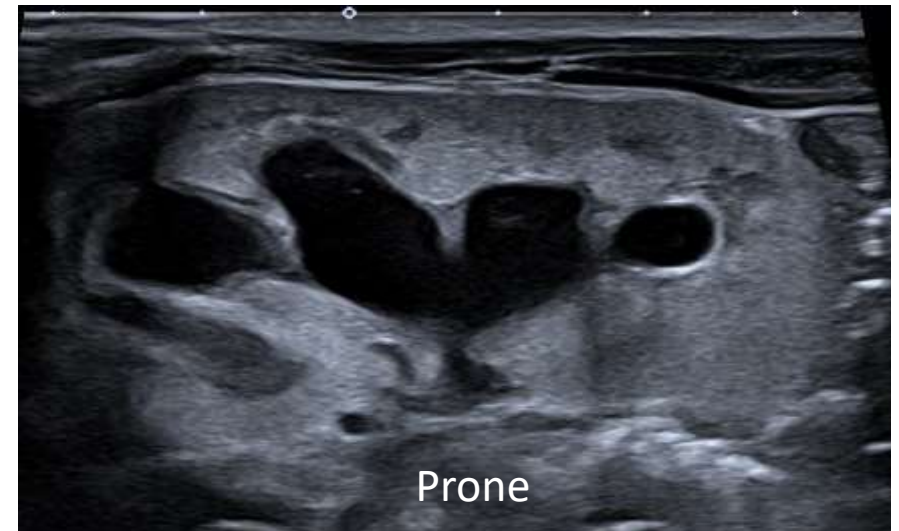
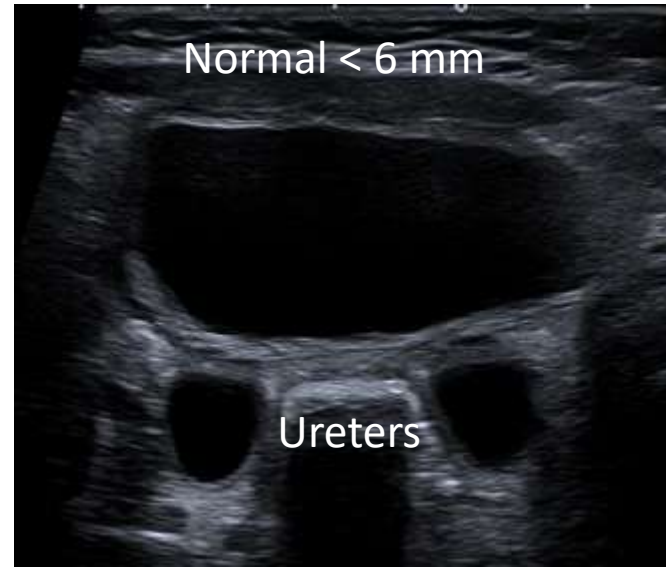
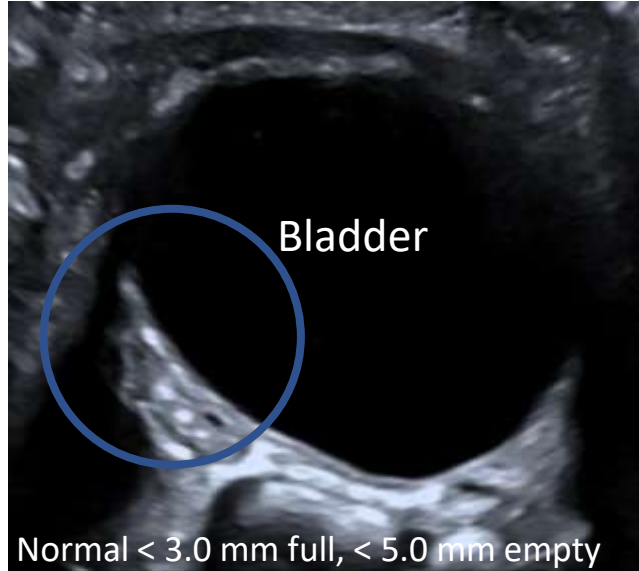
Contents

- The role of ultrasound and how we play our part
- Referrals for post-natal renal ultrasounds
- Pathways for low to high-risk babies
- Alternative imaging techniques
- Example-based cases:
 - Follow up imaging/intervention
 - Outcome

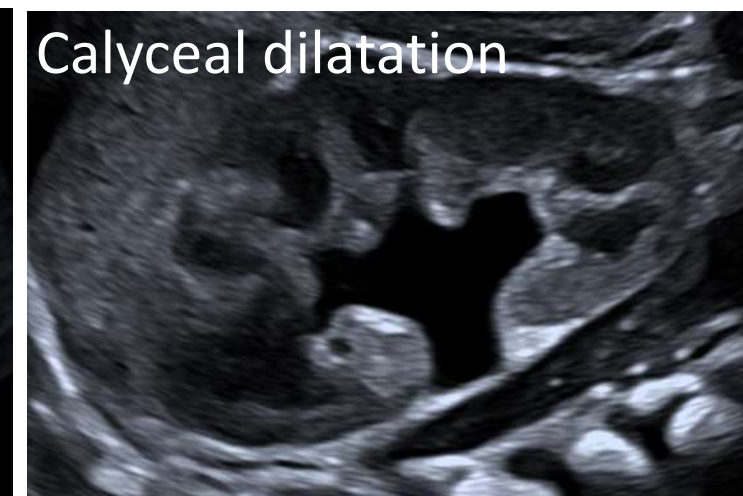
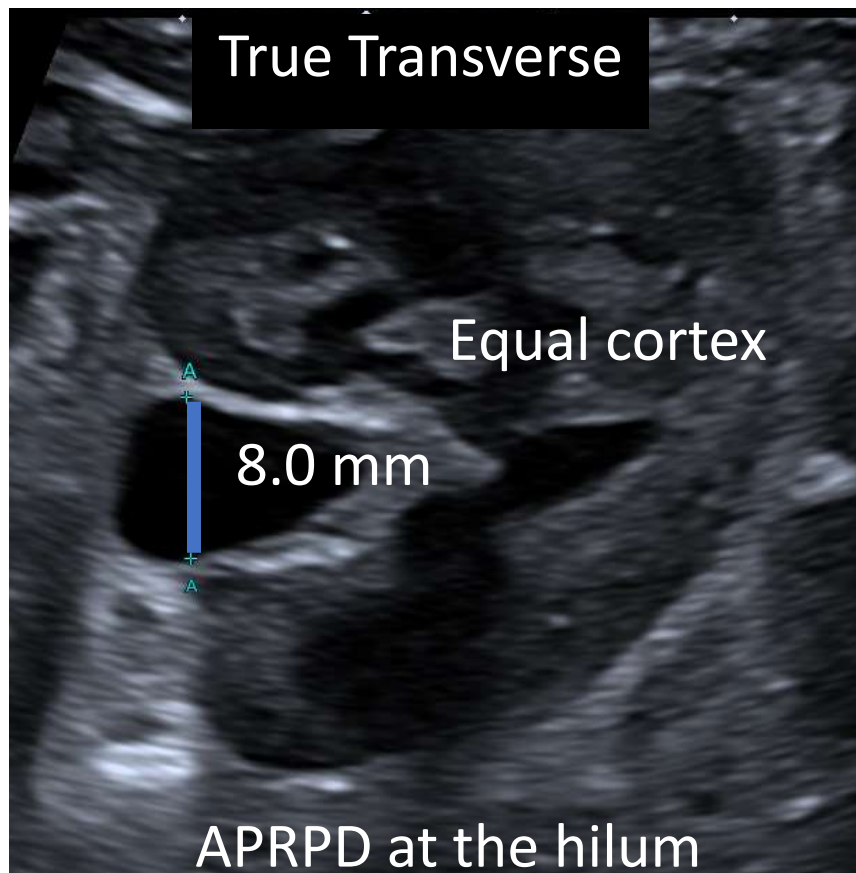
The role of the sonographer

- Systematic approach
- High quality images and accurate measurements
- Clear ultrasound report for the clinicians according to local and NICE guidelines
- Prompt referral for further imaging/investigation
- Communicate with the different teams – agree on terminology hydronephrosis vs pelvicalyceal (PC) dilatation

Systematic approach



Accurate imaging and reporting



Antero-posterior renal pelvis diameter (APRPD)

Degree of calyceal dilatation

Minor involving lateral calyces

Major involving the entire calyceal system

Referrals for renal ultrasound

- Majority of our work
- 1:100 babies affected
- 50-70% are physiological or transient and resolve
- Renal referrals are categorised **low to high-risk** depending on type of renal condition and/or degree of PC dilatation.

Obstructive conditions:

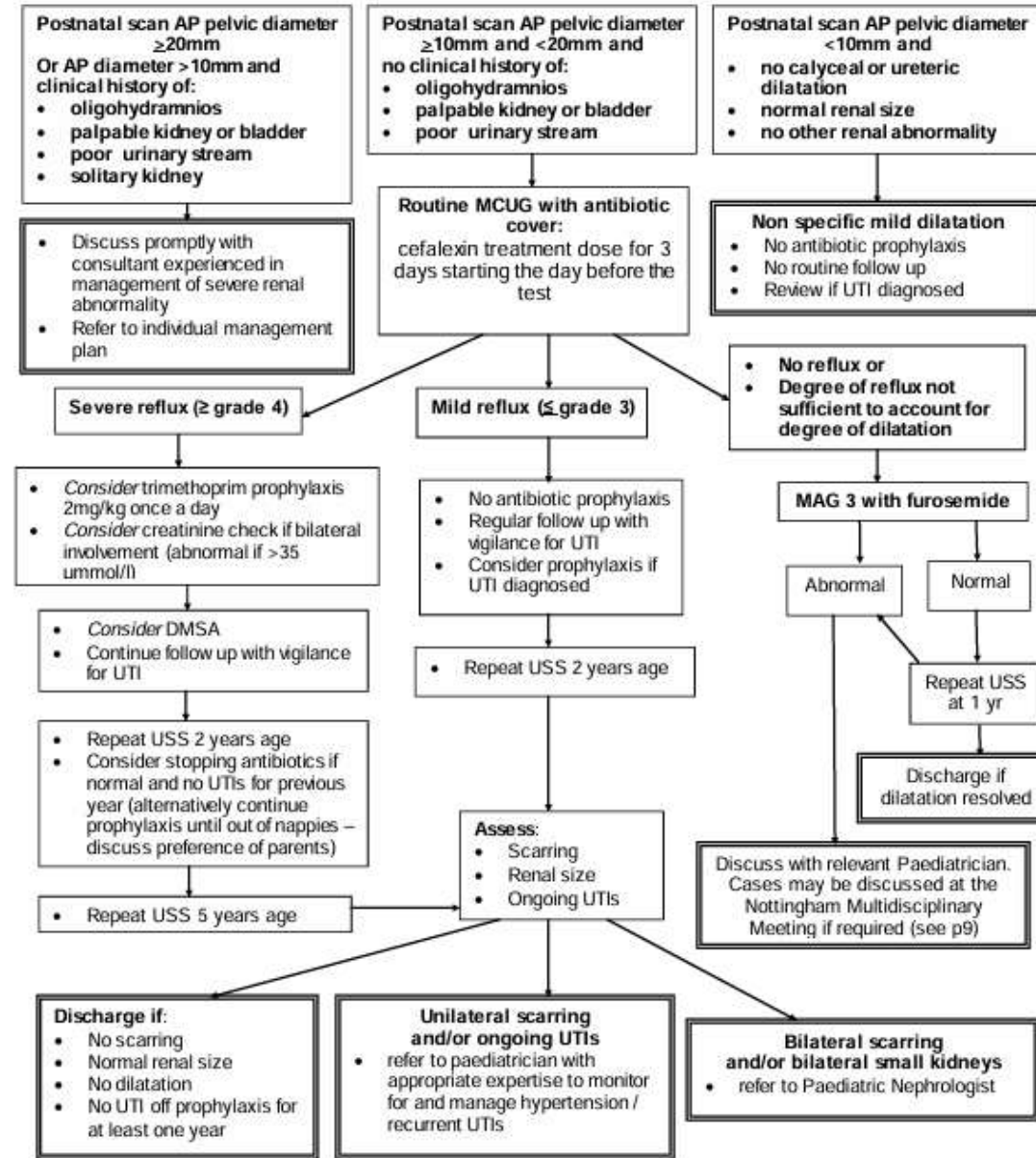
- Pelviureteric junction obstruction (PUJO)
- Vesicoureteric junction obstruction (VUJO)
- Posterior urethral valves (PUV)

Other conditions:

- Vesicoureteric reflux (VUR)
- Cystic diseases
- Normal variations (Ngyugen 2014)

3.3 Algorithm for management of urinary tract dilatation following postnatal ultrasound

Low,
moderate
or high-risk
pathway



Low risk

- **Unilateral APRPD 7.0 mm to 10.0 mm** at 20- week and 32-week antenatal ultrasound
- Uncomplicated normal variants
- Unilateral MCDK
- Ultrasound is undertaken at **4-6 weeks** as most cases are transient or physiological and resolve
- No calyceal or ureteric involvement and a normal bladder
- No UTI or additional concerns

Low risk: unilateral APRPD 8.0 mm

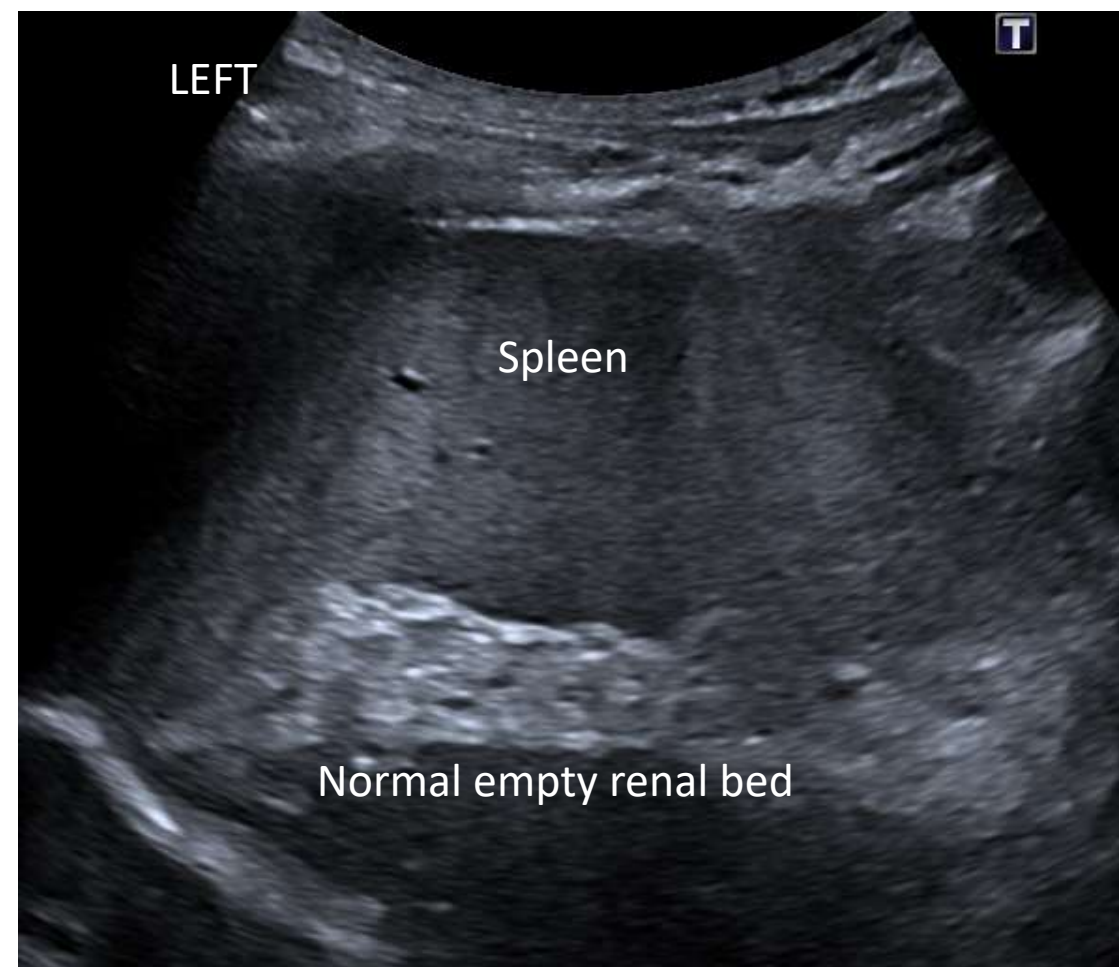
- **4-6-week post-natal ultrasound**
- Normal bladder and kidneys
- **APRPD < 10.0mm**
- No calyceal or ureteric dilatation



Outcome: Transient dilatation. No further imaging. No follow up. After clinical review, discharge

Low risk: normal variant

- Normal single kidney at the 3-week post-natal ultrasound
- Compensatory hypertrophy
- No clinical concerns
- Normal empty left renal bed



Normal variant: outcome

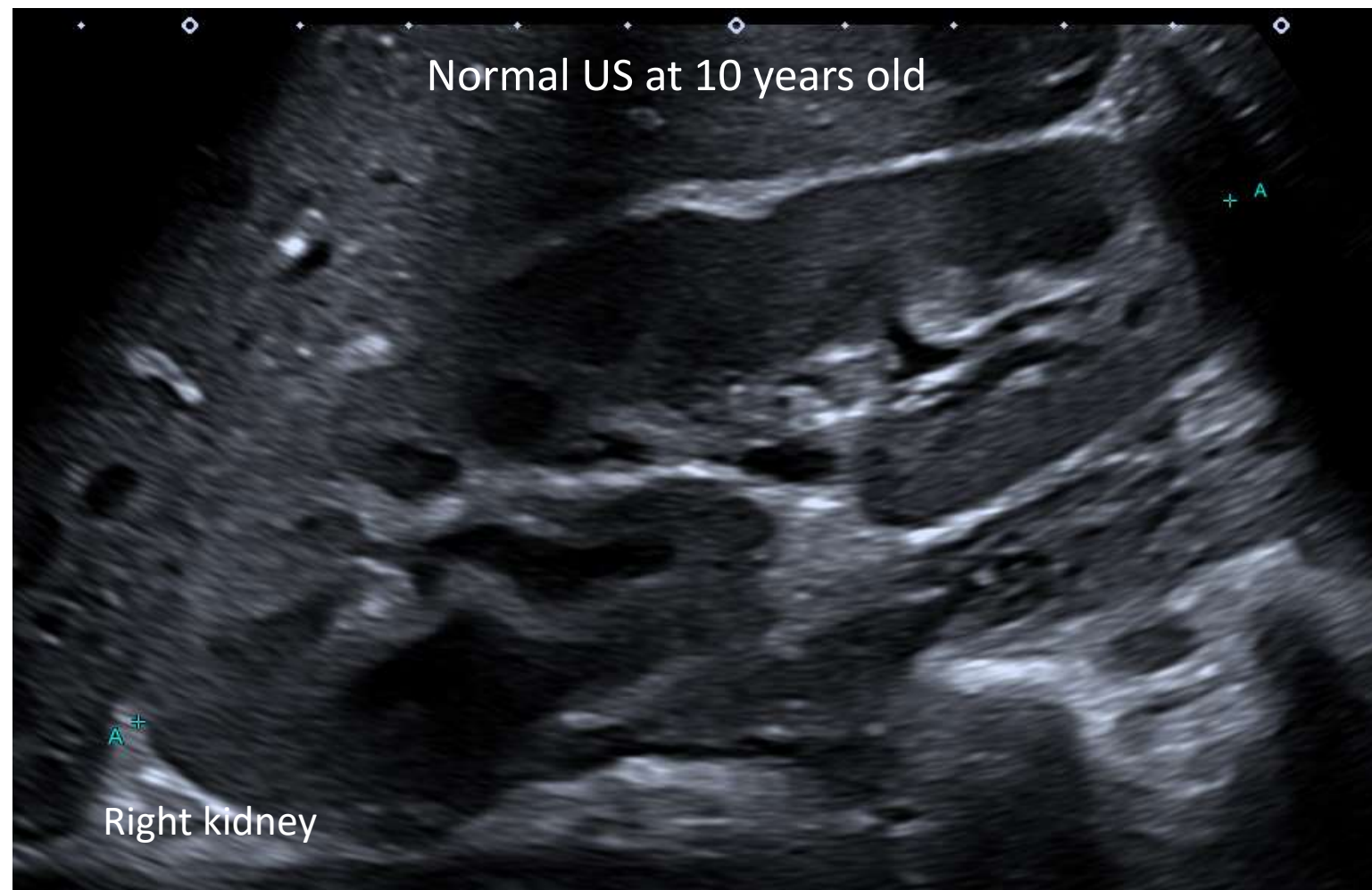
Follow up :

No alternative imaging
required

Annual US until
5 years old

Final ultrasound at
10 years old

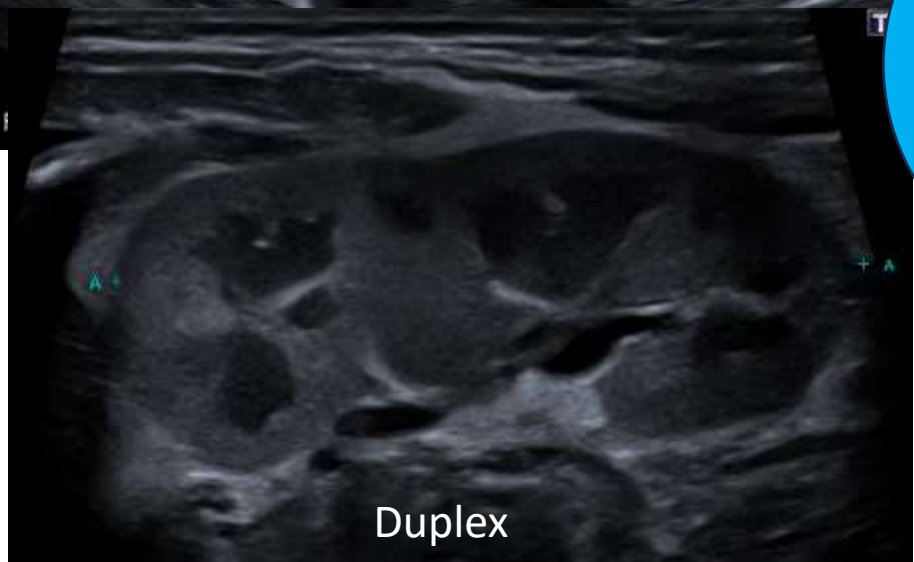
Outcome: discharge



Same applies for all uncomplicated normal variants

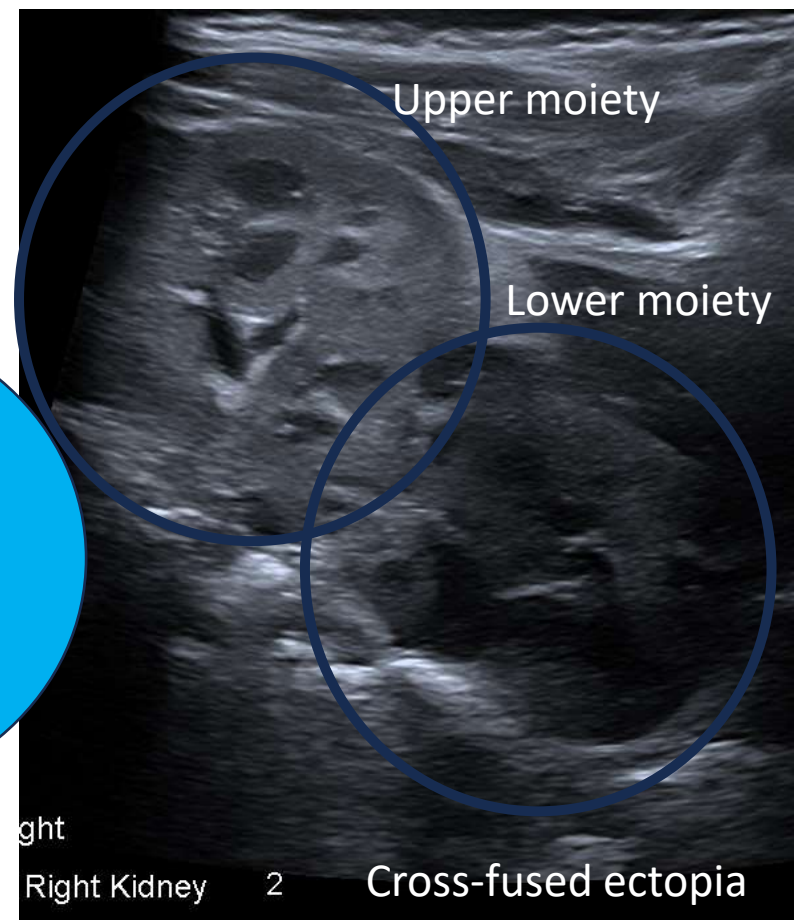


Horseshoe



Duplex

Yearly
ultrasound
until 5 years



Upper moiety

Lower moiety

Right

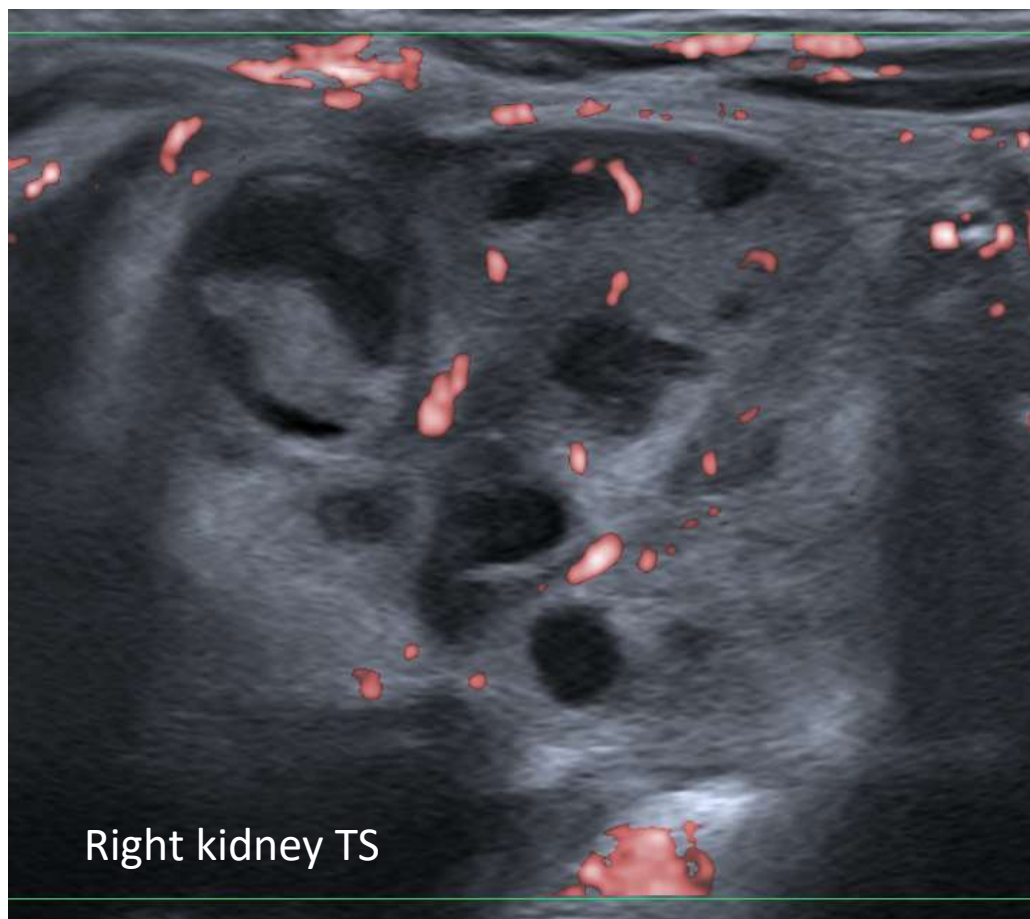
Right Kidney

2

Cross-fused ectopia

Low risk requiring additional imaging

Unilateral multicystic dysplastic kidney (MCDK)



- 1. DMSA confirmed no function
- 2. Agenesis of ureter and collecting system

Outcome/follow up:

- Repeat ultrasound in 3 months
- Then ultrasound at 1 year
- Yearly f/u if uncomplicated
- Nephrectomy only if so large it's affecting the baby

Unilateral MCDK outcome



Low risk cases only get followed up in clinic with repeat imaging if the patient later presents with new risk factors/symptoms

As a neonate:

Unexplained high fever
Urinary tract infection (UTI)
Off feeds
More sleepy than usual

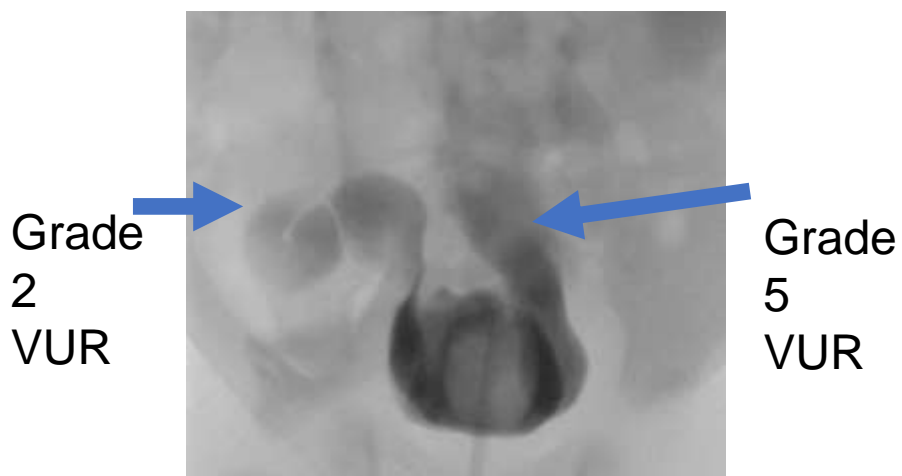
As a child:

UTI
Frequency
Urgency
Incontinence
Enuresis

Alternative imaging

Micturating cystourethrogram (MCUG):

Used to assess bladder function, to identify VUR and presence of ureterocele



Bilateral reflux



Ectopic ureter insertion

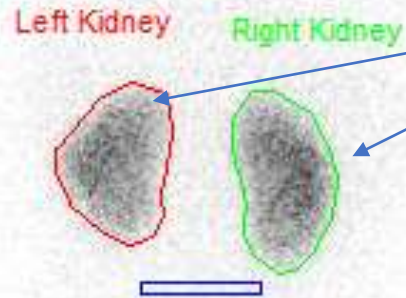


Bilateral ureteroceles causing PC dilatation and megaureters

Alternative imaging – nuclear medicine (NM)

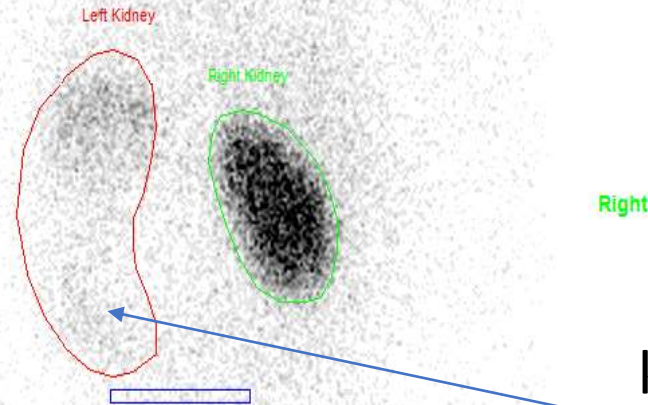
1. Static – DMSA- anytime after birth- cortical function and anatomical renal defects. 2-3 hrs post radionuclide injection
2. Dynamic – MAG3- 6/52 after birth (tubular function). but can get idea of RF after 2/52 and less radiation than DMSA. Immediately post injection.

DMSA shows normal function bilaterally



Motion Corrected
LT POST RT

Left

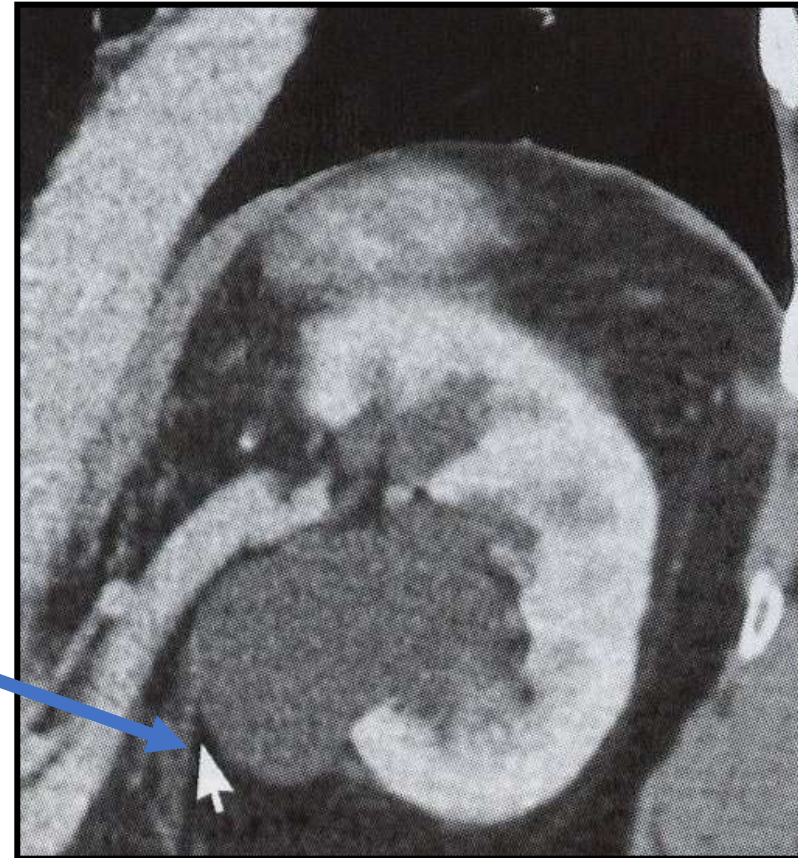


DMSA shows enlarged left kidney with reduced function in the case of PUJO

Alternative imaging - CT and MRI

- Rarely used
- For complex cysts/masses

Demonstrates an incidental PUIJ obstruction



Moderate risk

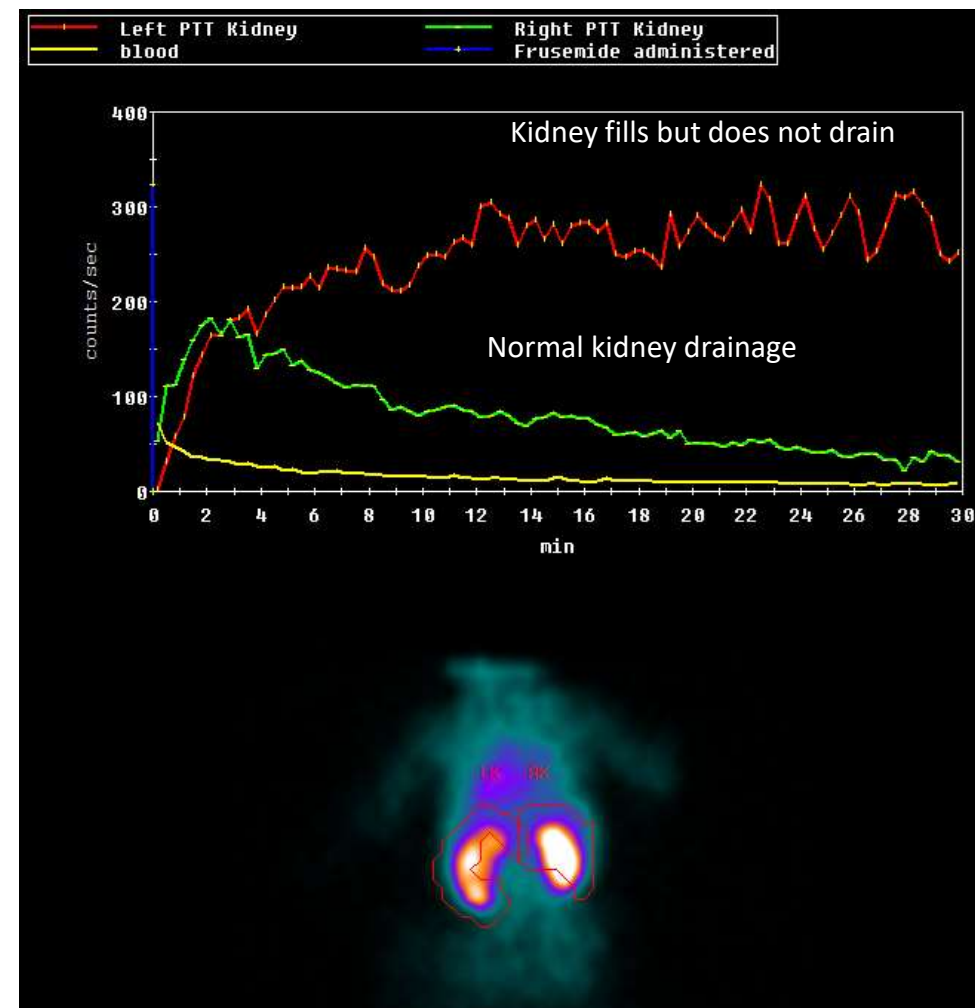
- Unilateral APRPD of 10 mm to 20 mm at 32-week antenatal ultrasound.
- Bilateral (7.0 mm -10 mm) +/- hydroureters
- Solitary kidney/normal variant (7.0 mm – 10 mm)
- Ureterocele with normal contralateral kidney
- Moderate risk - post-natal ultrasound must be undertaken **within in the first 2 weeks of life**
- Some literature suggests 2 follow up ultrasounds

Moderate risk- Intervention required

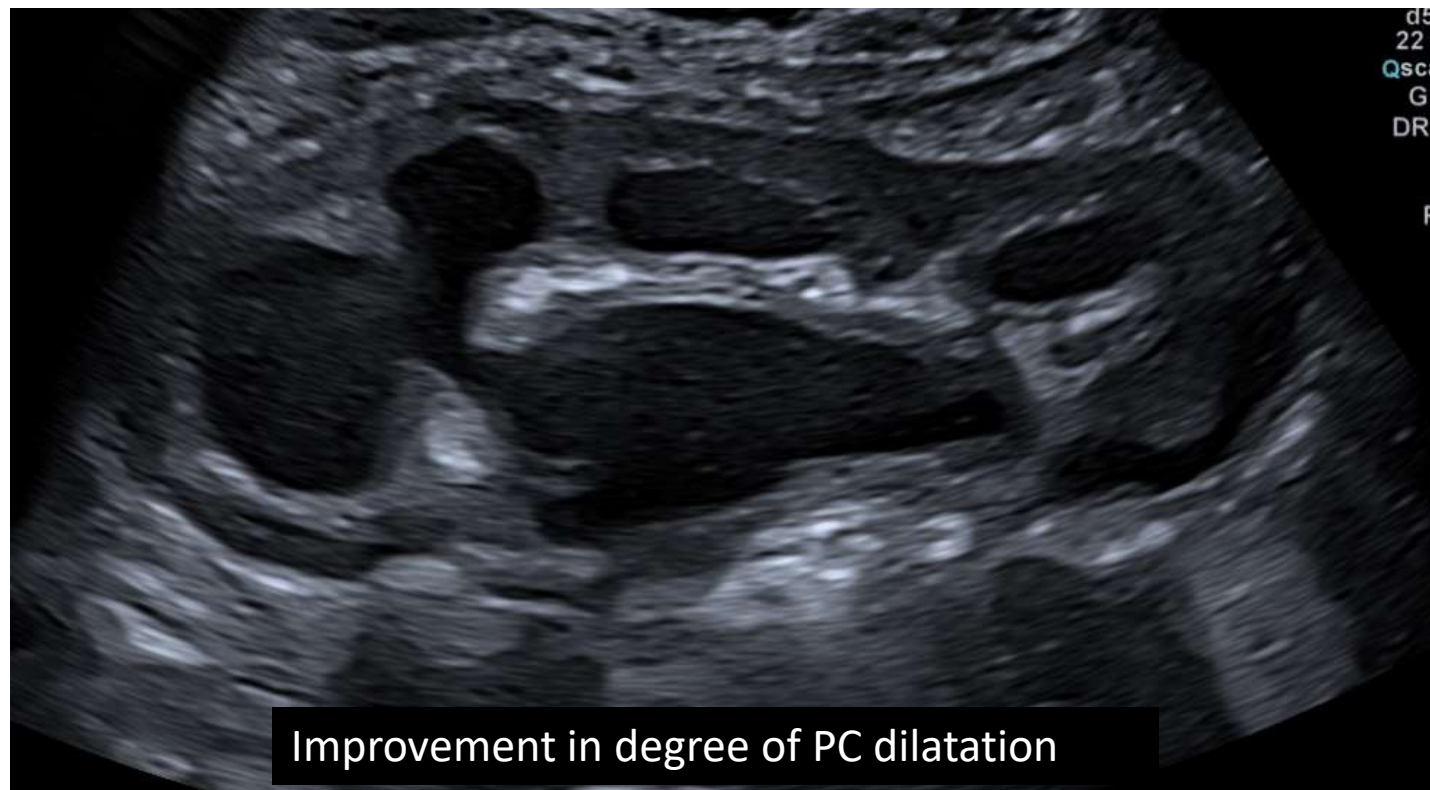
Antenatal Unilateral RPD of 20 mm



- Normal ureter and bladder
- PC dilatation on ultrasound in keeping with PUJO
- Slow drainage on DMSA
- Frequent UTIs affecting patient
- **Pyeloplasty required**



Moderate risk - Post pyeloplasty



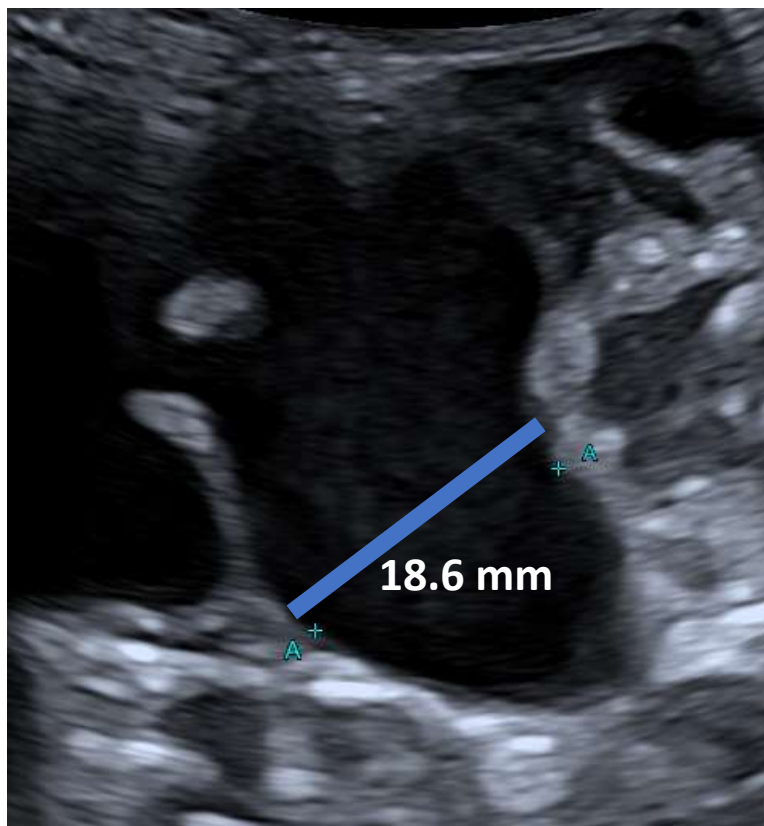
Timing of pyeloplasty is at discretion of the team providing care.

Decisions are based on

- 1) severity of the obstruction
- 2) worsening obstruction
- 3) concern regarding renal function e.g. deteriorating creatinine
- 4) recurrent UTIs

Follow up: Individual patient care plan – 3 monthly/yearly

Moderate risk: unilateral RPD 18.6 mm

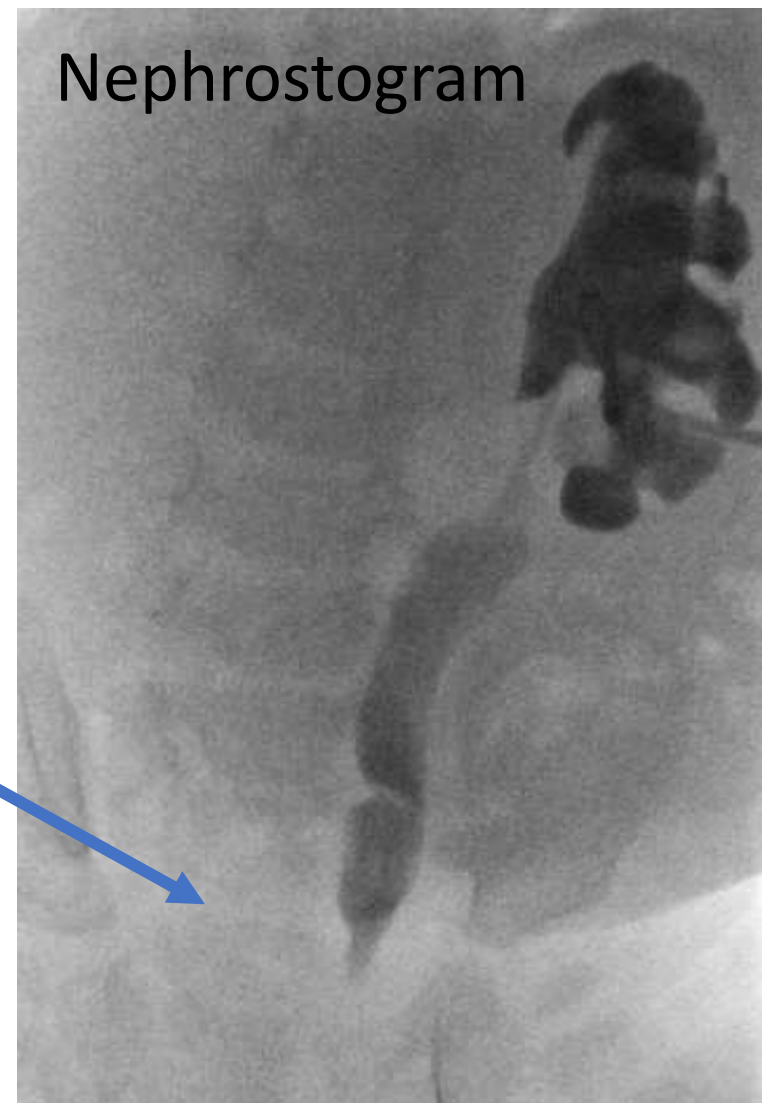


- Stable post-natal ultrasound at 3 weeks old
- Patient presented with UTI at 2 months old and then 4 months old

Moderate risk: diagnosis

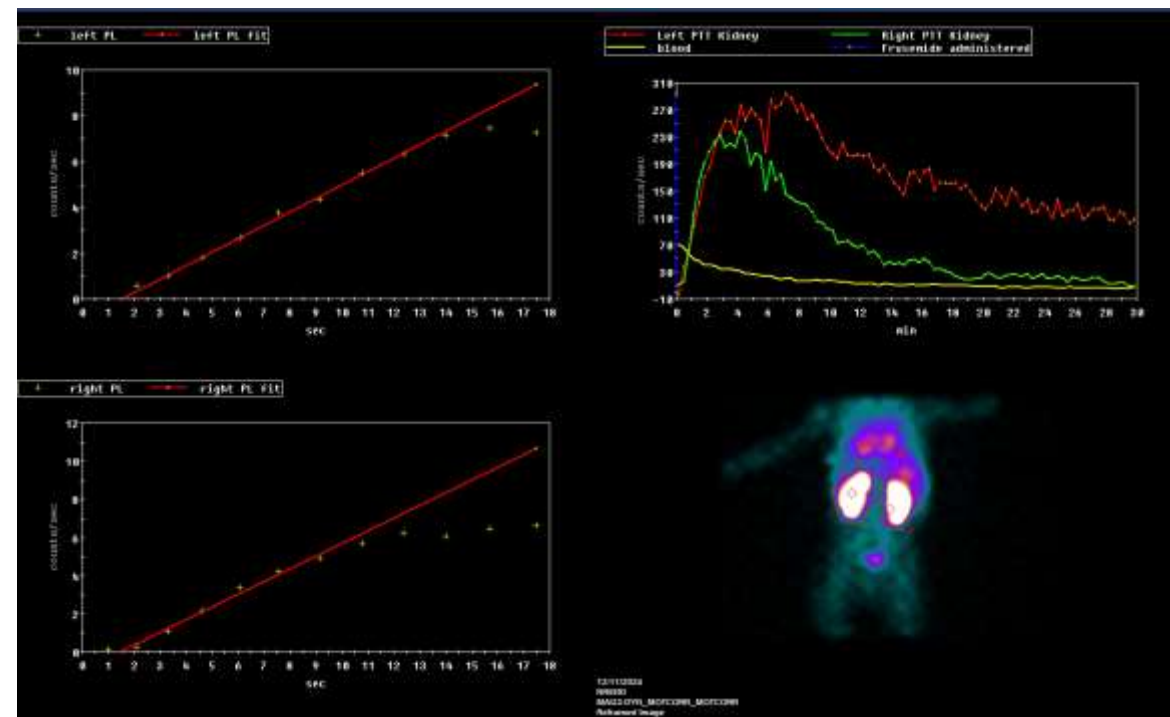
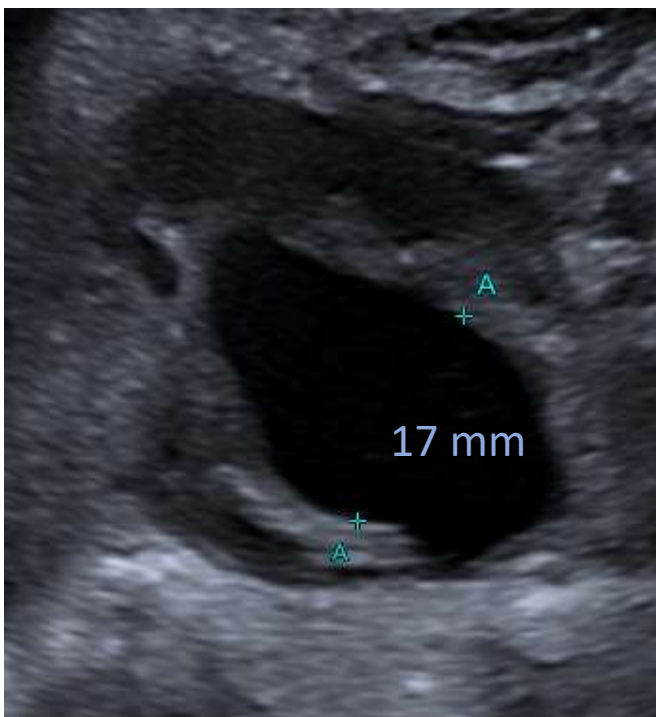
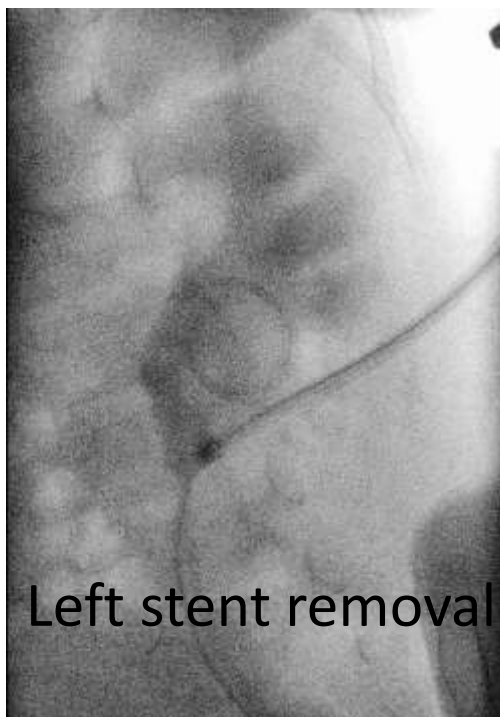
- Two severe UTIs by 5 months old. Treatment = pyeloplasty performed successfully
- 6 weeks post op stent removal - The dynamic study on the right demonstrated that there was also a VUJ obstruction
- 2nd surgery – open nephrostomy as catheter wire could not be passed through the VUJ

Nephrostogram



Completely
stenotic VUJ

Moderate risk case outcome



Outcome: Stable ultrasound at 10 months old post pyeloplasty and removal of VUJ obstruction

Nuclear medicine scan - normal uptake and drainage now demonstrating normal function at 6 months

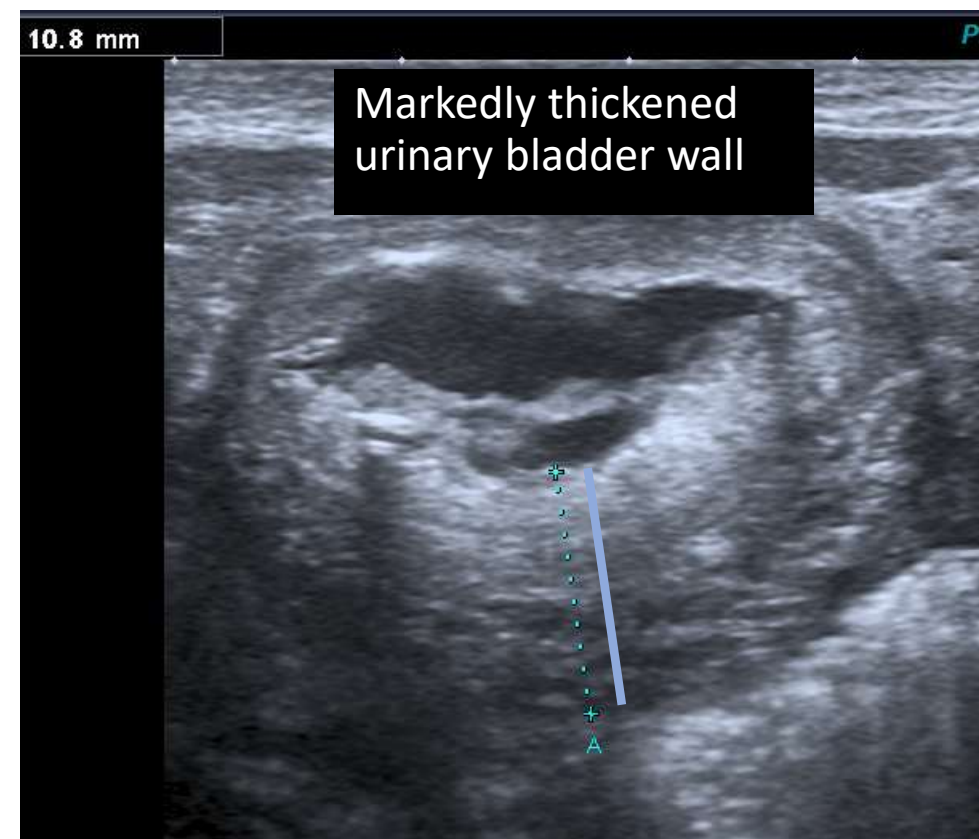
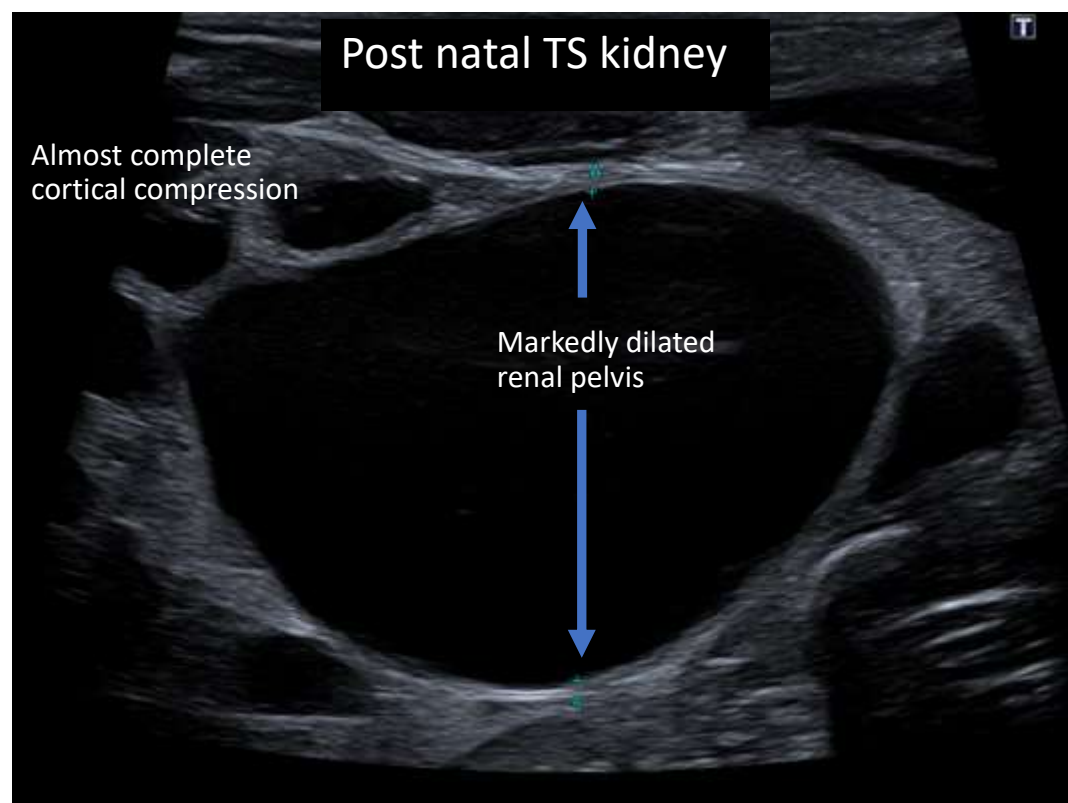
Follow up: 3 monthly ultrasound

High risk

- Antenatal APRPD > 20 mm (unilateral or bilateral)
 - APRPD > 10 mm in a solitary kidney +/- hydroureters
 - Complicated normal variant
 - Bilateral parenchymal abnormality – cystic/echogenic kidneys
 - Abnormal bladder appearance antenatally
- **All high-risk cases must be scanned within the first week of life but after 48 hrs to ensure corrected dehydration.** (Herthelius 2023)
 - **Urgent ultrasound within 24 hrs if male with enlarged bladder and bilateral PC dilatation - posterior urethral valves are suspected.**

High risk – PUV – Scan within 24 hrs

- Bilateral PC and ureteric dilatation antenatally



PUV further imaging

Intervention

- Urethral catheter then cystoscopic valve ablation
- Operated in the newborn period prior to discharge

Outcome

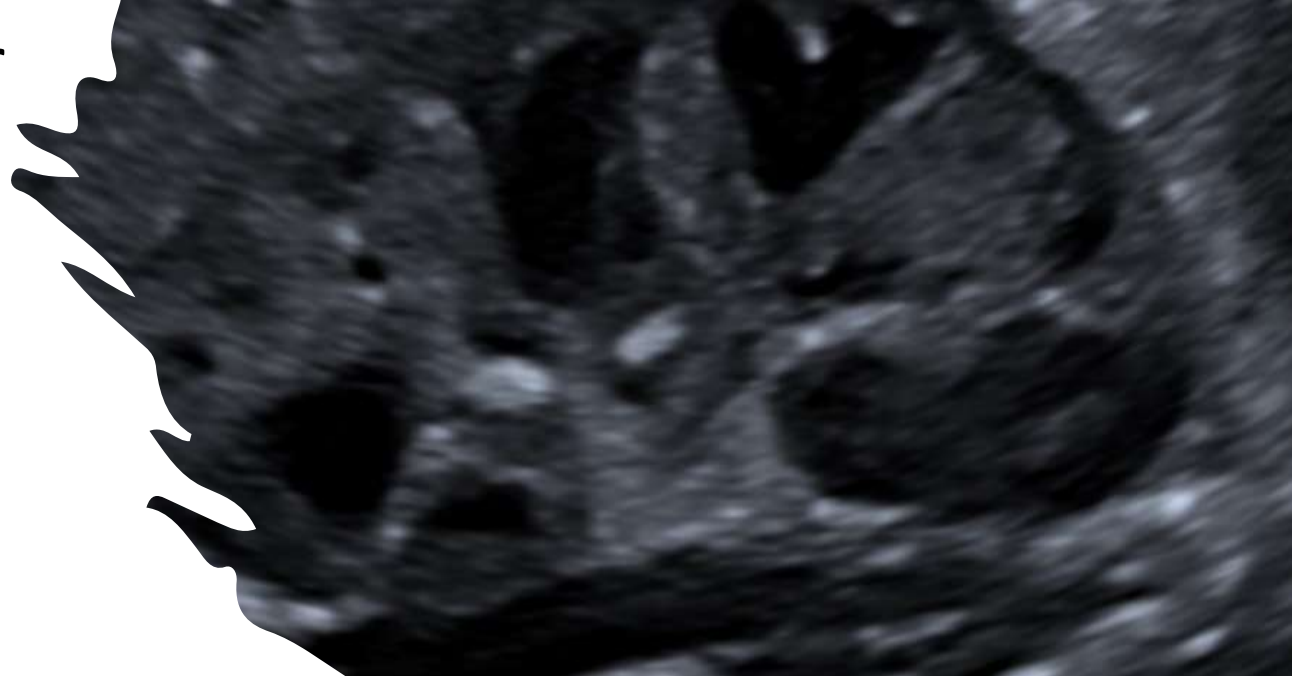
- Individual follow-up plan
- Serial ultrasounds 3-6 months



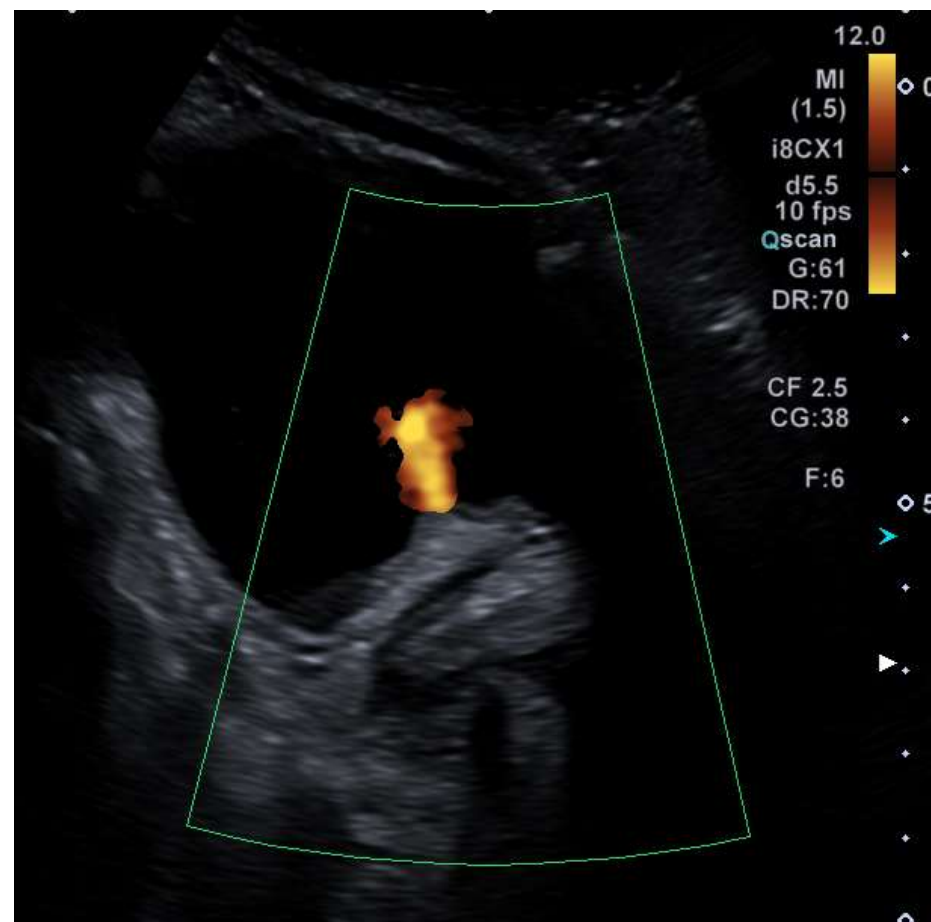
- MCUG assesses PUV and VUR and abnormal bladder
- This MCUG demonstrates PUV really well.

Summary

- Antenatally diagnosed renal conditions are the majority of our post-natal imaging workload
- Accurate imaging, reporting and communication is key
- No national consensus on a grading for PC dilatation it varies across institutions and literature
- **Accurate diagnosis with timely intervention limits scarring and preserves renal function for a better outcome.**



Thank you for listening and any (easy) questions?



References

1. Zuckerwise L. C (2021) Society for Maternal-Fetal Medicine. SMFM Fetal Anomalies Consult Series 4. Am J Obstet Gynecol.
2. Chitty, L.S and Altman, D.G. Charts of fetal size: kidney and renal pelvis measurements *Prenat Diagn* (2003); **23**:891-897
3. [Nottingham guidelines found at https://emeesykidney.nhs.uk](https://emeesykidney.nhs.uk)
4. National Institute for Health and Care Excellence CG54. Urinary tract infection in children: diagnosis, treatment and long-term management. London NICE 2007
5. Jegquier S, Rousseau O. Sonographic measurements of the normal bladder wall in children. *Am J Roentgenol* 1987; **149**:563-6
6. Hayden CK, Santa-Cruz FR, Amparo EG et al. Ultrasonographic evaluation of the renal parenchyma in infancy and childhood. *Radiology* 1984;**152**:413-7
7. Paliwalla M, Park K A practical guide to urinary tract ultrasound in a child: Pearls and pitfalls. *Ultrasound* 2014; **22**: 213-222
8. Becker AM. Postnatal evaluation of infants with an abnormal antenatal renal sonogram. *Curr Opin Pediatr* 2009; **21**:207-13
9. Herthelius M. Antenatally detected urinary tract dilatation: long-term outcome. *Pediatric Nephrology* (2023) **38**:3221–3227
10. Nguyen HT, Benson CB, Bromley B, Campbell JB, Chow J, Coleman B, Cooper C, Crino J, Darge K, Herndon CD, Odibo AO, Somers MJ, Stein DR. Multidisciplinary consensus on the classification of prenatal and postnatal urinary tract dilation (UTD classification system) (2014) *J Pediatr Urol* **10**:982–998.