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Antenatal Hydronephrosis: Approach to Management

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Aim of the Panel Discussion

To discuss

- Definition, burden of disease, classification
- Causes of antenatally diagnosed hydronephrosis
- What to look for in antenatal USG
- Role of antenatal intervention
- Postnatal evaluation
- Role of antibiotic prophylaxis and surgery
- How to follow-up

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Introduction

Antenatal Ultrasound scans (AN-US) have become a vital tool for monitoring pregnancies. They enable early diagnosis and optimum management of several congenital conditions.

Case #1
27 yr G_2P_1 mother
20 weeks gestation : “swelling in the kidney” on ultrasonography
Previous child: 3 yr male child, healthy

- What is antenatal hydronephrosis?
- How commonly is it detected by AN-US?
- What are the causes of Antenatal Hydronephrosis?

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Antenatal Hydronephrosis

- Antenatal hydronephrosis (AHN), defined as dilation of renal pelvis and/or calyces
- It is the most frequently detected abnormality by prenatal ultrasonography (US) occurring in 0.64–5.4% of all pregnancies
- More than half the cases of AHN resolve spontaneously by the end of gestation or during the first year of life
- May be a marker of underlying significant Renal pathology

Sinha A, Bagga A, Krishna A, Bajpai M, Srinivas M, Uppal R, Agarwal I; Indian Society of Pediatric Nephrology. Revised guidelines on management of antenatal hydronephrosis. Indian Pediatr. 2013

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Etiology of ANH

- Causes vary from self-resolving transient hydronephrosis to CAKUT including spectrum of malformations that can occur at the level of the kidney, ureters, bladder, and/or urethra

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

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- How do we determine if the hydronephrosis is significant?
- How would you counsel and follow up this antenatal mother, she is worried if there is a problem with her baby's kidneys?
- Will an early delivery be needed?

Dr RK

Case #1

Gestation	Right kidney	Left kidney
20 weeks	Pelvic dilatation	Normal
	AP diameter: 8 mm	4 mm

Classification of ANH Severity

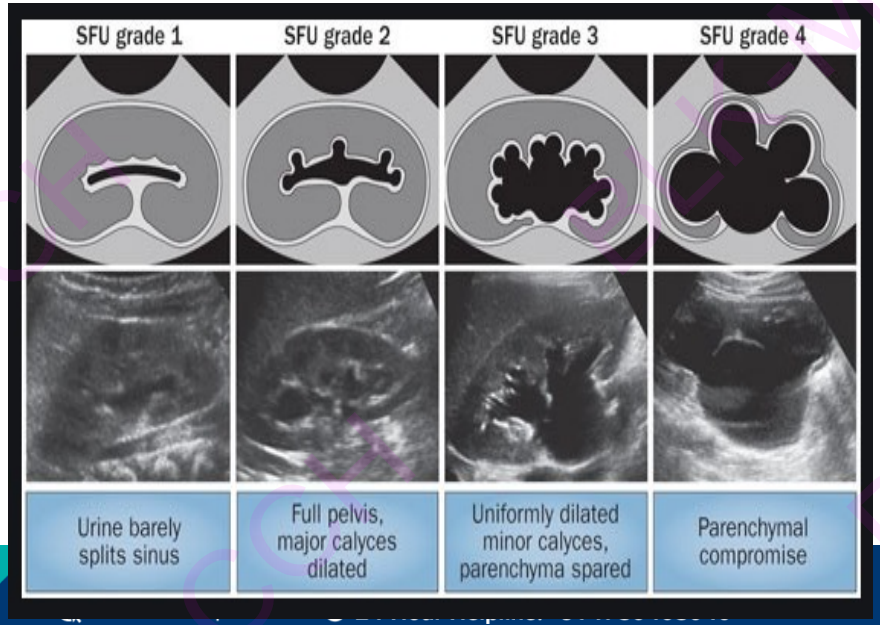
Severity of hydronephrosis indicates the possibility of significant renal pathology

APD Based Grading

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

Society For Fetal Urology Grading



Meta-analysis: stabilization of pelviectasis in 98% of patients with grades 1–2 and in 51% of patients with grades 3–4 .

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

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

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Case #1: Moderate Unilateral Hydronephrosis

- Fetal Ultrasound every 4 weeks to monitor severity
- Unless associated with severe extra-renal malformations, severe oligo hydramnios, suspected pulmonary hypoplasia –termination of pregnancy not required
- Pregnancy should be allowed to continue to term gestation; significant risks with preterm delivery

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Case # 2

Gestation	Right kidney	Left kidney
21 weeks	Normal 5 mm	Pelvic dilatation AP diameter: 10 mm
32 weeks	Normal 5 mm	Pelvic dilatation AP diameter: 38 mm

Unilateral HDN

Increased on follow up

- Is this information sufficient on Ultrasound?
- What are the red flag signs on Antenatal USG?

Dr SB

At 20 weeks

At 32 weeks

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What Information should an USG report contain?

Table 3 Normal values for Urinary Tract Dilation Classification System.

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

Red Flag Signs in Antenatal USG

- Central & Peripheral calyceal dilatation
- Parenchymal thinning, echogenicity or presence of cysts
- Dilated ureters
- Thick walled bladder, Failure to empty
- Oligohydramnios

Nguyen, Hiep T. et al. Multidisciplinary consensus on the classification of prenatal and postnatal urinary tract dilation (UTD classification system). Journal of Pediatric Urology, Volume 10, Issue 6, 982 - 998

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- How to categorize the risk category based on ultrasound findings just discussed?

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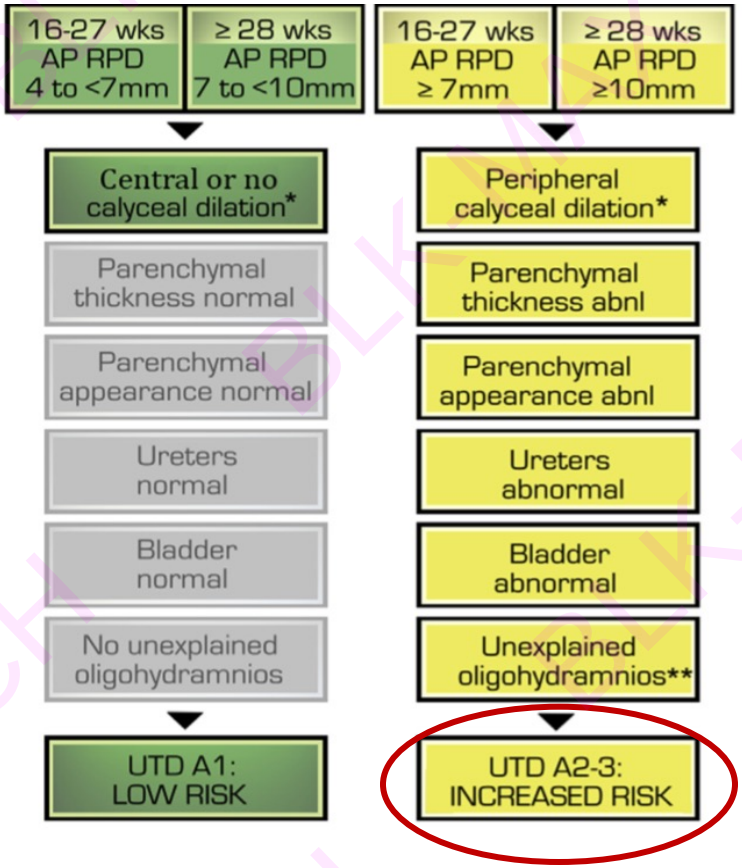
UTD Classification-Antenatal



UTD A1 (low risk)

If diagnosed < 32weeks – a repeat USG scan after 32 weeks

- If USG beyond 32 weeks shows resolved renal architecture – no further follow-up antenatally
- If USG shows UTD A1 – postnatal USG at > 48 hours but < 1month and 6 months later.

UTD A 2-3 (higher risk)

- Monthly USG assessment
- Prenatal counselling session with Pediatric Nephrologist / Urologist.
- Postnatal USG > 48 hours but < 1 month (except bilateral lesions and evidence of bladder outlet obstruction where assessment has to be <48 hours after birth or earlier).

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Post-Natal Follow up

- Male child, born at term
- Clinically stable and feeding well
- Urine passed in good stream
- Bladder not palpable

- How should such patients be evaluated after birth?
- Timing of postnatal USG?

Dr RK

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Postnatal Evaluation of ANH

- Examination
  - Obvious external malformations (not commonly associated)
  - Abdominal distention, Ascites
  - Palpable kidney and bladder
  - External genitalia and anal opening
  - Spine and markers of spinal dysraphism

Post Natal Follow up

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 → Individualized investigations and management
- After 48 hrs, preferably after 7 days. Early USG may underestimate degree of hydronephrosis, due to relative state of dehydration till adequate feeding is established.

- Exceptions
  - Suspected LUTO
  - Severe bilateral hydronephrosis
  - Solitary kidney, esp APD is > 15 mm or SFU gr 2 (3rd trim)

- *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*

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- How to follow up patients with mild hydronephrosis <10 mm on post natal USG, without any red flag signs?

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Mild/transient hydronephrosis

- No hydronephrosis in postnatal ultrasound: repeat at 4-6 weeks of life
- Mild hydronephrosis (APD < 10 mm, SFU grade 1-2): sequential ultrasonography at 3 & 6 months, then 6-12 monthly till resolution or age 5-6 years
- Two consecutive normal USGs = resolution

Sinha A, Bagga A, Krishna A, et al. Revised guidelines on management of antenatal hydronephrosis. Indian J Nephrol. 2013;23(2):83–97. doi:10.4103/0971-4065.109403

Postnatal ultrasound Day 3

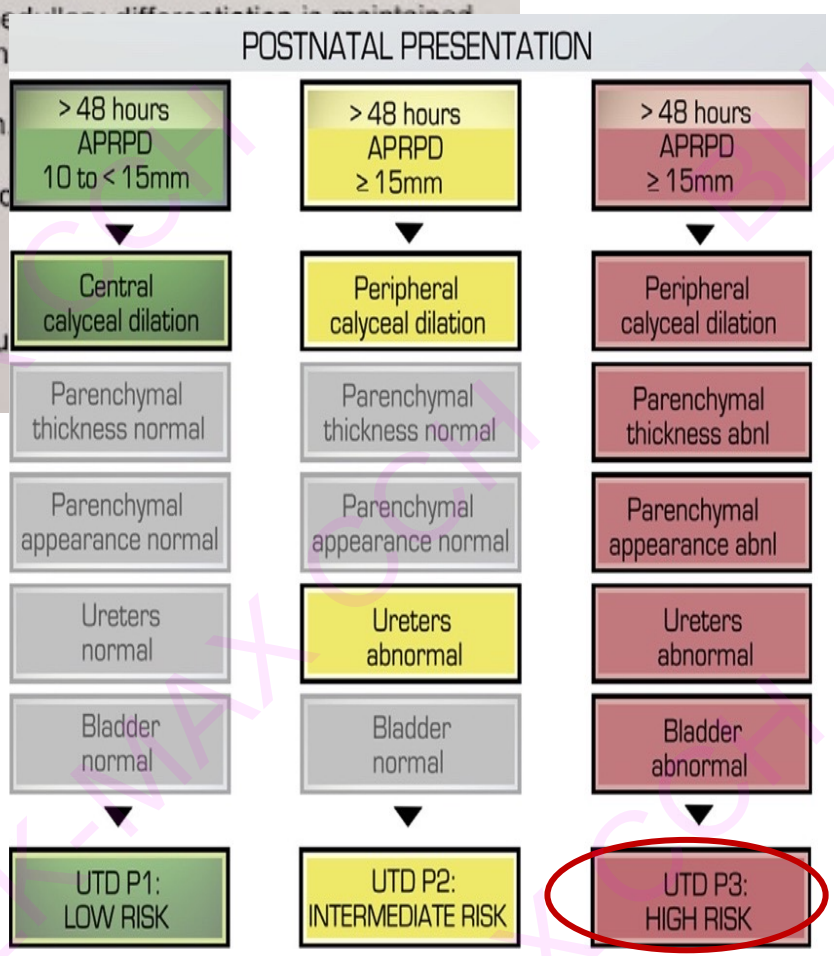
Right kidney: Measures 4.7 cm, in length with cortical thickness of 0.5 cm.

Left kidney is enlarged in size and shows thinned out cortex. Cortico-me
No evidence of calculi. Moderate to large hydronephrosis with balloonin
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 thic

Prostate: Normal for age.

MIS: No evidence of ascites. No evidence of bowel wall thickening or gu



UTD P3: High Risk category

- What is possible etiology?
- What Further Evaluation is required and when it should be done?

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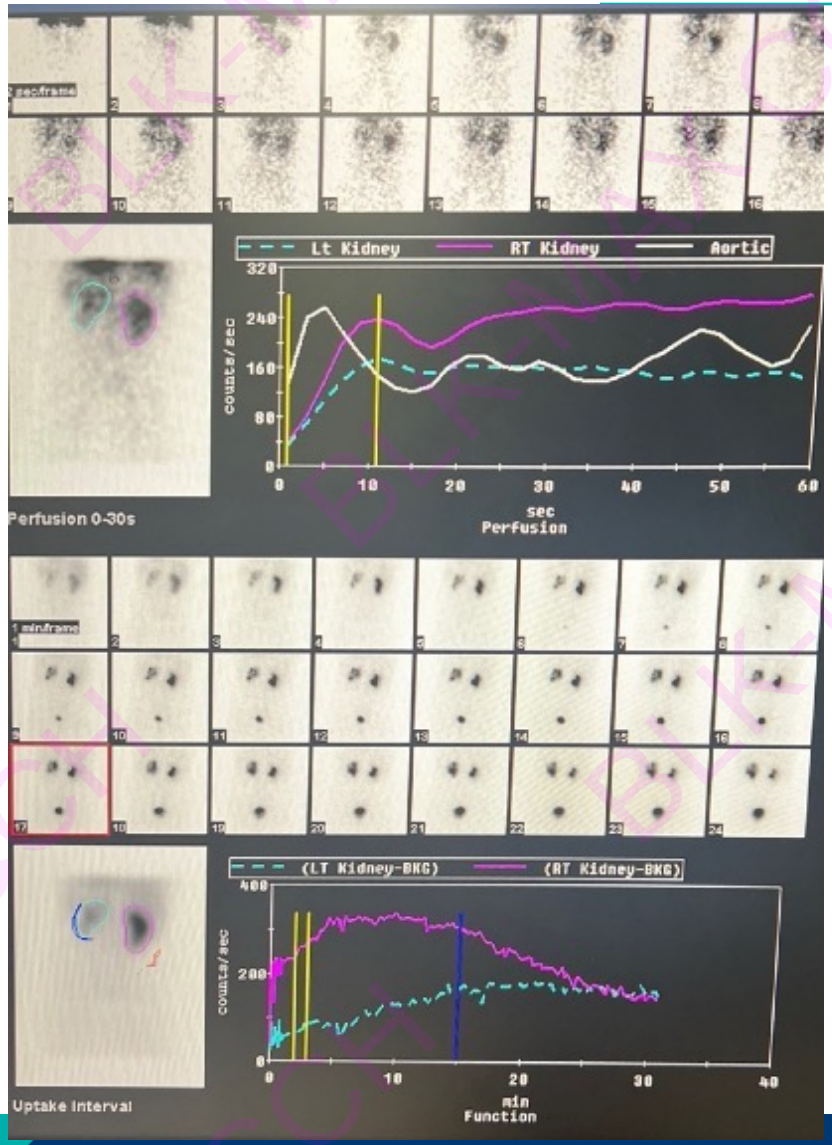
Diuretic renography for suspected PUJO

- Moderate to severe unilateral or bilateral HDN (SFU grade 3-4, APD >10 mm), no VUR
- HDN, dilated ureter, no VUR
- MAG-3 & EC preferred over DTPA
- Perform after 6-8 weeks
- LLEC scan earliest at 4 weeks

Sinha A, Bagga A, Krishna A, et al. Revised guidelines on management of antenatal hydronephrosis. Indian J Nephrol. 2013;23(2):83–97. doi:10.4103/0971-4065.109403



Kidney	Left	Right
Kidney Area (cm^2):	43.75	64.85
Kidney depth (cm):	4.26	4.23
Perfusion% (Int):	42.41	57.59
Perfusion% (Sio):	39.95	60.05
Uptake% (Int):	22.62	77.38
Time to peak:	20.55	9.55
Peak to 1/2 peak:	NA	16.5
30min/peak ratio:	.9	.44
30min/3min ratio:	2.18	.68
Diuretic T1/2:	NA	13.88

Left Pelvi-ureteric Junction Obstruction
With impaired renal function

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- What are the indications of surgery in PUJO?
- What are the different surgical options?

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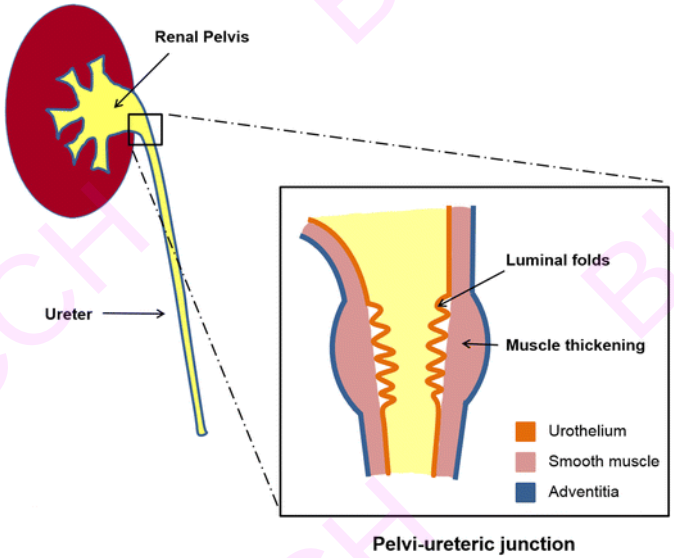
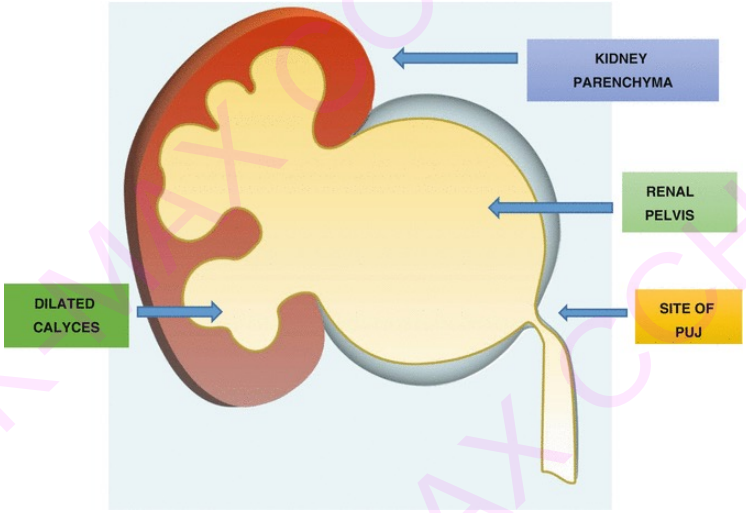
Indications of Surgery in PUJO

- Impaired renal function
- Split renal function <40%
- Thinning of renal parenchyma on USG
- Deterioration in renal function by >10% on follow up scan
- Worsening hydronephrosis
- Symptoms; UTI, Pain





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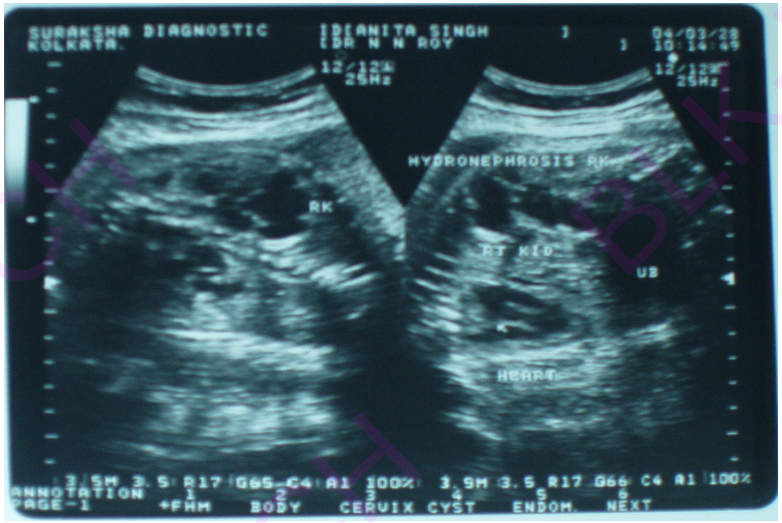
Case #3

Gestation	Right kidney	Left kidney
19 weeks	Pelvic dilatation + APD: 8 mm	Pelvic Dilatation + APD: 10 mm
	Bilateral ureters dilated and thick walled bladder	
32 weeks	APD: 12 mm	APD:14 mm
	Bilateral kidneys show echogenic parenchyma, ureters dilated and thick walled bladder, key hole appearance, borderline oligohydramnios	



- What is possible etiology?
- How will you counsel the family given the red flag signs in antenatal USG ?

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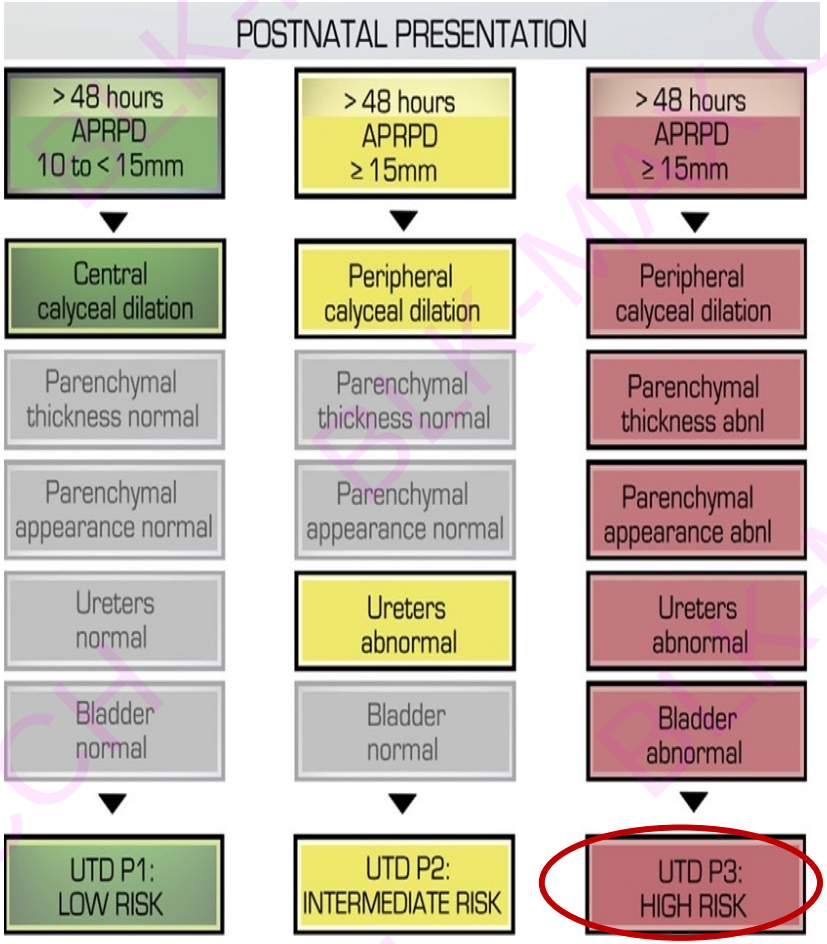
High Risk Urinary Tract Dilation



- Closer follow up every 2 weeks USG for fetal well being, oligohydramnios etc
- Referral to Pediatric Nephrologist/Urologist
- May need early delivery for fetal indications
- Postnatal need for prompt evaluation, possible renal damage and need for surgical intervention explained
- Preferably delivery at equipped center

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- What are the immediate concerns at the time of delivery?

Dr RK

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

- What should be the timing of MCUG in Antenatal hydronephrosis and in this particular patient?

DR NB

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

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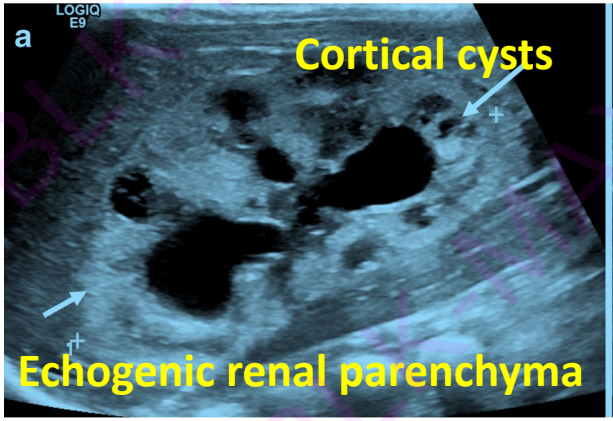
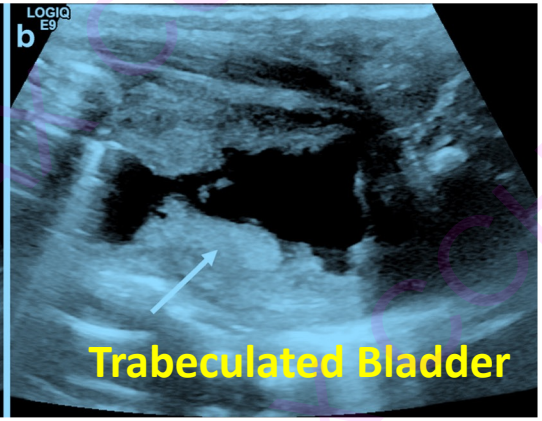
Indications for MCUG

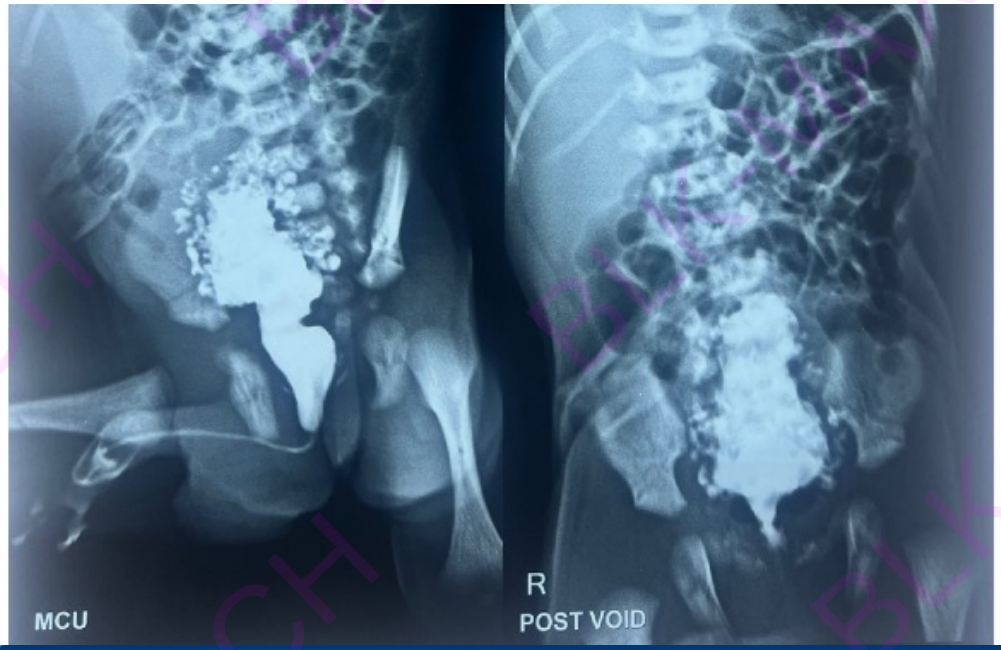
- Unilateral or bilateral hydronephrosis with renal pelvic APD > 10 mm, SFU grade 3-4 or ureteric dilatation
- In case of UTI
- Worsening hydronephrosis, progressive parenchymal thinning
- Timimg: within 24-72 hrs in patients with suspected LUTO, at 4-6 weeks of age for others

Sinha A, Bagga A, Krishna A, et al. Revised guidelines on management of antenatal hydronephrosis. Indian J Nephrol. 2013;23(2):83–97. doi:10.4103/0971-4065.109403


a
Cortical cysts
Echogenic renal parenchyma


b
Trabeculated Bladder

USG KUB


MCU
R
POST VOID

MCUG

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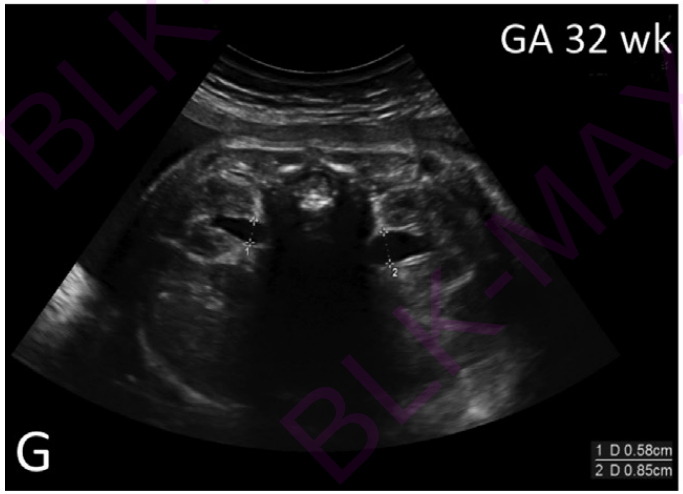
- Surgical Management of PUV?
- Long term follow up and complications?

Dr AP

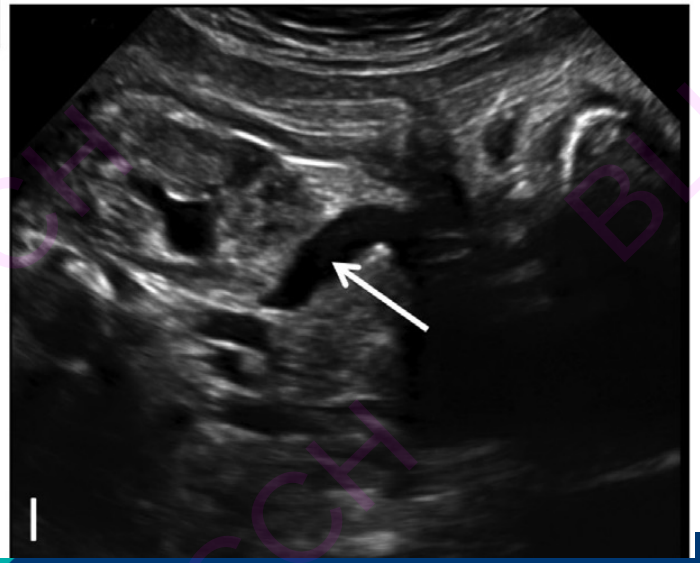
- Surgical Intervention after initial stabilization
  - Cystoscopy and valve fulguration
  - Urinary diversion procedure

- Effective management of bladder dynamics is the key for long-term renal health.
  - High bladder pressures may lead to on-going renal damage
  - Bladder pressure and characters vary on follow up, needs periodic evaluation with USG, Urodynamic study etc.

Case #4: 3-day old newborn: Postnatal USG



	Right kidney	Left kidney
Pelvis	Normal	Dilated
Calyces	Normal	Normal
AP diameter:	6 mm	12 mm
Cortex	Normal	Normal
Ureter	Normal	Dilated



MCUG at 8 weeks Right Grade II VUR, Left grade IV VUR,

Primary Bilateral VUR

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- What is the risk of UTI in patients with antenatal hydronephrosis and those with VUR?

- What is the role of antibiotic prophylaxis in Antenatal hydronephrosis?

DR NB

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ANH & UTI

- Increased risk of UTI 6-8%
- More in females
- More in non-circumcised males
- More in higher grades of HN
- More in presence of VUR and other structural urinary tract abnormalities

Role of antibiotic prophylaxis in antenatal hydronephrosis: A systematic review from the European Association of Urology/European Society for Paediatric Urology Guidelines Panel. Silay, Mesrur Selcuk et al. Journal of Pediatric Urology, Volume 13, Issue 3, 306 – 315

Clinical Course of 822 Children with Prenatally Detected Nephrouropathies Isabel G. Quirino, Jose Silverio S. et al. CJASN Mar 2012, 7 (3) 444-451

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Antibiotic prophylaxis in ANH

- Benefit of antibiotic prophylaxis is unclear-no evidence of effectiveness
- Most increased risk of UTI is with VUR, which constitutes only 10-20% of ANH
- Increased risk of UTI with resistant uropathogens
- ISPN 2013 guidelines
  - ABP if SFU Grade >3 or 4 or APD >10 mm
  - if diagnosed with VUR-up to 1 year of age in Grade1/2 VUR; longer for higher grades of VUR

Role of antibiotic prophylaxis in antenatal hydronephrosis: A systematic review from the European Association of Urology/European Society for Paediatric Urology Guidelines Panel. Silay, Mesrur Selcuk et al. Journal of Pediatric Urology, Volume 13, Issue 3, 306 - 315

Evidence-based clinical practice guideline for management of urinary tract infection and primary vesicoureteric reflux

Recommendation

ISPN 2023

We suggest not using antibiotic prophylaxis for the prevention of symptomatic UTI in children with antenatally detected hydronephrosis while awaiting evaluation (2⊕◯◯◯).

The guideline panel places a relatively moderate value, for this recommendation, on very-low quality evidence suggesting that antibiotic prophylaxis has little or no efficacy in preventing symptomatic UTI in infants with antenatally diagnosed hydronephrosis. Similarly, a relatively higher value was placed on the moderate quality evidence of antibiotic prophylaxis resulting in an increased risk of antimicrobial resistance.

Those diagnosed with high grade VUR and who develop UTI may be offered antibiotic prophylaxis.

Hari P et al. Indian Society of Pediatric Nephrology. Evidence-based clinical practice guideline for management of urinary tract infection and primary vesicoureteric reflux. Pediatr Nephrol. 2023 Oct 28. doi: 10.1007/s00467-023-06173-9.

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- What are the indication of Surgical intervention in Primary vesicoureteric reflux?

Dr AP

Indications for Surgery for Primary VUR

Recommendation

We suggest that antibiotic prophylaxis should be the first-line of management in patients with high-grade VUR (2⊕⊕⊕◯).

We suggest that surgical reimplantation be considered in patients with high-grade VUR with recurrent breakthrough febrile UTI on antibiotic prophylaxis (2⊕⊕⊕◯).

Other indications

- High Grade VUR in solitary kidney
- Parental preference for surgery than antibiotic prophylaxis

Hari P et al. Indian Society of Pediatric Nephrology. Evidence-based clinical practice guideline for management of urinary tract infection and primary vesicoureteric reflux. Pediatr Nephrol. 2023 Oct 28. doi: 10.1007/s00467-023-06173-9.

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Take Home Points

- Majority of antenatal hydronephrosis is transient and benign.
- We need to correctly select patients who have significant underlying disease and require interventions to avoid progressive kidney damage.
- A standardised system of classification and nomenclature will help in early prognostication and planning of follow-up
- The presence of features of lower urinary tract obstruction require close monitoring, and delivery in an unit with NICU and Nephro-Urology set up.
- Obstructed renal systems will have signs of severe /progressive dilatation and deterioration of function, these require early detection and intervention.

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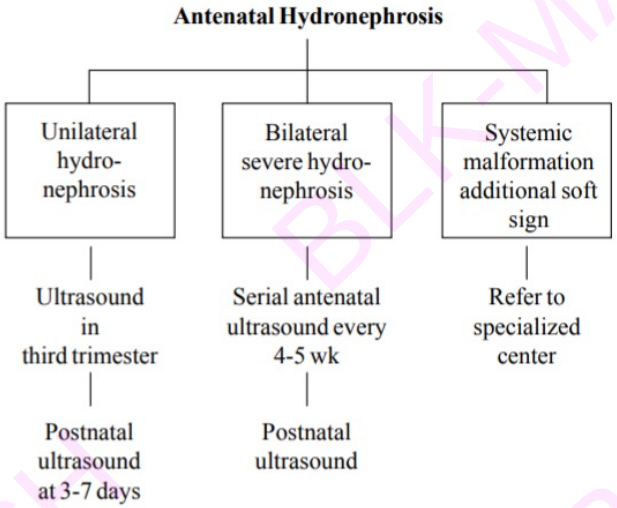
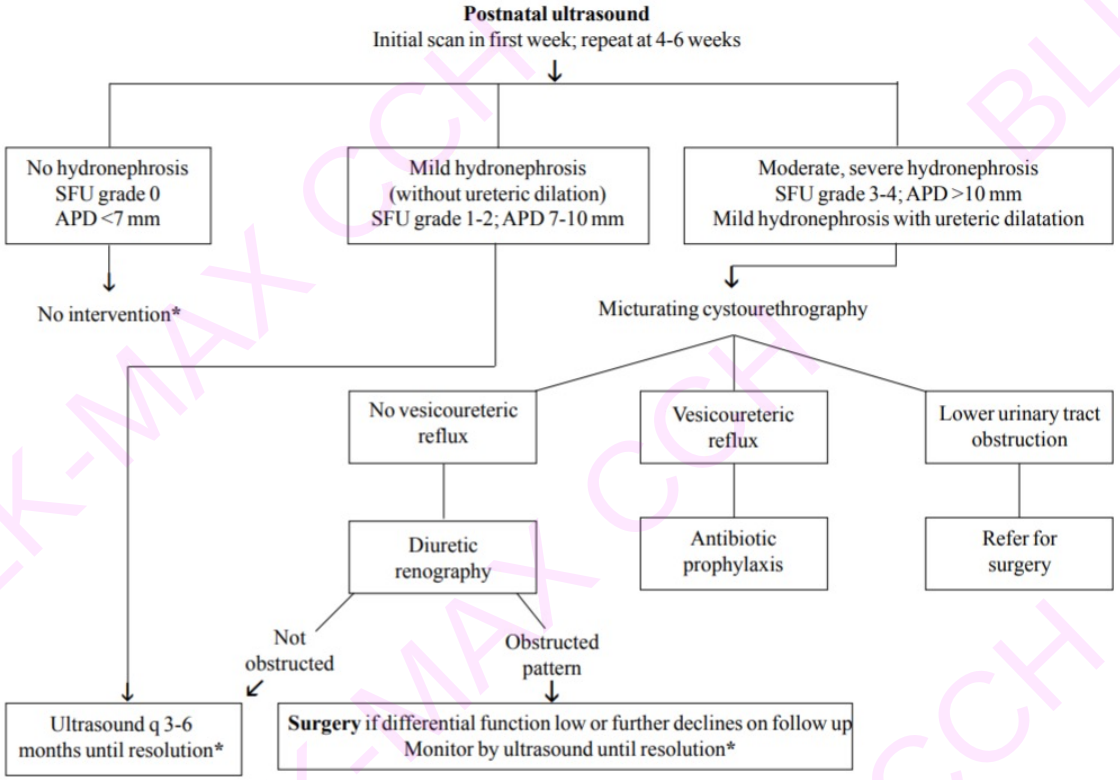
At a Glance





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Thank You