BLK-MAX
Super Speciality Hospital

Antenatal hydronephrosis: Assessment & Management

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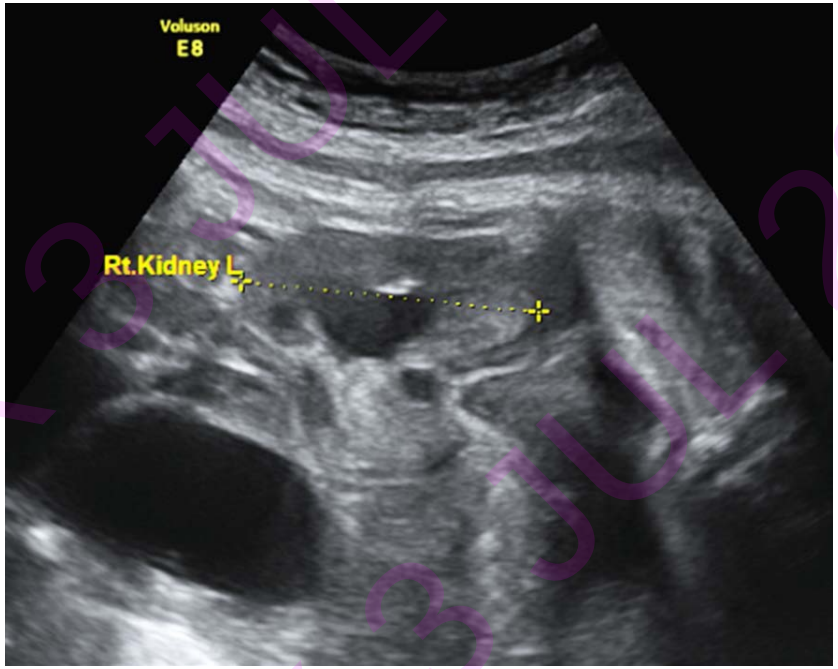
Case #1: 1-day old newborn

- On morning rounds, the mother of an otherwise well male newborn tells you that she was informed of some problem in one kidney on the ultrasound carried out at 6-months gestation. However, the problem seemed to have **resolved** on an ultrasound done later.

Gestation	Right kidney	Left kidney
25 weeks	Pelvic dilatation	Normal
	AP diameter: 8 mm	5 mm
32 weeks	Normal	Normal
	AP diameter: 6 mm	5 mm



The mother is worried. "What was the problem? Does my baby need any evaluation?"

How do you respond to that?

Questions??

What is antenatal hydronephrosis?

How common is it during pregnancy?

What does ‘APD’ mean?

Is antenatal Hydronephrosis always pathological?

What are the causes?

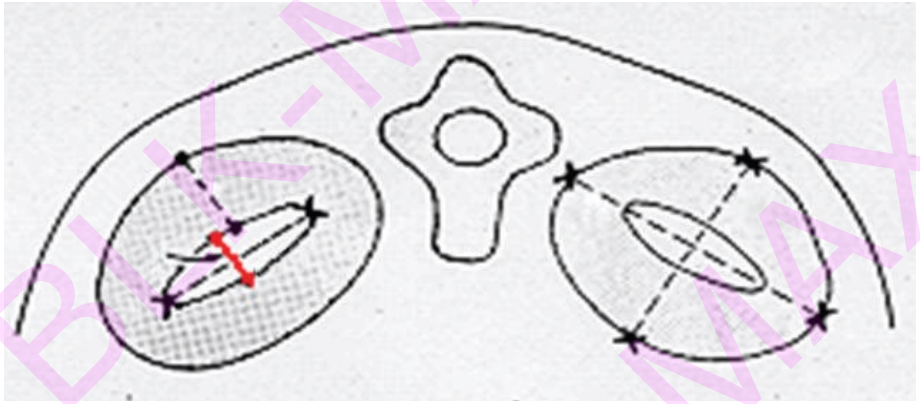
Antenatal Hydronephrosis(ANH)

- Ultrasound screening in antenatal period has led to increased recognition of hydronephrosis
- Prevalence between 0.6 and 5%, bilateral in 17 to 54%; 4-15% require post-natal intervention
- Pelvic dilatation is determined by the gestation, hydration, bladder distension
- Varying definitions; Grading systems for fetal & neonatal ultrasonography

- *Sinha A,;et al, Indian Society of Pediatric Nephrology. Revised guidelines on management of antenatal hydronephrosis. Indian Pediatr. 2013*
- *Dos Santos J, et al, A New Grading System for the Management of Antenatal Hydronephrosis. Clin J Am Soc Nephrol. 2015*
- *Arora M, et al, Significance of third trimester ultrasound in detecting congenital abnormalities of kidney and urinary tract-a prospective study. J Pediatr Urol. 2019 .*

Defining fetal hydronephrosis

Maximum antero-posterior diameter (APD) of renal pelvis in transverse plane

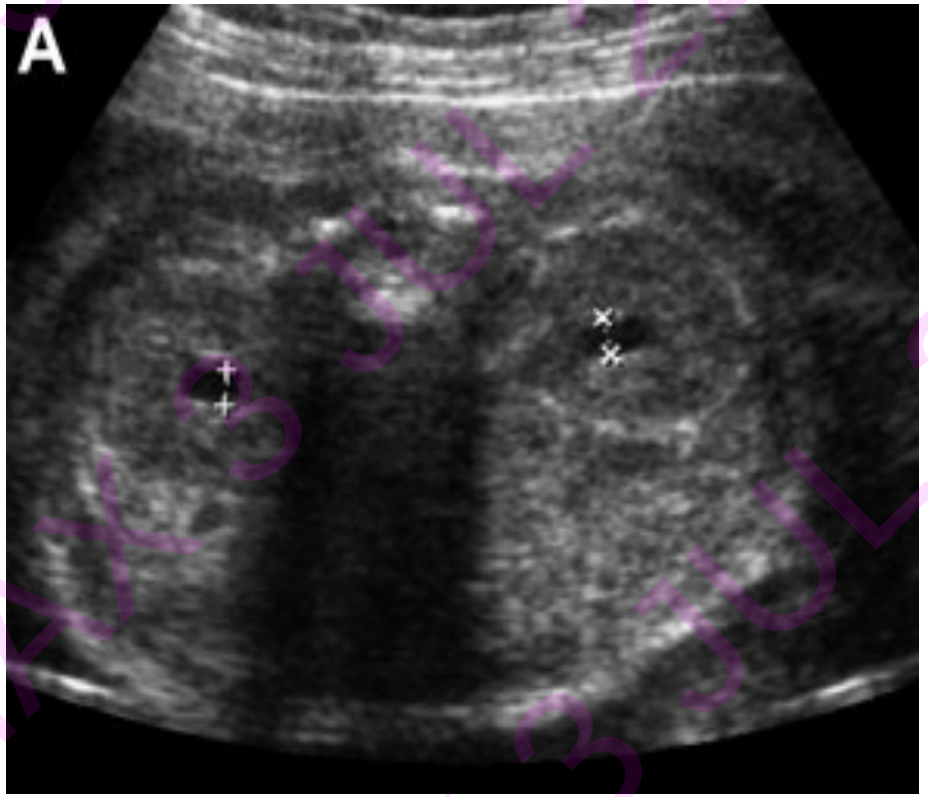


>4 mm in 2nd trimester
>7 mm in 3rd trimester

Disregards calyceal dilatation; parenchymal change

Objective; reproducible

Low intra- & inter- observer variation



Etiology of ANH

Etiology	*All cases (%)*
Transient hydronephrosis	41-88
Pelviureteric junction obstruction	10-30
Vesicoureteric reflux	10-20
Vesicoureteric junction obstruction, megaureter	5-10
Multicystic dysplastic kidney	4-6
Duplex kidneys (±ureterocele)	2-7
Posterior urethral valves	1-2
Others: urethral atresia, urogenital sinus, prune belly syndrome, tumors	Uncommon

The Society for Fetal Urology consensus statement on the evaluation and management of antenatal hydronephrosis. Journal of Pediatric Urology (2010) 6, 212e231

- Prospective study from New Delhi: 32,443 fetuses, ANH in 0.83%
- Criteria: APD ≥4mm in 2nd trimester, ≥7mm in 3rd trimester
- >70% of second trimester HDN had resolved postnatally, while
- >85% of third trimester HDN with renal pelvic diameter >10mm, resulted in post natal CAKUT

APD >10 mm in the post-natal Ultrsound is significant

Case#2

Unilateral HDN Right Kidney

At 20 weeks

APD 18 mm

At 32 weeks

APD 36 mm

Case # 2

- What are the observations that should be reported in USG ?
- How would you advise ante-natal follow-up for this lady?
- Is there any indication for early delivery?

USG Criteria

- Kidney size
- Measurements of pelvi-calyceal dilatation (pelvic diameter)
- Cortical / parenchymal thickness
- Character of renal parenchyma
- Any ureteric dilatation
- Bladder filling and emptying
- Bladder wall thickness
- Amniotic fluid volume
- Abnormalities in other systems (spine, heart, etc)

How to assess Prognosis in Antenatal period?

Gradation by pelvic anterio-posterior diameter

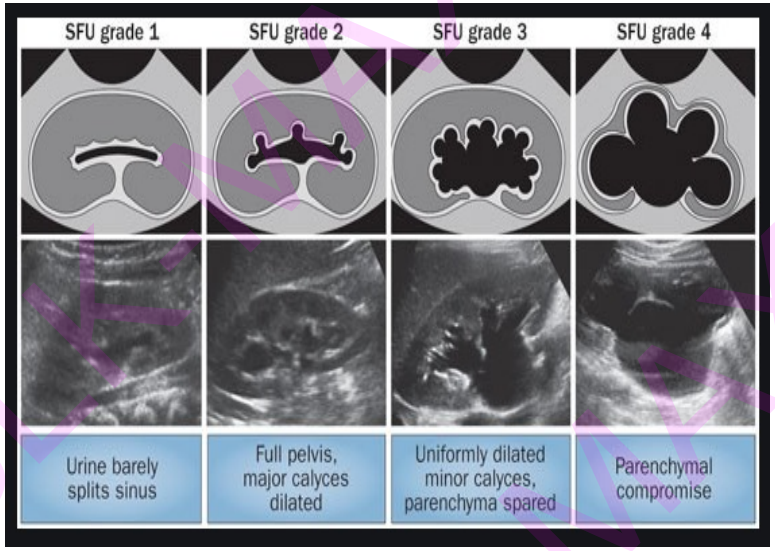
Classification of Hydronephrosis	Renal pelvic APD		Risk of Postnatal pathology
	Second trimester	**Third trimester**	
Mild	4-6 mm	7-9 mm	12%
Moderate	7-10 mm	10-15 mm	45%
Severe	>10 mm	>15 mm	88%

VUR is the exception

Lee RS eta al. (2006) Antenatal hydronephrosis as a predictor of postnatal outcome: a meta-analysis. Pediatrics 118:586–593

SFU grading

Grade	Renal pelvic complex	Renal parenchymal thickness
0	Intact	Normal
I	Mild splitting	Normal
II	Moderate splitting (confined to renal border)	Normal
III	Marked splitting (outside renal border, calyceal dilatation)	Normal
IV	Pelvicalyceal dilatation	Thin



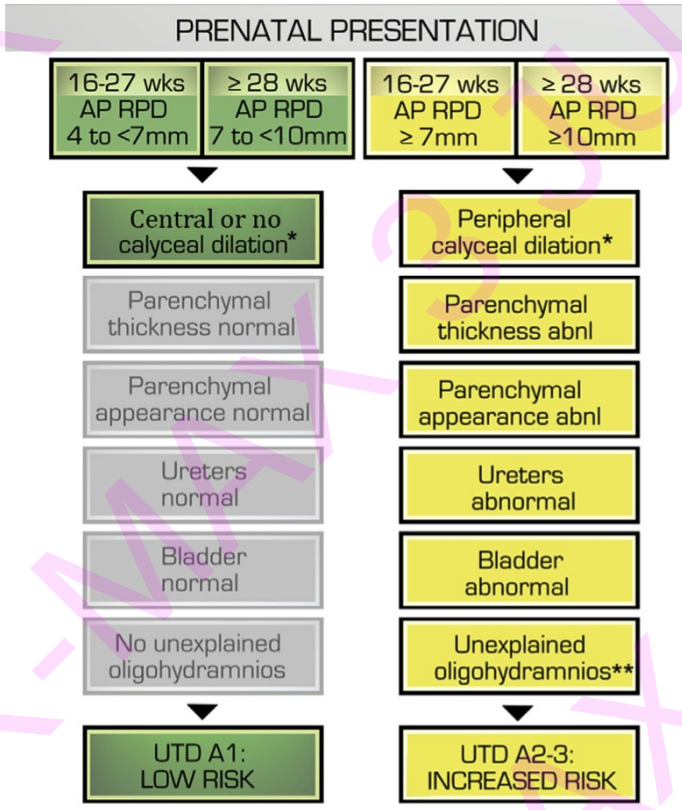
Fernbach SK, Maizels M, Conway JJ (1993) Ultrasound grading of hydronephrosis: introduction to the system used by the Society for Fetal Urology. Pediatr Radiol 23:478–480

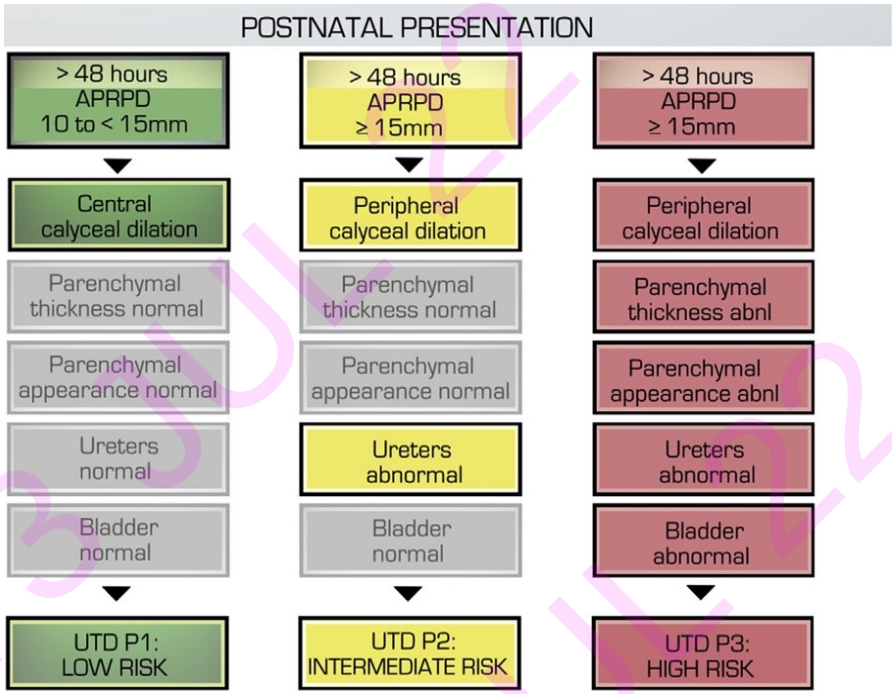
Meta-analysis of data extracted from seven papers showed stabilization of pelviectasis in 98% of patients with grades 1–2 (95% CI 0.93–1.0; p=0.0008) and in 51% of patients with grades 3–4 (95% CI 0.34– 0.68; p <0.00001).

Outcome of isolated antenatal hydronephrosis: a systematic review and meta-analysis. Pediatr Nephrol. 2006 Feb;21(2):218-24.

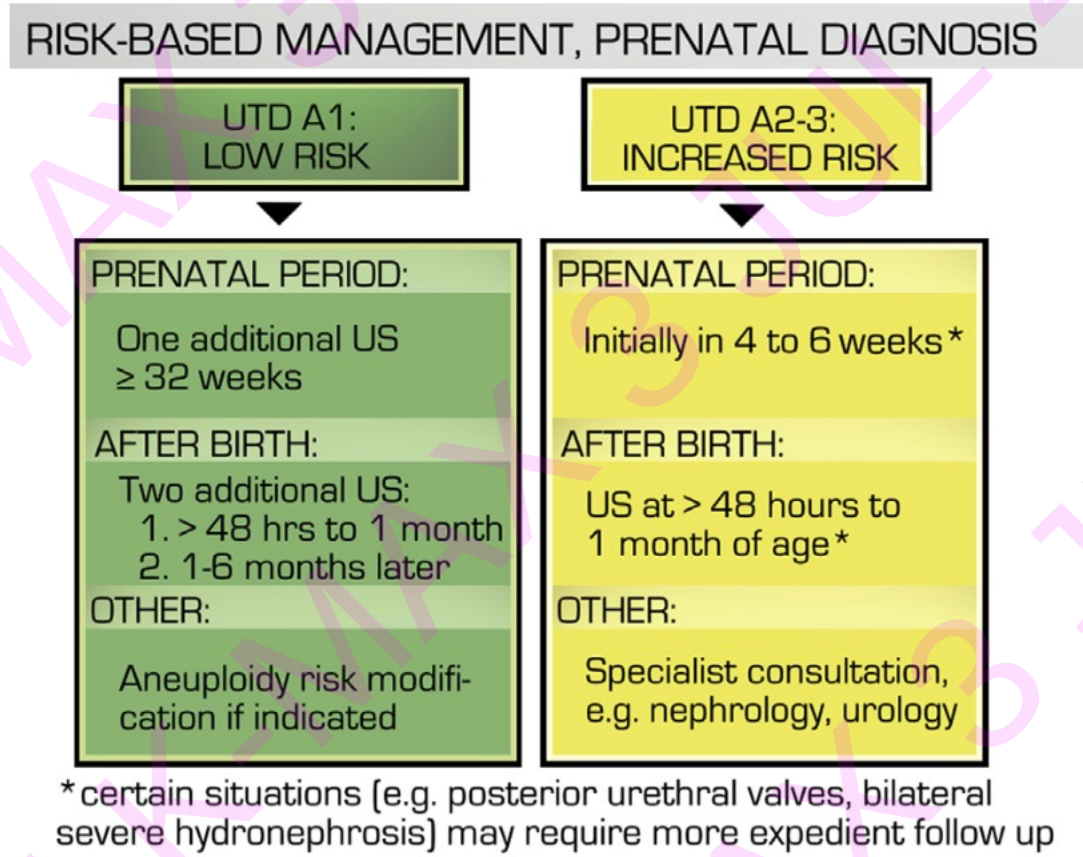
UTD Classification

Ultrasound findings	Time at presentation		
	16–27 weeks	≥28 weeks	Postnatal (>48 h)
Anterior-Posterior Renal Pelvis Diameter (APRPD)	<4 mm	<7 mm	<10 mm
Calyceal dilation			
Central	No	No	No
Peripheral	No	No	No
Parenchymal thickness	Normal	Normal	Normal
Parenchymal appearance	Normal	Normal	Normal
Ureter (s)	Normal	Normal	Normal
Bladder	Normal	Normal	Normal
Unexplained oligohydramnios	No	No	NA

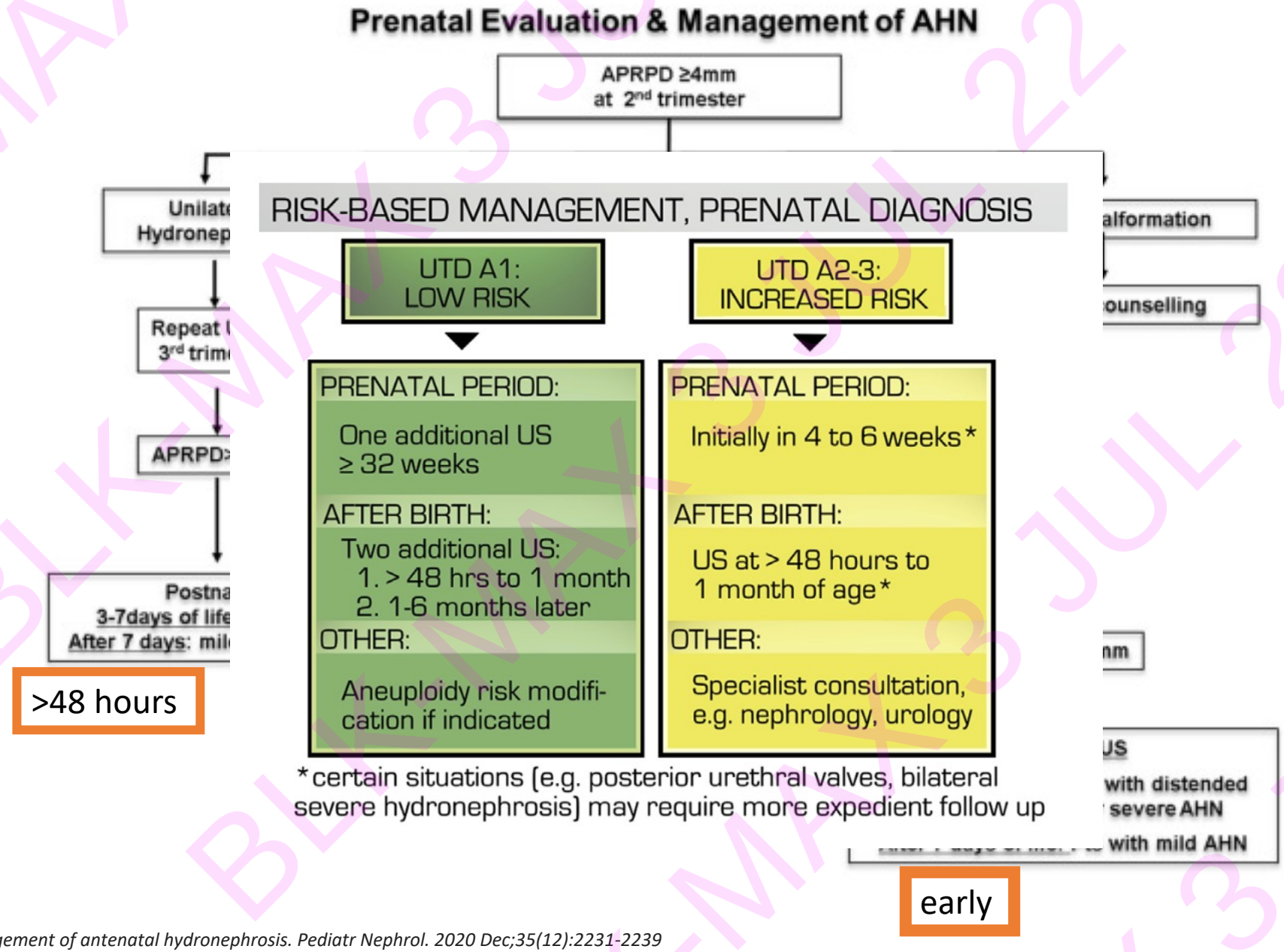




Nguyen TH et al. Multidisciplinary consensus on the classification of prenatal and postnatal urinary tract dilation. J Pediatr Urol 2014



*certain situations (e.g. posterior urethral valves, bilateral severe hydronephrosis) may require more expedient follow up



Yalçınkaya F, Özçakar ZB. Management of antenatal hydronephrosis. Pediatr Nephrol. 2020 Dec;35(12):2231-2239

Post Natal Follow up of Low Risk ANH

- The challenge is to select patients who have damaging pathologies, investigate and treat them early and aggressively, while avoiding over- investigating those that will have a benign course.

- Post natal USG → Individualised investigations and management

- No hydronephrosis in postnatal USG: repeat at 4-6 weeks of life
- Two consecutive normal USG = resolution

- "*Stable isolated* HDN" - Sequential ultrasonography: initially 3 - 6 monthly, then 6-12 monthly till resolution or age 5-6 years.

"Current approach is becoming increasingly conservative during diagnosis and follow-up of these patients with less imaging and close follow-up."

- *Yalçınkaya F, Özçakar ZB. Management of antenatal hydronephrosis. Pediatr Nephrol. 2020 Dec;35(12):2231-2239*
- *Revised guidelines on management of antenatal hydronephrosis. Indian J Nephrol. 2013;23(2):83–97. doi:10.4103/0971-4065.109403*

Post Natal Follow up of High/Intermediate risk ANH

- Ultrasound KUB: One ultrasound between 3-7 days; 24-48 hrs if severe bilateral HDN or obstruction suspected

- MCUG:
  - Within 24-48 hrs if abnormal bladder, suspected lower tract obstruction
  - Moderate to severe HDN, Ureterocele, duplex system
  - Infants with ANH who develop UTI

- DTPA scan after 6-8 weeks infants with moderate to severe unilateral or bilateral hydronephrosis with suspected PUJO/VUJO (SFU grade 3-4, APD >10 mm) or those *who do not show VUR on MCU*

- DMSA scan after 6 weeks for VUR

Antibiotic Prophylaxis

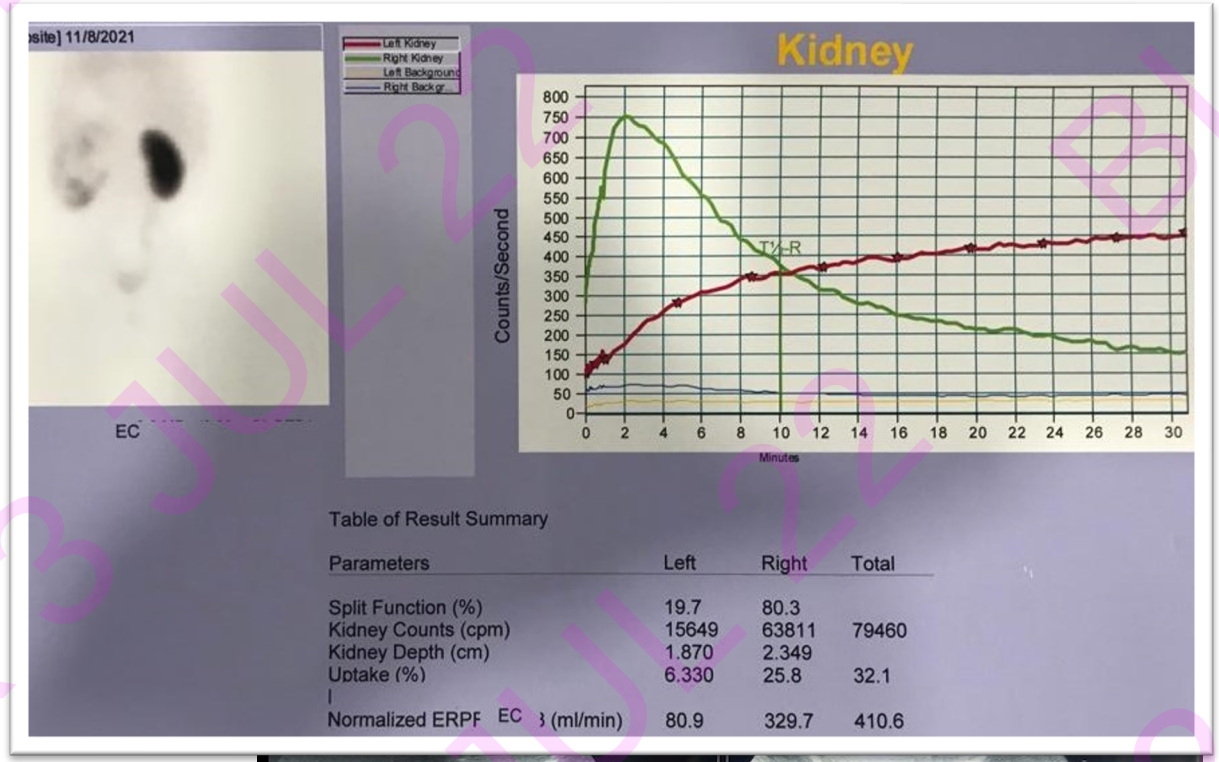
- All antenatal and post-natal hydronephrosis need to be counselled about risk of UTI

- Infants with post-natally confirmed moderate to severe hydronephrosis(SFU 3-4, APD >10 mm) or dilated ureter receive antibiotic prophylaxis while awaiting evaluation

- All infants detected to have VUR receive prophylaxis through the first year of life

Case # 2

- Delivered at term
- Clinically stable and feeding well
- Urine passed in good stream
- Bladder not palpable



Gender : Male
Age : 3 Days

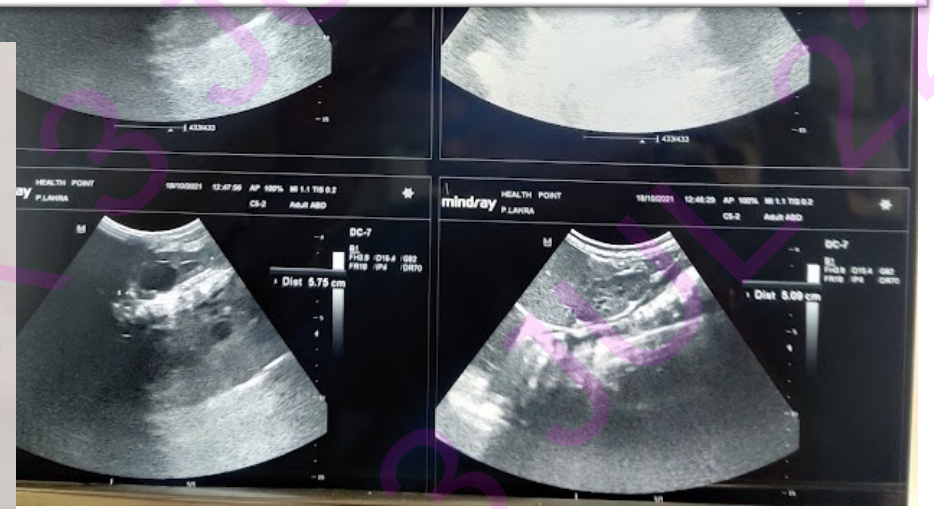
Right kidney: Measures 4.7 cm, in length with cortical thickness of 0.5 cm.

Left kidney is enlarged in size and shows thinned out cortex. Cortico-medullary differentiation is maintained. No evidence of calculi. Moderate to large hydronephrosis with ballooning of left renal pelvis. AP diameter of left renal measures 43 mm. Left ureter not dilated.
Left kidney: Measures 7.1 cm, in length with cortical thickness of 0.3 cm.

Urinary bladder: Well distended. No evidence of urinary bladder wall thickening or calculi.

Prostate: Normal for age.

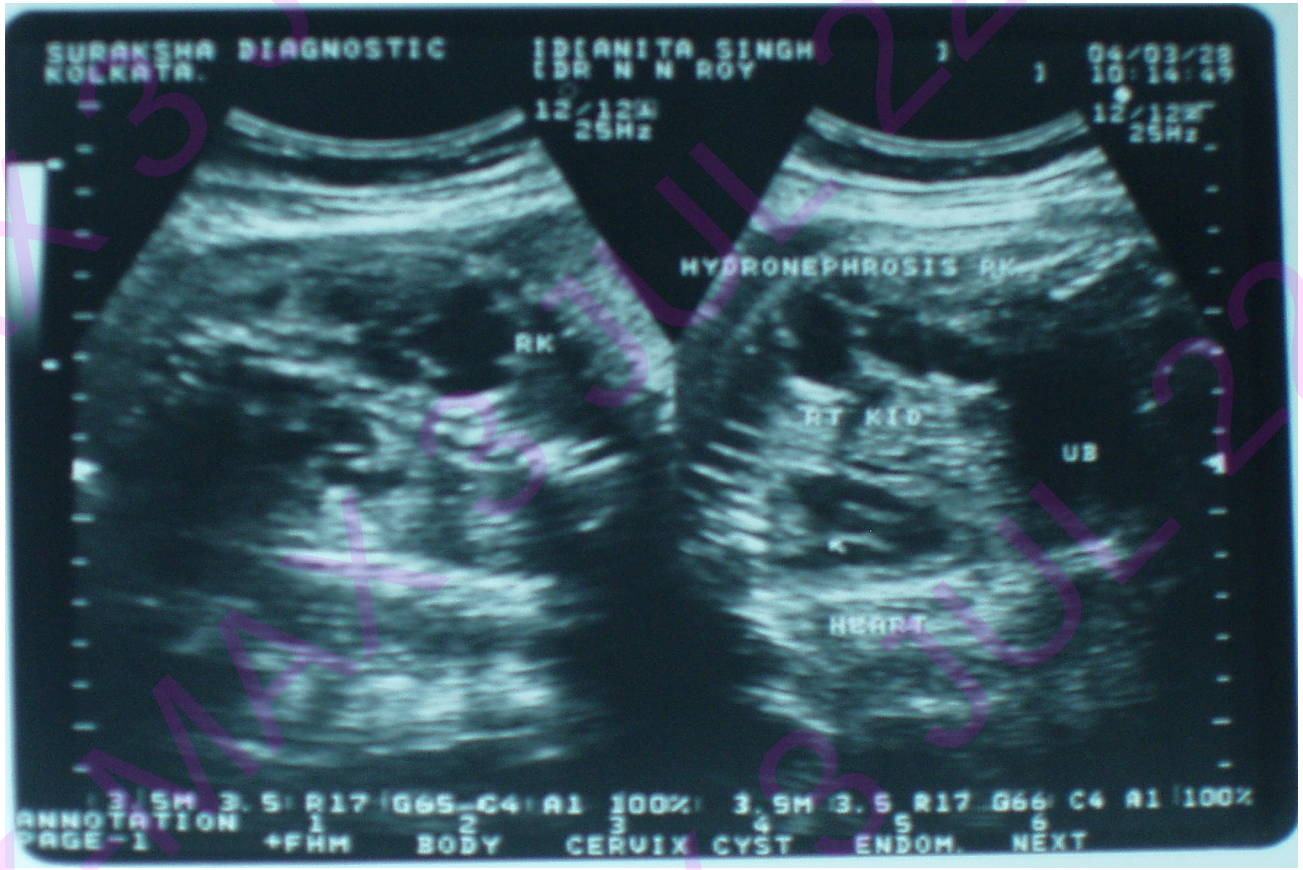
MIS: No evidence of ascites. No evidence of bowel wall thickening or gut dilatation.



Left Pelvi-ureteric Junction Obstruction

Case # 3

- Bilateral HDN
- Persistently dilated bladder
- Borderline oligohydramnios



Case # 3

- What are the possible causes of bilateral HDN ?
- How should this patient be followed up in the antenatal period?
- Are there any indications for termination of pregnancy ?
- In critical cases indications for antenatal intervention ?

Antenatal Interventions

- Amnio-infusions
- Fetal Urine Biochemistry
- Fetal vesico-amniotic shunt
- Fetoscopic PUV ablation

Threshold values of fetal urine parameters that predict good renal function

Parameter	Common units
Sodium	<100 mEq/L
Chloride	<90 mEq/L
Calcium	<4 mEq/L
Osmolarity	<210 mOsm/L
B2-Microglobulin	<10 mg/L
Total protein	<20 mg/dl

- ONLY in centres with expertise
- Improved immediate postnatal survival and ventilation requirement, however the long term renal survival has not improved with these procedures.
- Accidental stimulation of labour, IUD and infection are the associated risks.

- *Amnioinfusions to Treat Early Onset Anhydramnios Caused by Renal Anomalies: Background and Rationale for the Renal Anhydramnios Fetal Therapy Trial. Fetal Diagn Ther. 2019;45(6):365-372.*
- *The Percutaneous shunting in Lower Urinary Tract Obstruction (PLUTO) study and randomised controlled trial: evaluation of the effectiveness, cost-effectiveness and acceptability of percutaneous vesicoamniotic shunting for lower urinary tract obstruction. Health Technol Assess. 2013 Dec;17(59):1-232.*
- *Current applications of in utero intervention for lower urinary tract obstruction. J Pediatr Urol. 2015 Dec;11(6):341-7.*
- *Posterior Urethral Valve: Outcome of antenatal intervention. Int J Urol. 2006 October;13(10): 1317-22.*

Indications for Early Delivery

- Viable fetus with severe oligohydramnios →
- Potential complications such as fetal lung hypoplasia, fetal distress, arrested fetal growth.

- Antenatal Steroid for inducing lung maturity

"Gestational age at appearance of oligo- or anhydramnios and BV at diagnosis can accurately predict mortality and morbidity in fetuses with LUTO."

Fontanella F et al. Antenatal staging of congenital lower urinary tract obstruction. Ultrasound Obstet Gynecol. 2019 Apr;53(4):520-524

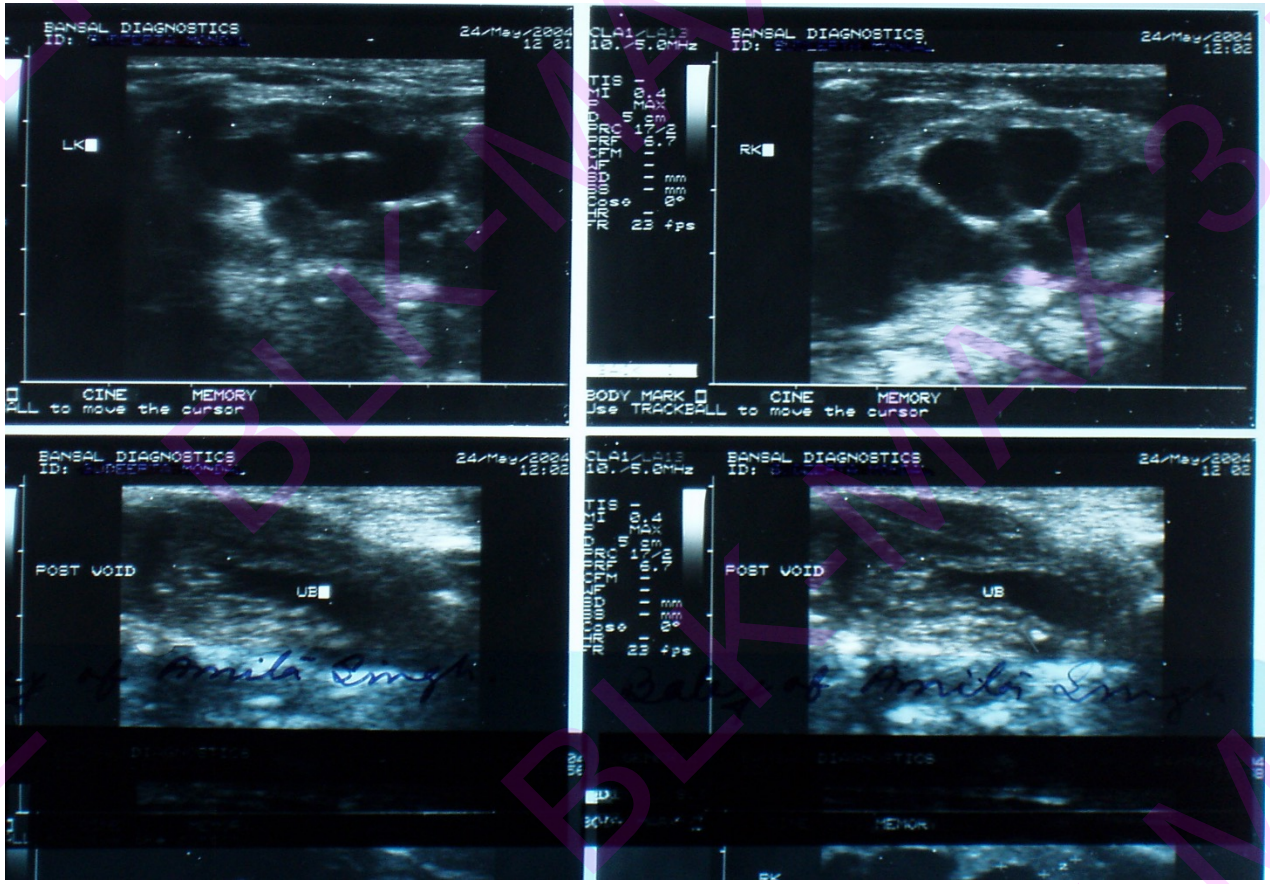
Delivery of a baby with suspected LUTO

- Respiratory management
- Urinary stream, bladder emptying →Ensure bladder drainage
- The baseline renal function, electrolytes, acid-base balance is recorded.
- Early USG
- Urinary infection and metabolic derangements if any, are corrected

- Once the baby is medically stable, the specific investigations (MCUG) and intervention is performed. Most commonly, this involves fulguration of PUV.

Consensus on the Management of Posterior Urethral Valves from Antenatal Period to Puberty. J Indian Assoc Pediatr Surg. 2019 Jan-Mar;24(1):4-14. doi: 10.4103/jiaps.JIAPS_148_18

Case # 3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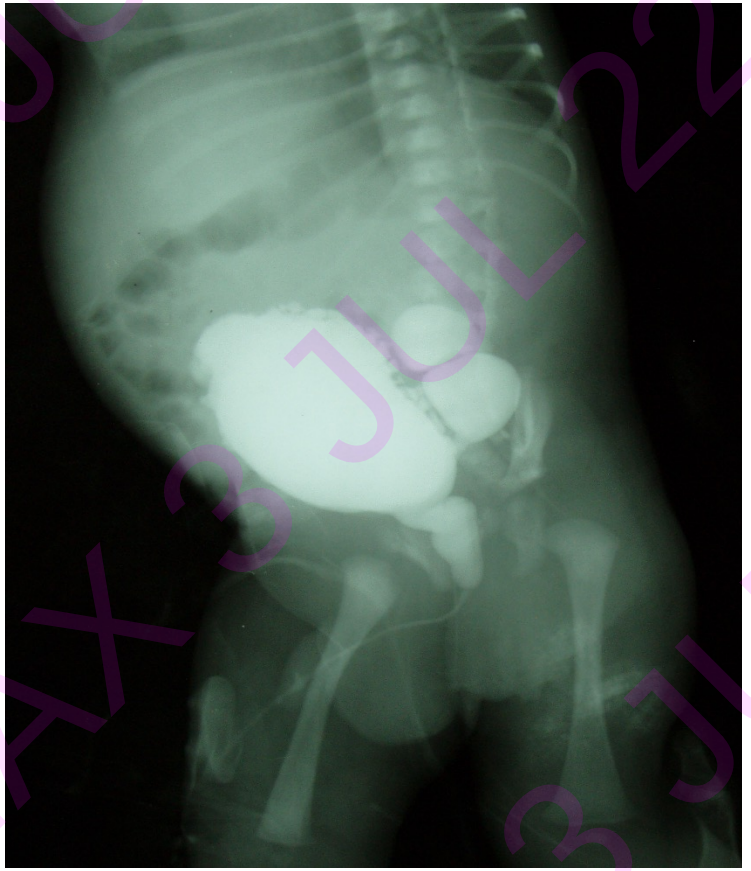

Vesicoureteric reflux

- VUR in 10-20% of cases of ANH
- Normal postnatal USG does not reliably exclude VUR
- Patients with two normal postnatal ultrasounds do not benefit from MCUG unless UTI
- The degree of dilatation on USG doesn’t correlate with grade of VUR

Take Home Message

- The majority of antenatal hydronephrosis is transient and benign.
- Remember APD 4,7 and 10 mm
- ANH rarely a reason for termination of pregnancy/early delivery
- Mild hydronephrosis needs limited post-natal evaluation
- We need to correctly select patients who have significant underlying disease and require interventions to avoid progressive kidney damage.
- The presence of features of lower urinary tract obstruction require close monitoring, and delivery in an unit with NICU and Nephro-Urology set up.
- Team Work!

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