




Paediatric Renal Ultrasound

Monash Health Trainee Workshop 2024 – Jessica Slater



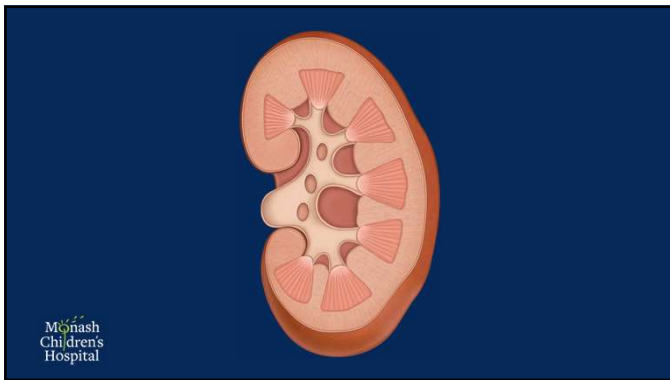
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Overview

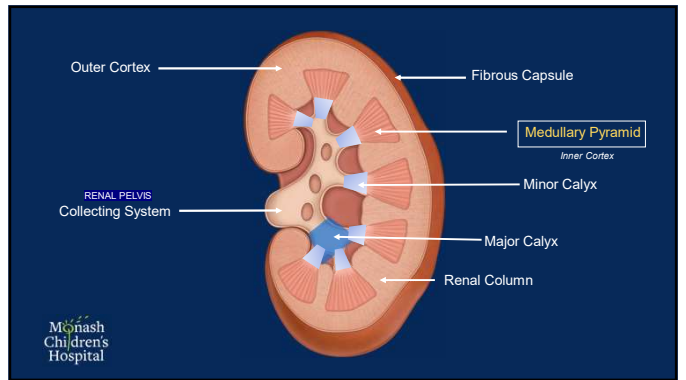
- Anatomy
- Scanning Technique
- Importance of Linear Imaging
- Renal Anomalies
- Common Pathologies



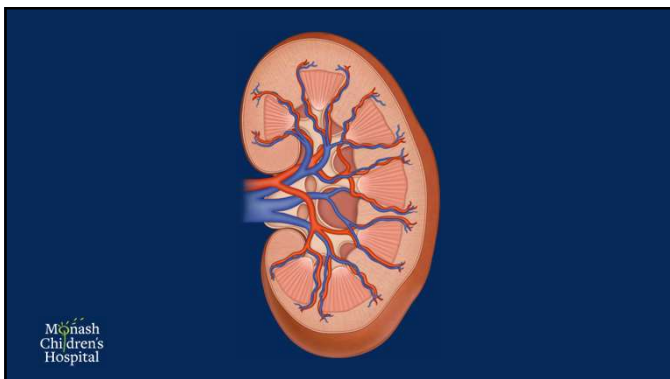
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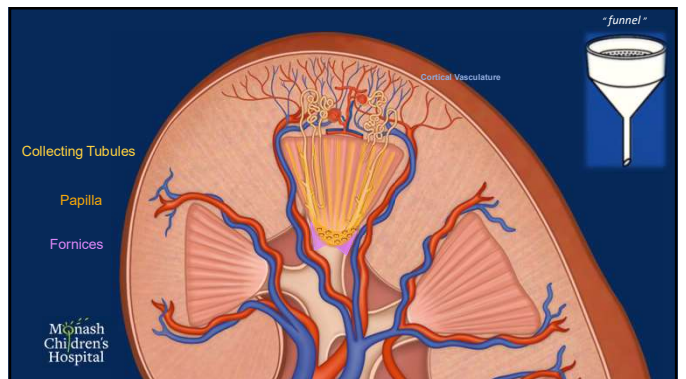
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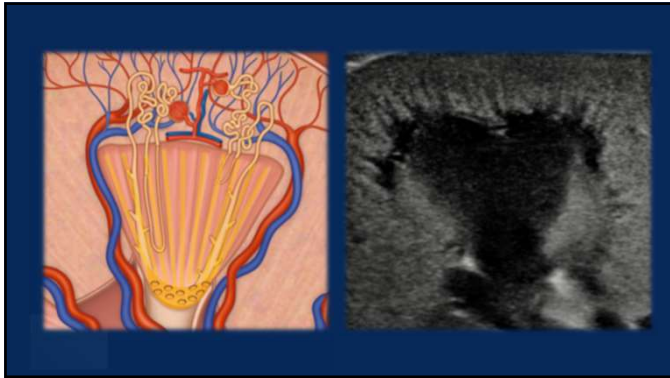
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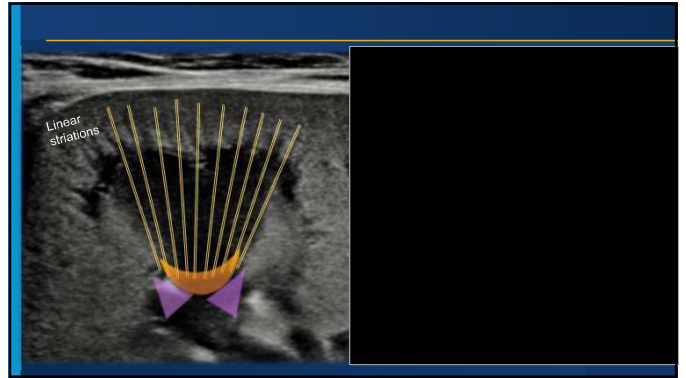
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6



7



8

Transducer Selection

- Curvilinear Probe
- Linear Probe
- Warm Gel

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9

Scanning Approach

BLADDER

- Transverse
- Longitudinal

DOCUMENT

- Pre and post micturition
- Smooth bladder wall
- Document ureteric jets
- Measurement of distal ureters*

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10

Scanning Approach

SUPINE **DECUBITUS** **PRONE** **ERECT**

BABY ON PARENT

- Versatility
- Prioritise patient comfort
- Parents as guide
- Efficiency

Reference: Google Images

11

Scanning Approach

RIGHT KIDNEY

- Use liver as a window
- Parallel and between ribs
- Breath hold*
- Arm above head

12

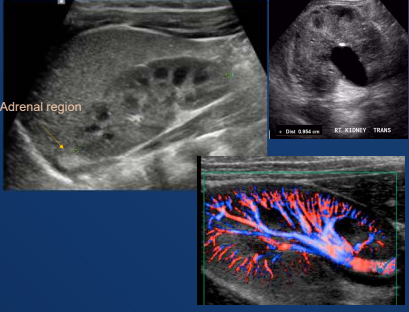
Scanning Approach

KIDNEY

- Longitudinal
- Transverse


DOCUMENT

- 3-5 images in both planes
- Bipolar measurement
- Perfusion (2-3 images)
- Measurement of TPD (if notable)



13

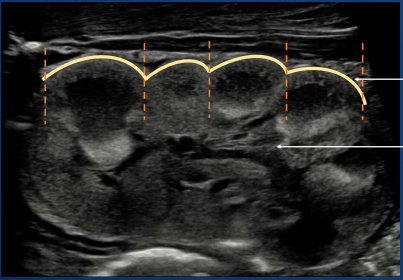
The Kidney from Birth to Adulthood



PREMATURE	TERM INFANT	OLDER CHILD / ADULT
<ul style="list-style-type: none"> - Thinner cortex - Hyperechoic, bright cortex - Less renal sinus fat 	<ul style="list-style-type: none"> - Slightly thicker cortex - Mildly hyper / isochoic cortex 	<ul style="list-style-type: none"> - Thick cortex - Normal C-M diff - Abundant renal sinus fat


14

Normal Neonatal Kidney




Fetal Lobulation

Reduced Central Sinus Echoes (Fat)




15

Normal Neonatal Kidney



Large hyperechoic pyramids

Thin Cortex



16

Normal Phenomenon


PRESENTATION

- First few days of life
- Abundance of "Tamm Horsfall" protein
- Clinically no renal impairment


DIAGNOSTIC FEATURES

- Hyperechogenicity at tips of pyramid
- Spared hypoechoic base
- No acoustic shadowing

" Transient Hyperechogenicity"

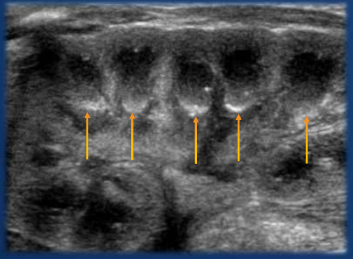


Daneman et al, 2010




17

Normal Phenomenon



" Transient Hyperechogenicity"

Normal Physiological Variant



18

Congenital Renal Anomalies

STRUCTURAL <ul style="list-style-type: none"> - Persistent Fetal Lobulation - Hypertrophied Column of Bertin - Dromedary Hump 	POSITION <ul style="list-style-type: none"> - Malrotation - Ectopic - Crossed Ectopia
FUSION <ul style="list-style-type: none"> - Horseshoe kidney - Pancake kidney 	NUMBER <ul style="list-style-type: none"> - Agenesis - Supernumerary

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Normal Structural Anomalies

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Abdallah et al. 2021

20

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Fusion Anomalies

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Abdallah et al. 2021

22

Horseshoe Kidney

- Most **common** renal fusion
- Incidence 1:400-600 (Nabais et al. 2014)
- Unable to visualise distinct lower poles
- Fusion of the lower poles
 - Midline assessment
- Often asymptomatic
 - UTI
 - PUJ Obstruction
 - Calculi

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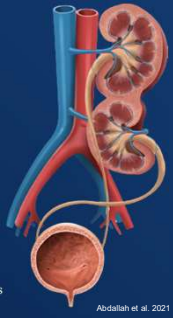
Ectopic – Pelvic Kidney

- Kidney does not migrate
- Absent kidney in the flank
- Incidence 1:3000
- Normal contralateral kidney
- Abnormal vessels from aorta / iliac arteries.
- Often Asymptomatic:
 - UTI
 - PUJO
 - Calculi

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Cross-Fused Ectopia



- Markedly rare
- Incidence 1:2000
- One kidney crosses midline
- Parenchyma fuses
- Ureters cross midline to enter bladder
- Often Asymptomatic:
 - Hydronephrosis
 - UTI
 - Calculi

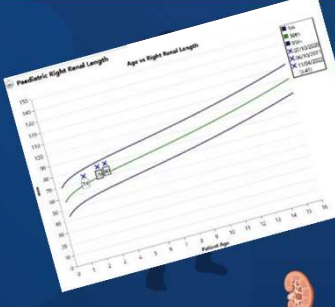
(Solanki et al. 2013)

Abdallah et al. 2021

25

Common Clinical Indications

- Postnatal U/S
 - F/u antenatal pyelectasis
- UTI's
 - ? Pyelonephritis
 - ? Structural predisposition
- Family Hx / Genetic
 - ? Renal cystic disease
- Palp abdominal mass
 - ? tumour
- Follow up scans
 - Renal Growth
 - Hydronephrosis




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Antenatal Pyelectasis

Society for Fetal Urology

- T2: APD $\geq 4\text{mm}$
- T3: APD $\geq 7\text{mm}$

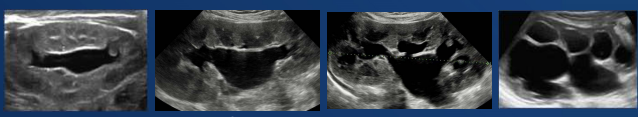


Post natal renal U/S


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Hydronephrosis



- Mild renal sinus separation
- Major Calyces dilated
- Minor and Major Calyces dilated
- Thin parenchyma Ballooning calyces



NORMAL MILD MODERATE SEVERE

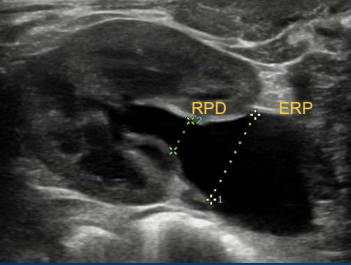
Grade I Grade II Grade III Grade IV

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Where should the measurement be taken?

Grading Criteria

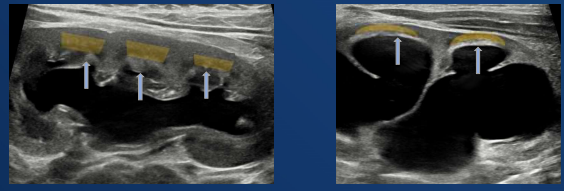


RPD: Renal Pelvis Diameter
ERP: Extra Renal Pelvis

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Hydronephrosis



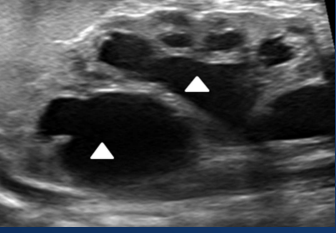
Moderate Severe

Curvilinear echogenic band (interface)

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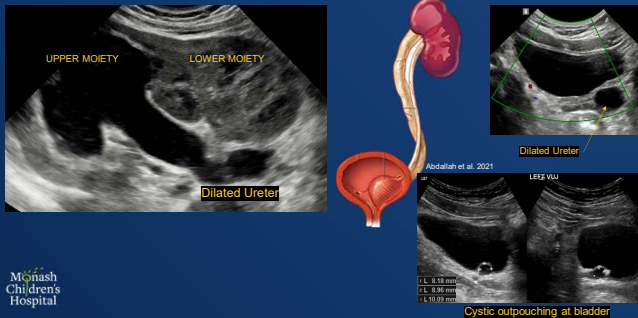
Duplex Kidney



- Common, normal variant
- Incidentally diagnosed
- Usually asymptomatic
- 2 moiety's (upper and lower)

31

Duplex Kidney



Abdallah et al. 2021


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Urinary Tract Infection (UTI)

PRESENTATION

- Sudden fever
- Flank pain
- Burning, stinging urination
- Foul smelling urine



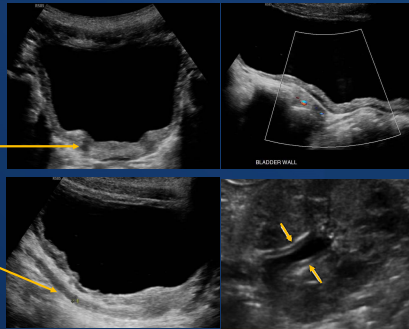
?acute pyelonephritis ?structural abnormality

33

UTI

U/S FEATURES

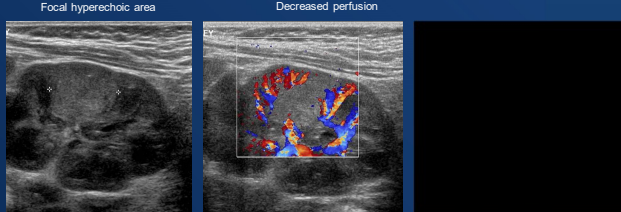
- Thickened bladder wall
- Thickened ureteric walls



34

Pyelonephritis

Focal hyperechoic area Decreased perfusion



U/S FEATURES:

- Oedema – size discrepancies
- Focal or diffuse cortical change
- Triangular, wedge shaped /mass –like region
- Loss of perfusion

Abscess formation
AND
Perinephric Collection

35

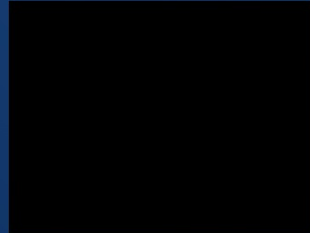
ARPKD - Autosomal Recessive Polycystic Kidney Disease

DEVELOPMENT

- Hereditary
- Observed antenatally
- Genetic - Mutation PKHD 1

U/S FEATURES

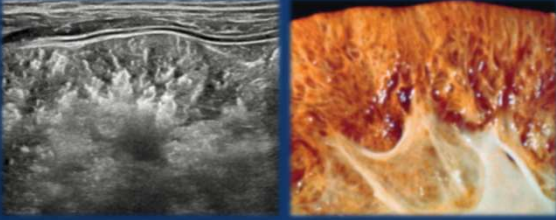
- Cystic dilatation of distal tubules
- Restricted to pyramids
- Progresses to globally echogenic kidney



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ARPKD - Autosomal Recessive Polycystic Disease



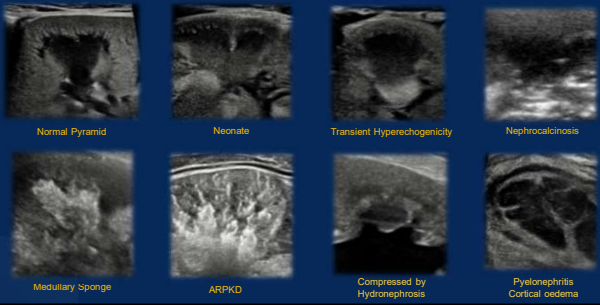
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ARPKD
Microcystic disease of distal tubules

Daneman et al. 2010

37

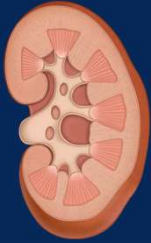
The Pathological Medullary Pyramid



Normal Pyramid Neonate Transient Hyperechogenicity Nephrocalcinosis

Medullary Sponge ARPKD Compressed by Hydronephrosis Pyelonephritis Cortical oedema

38



Questions?

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Thanks to Dinuki Jayawardana & Mikaelah Farmer
Keith VanHaltren & Joyce Chen

39

References

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40