Conceptual Radiology

Concepts in Radiology

[Based on In-App Videos]

Vol.-3

Authored By The Faculty of Conceptual Radiology

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[Based on In-App Videos]

FOREWORD

It is with great pleasure that I introduce this collection of lecture notes, a comprehensive resource drawn from the collective expertise of esteemed faculty members of Conceptual Radiology, spanning various subspecialties within the field of radiology. This compilation is designed to serve as a vital reference for students embarking on their journey to understand the complexities of medical imaging and radiological diagnosis.

Radiology, with its vast and ever-evolving landscape, has become a cornerstone in modern medicine. The integration of advanced imaging techniques, from diagnostic radiology to interventional radiology, neuroradiology, musculoskeletal, and beyond, has revolutionized how we perceive and treat diseases. For students, mastering the nuances of each subspecialty can be daunting. This book distills key concepts, clinical insights, and imaging principles into accessible, focused notes that are both comprehensive and concise.

What sets this compilation apart is the collaboration between experts who have generously shared their knowledge and experience. Their combined efforts ensure that each chapter not only provides theoretical foundations but also bridges the gap between classroom learning and clinical application.

As you delve into these pages, I encourage you to approach radiology not merely as a tool for diagnosis but as an art that requires attention to detail, a deep understanding of anatomy and pathology, and, most importantly, a commitment to patient care.

I trust that this collection will serve as an invaluable guide for your studies and a lasting resource throughout your medical career.

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Section 9

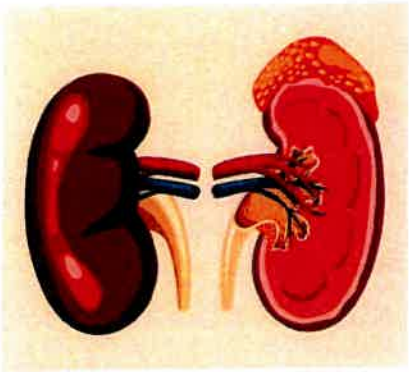
Uro-radiology

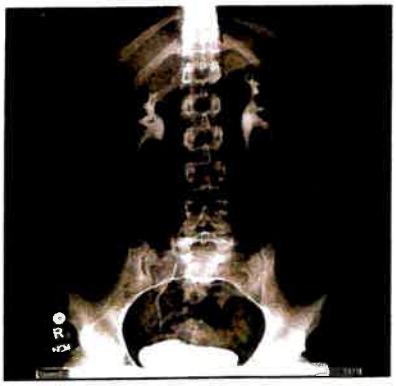
CHAPTER

9.1

Imaging Modalities and Radiological Anatomy of Upper Urinary Tract

Anatomy





- Renal Pelvis facing anteromedially
- Normal Length: 8-12 cm, difference between the two < 1.5cm
- Renal pelvis- Relation- VAP
- Cortex- Thickness 1.5cm
- Medulla
- Minor Calyces (10-14) and Major Calyces

Variants of Calyceal Anatomy

1) Compound Calyx

- Polar Region; Reflux Nephropathy

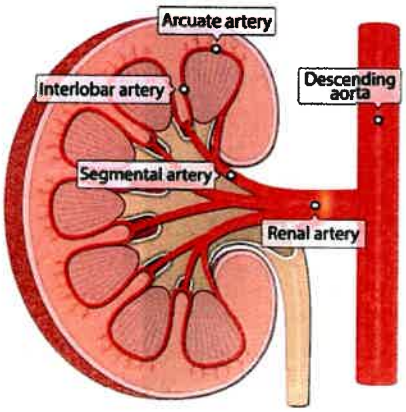
2) Megacalycosis

- 15 calyces, Normal renal pelvis, ureter
- DD: Renal Papillary necrosis

3) Calyceal Diverticulum

Scan the QR code(s) on this page with any QR scanner or the eConceptual App to directly access related study materials, providing more insights and a deeper understanding of the topic. Alternatively, you can search on the eConceptual App using the code starting with '#' located below the QR code for quick access to the related content.

Vascular Supply



- Arterial Supply – Renal Arteries (L1- L2 level)
  - Accessory renal arteries (U/L– 30%, B/L – 10 %)
- Venous Drainage
  - LRV longer –anterior to the aorta and posterior to SMA.
  - RRV- shorter, directly drains into the IVC

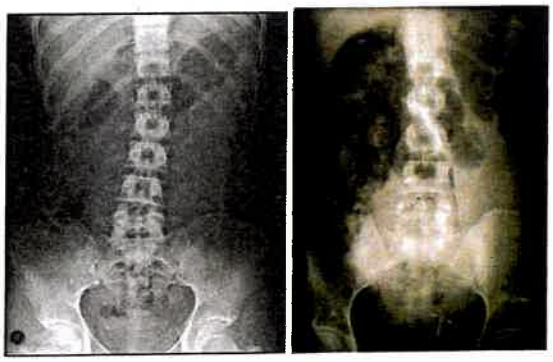
Ureter

- Anterior to psoas within 1 cm of the lateral margin of transverse processes
- At level of SI joint- anterior to common iliac artery bifurcation
- Pelvis- lateral pelvic wall, over the obturator internus muscle.
- Turns antero-medial at the level of ischial spine to enter the bladder base.
- Intramural course – 2cm.

Normal Ureteric Constriction

- At Ureteropelvic Junction
- Crossing the iliac vessels
- Pelvic Inlet

Imaging Techniques – Conventional Radiography



- Air -Emphysematous Pyelonephritis
- Calcification

Calcifications of the urinary tract on the KUB
Renal: Calculi, TB, RCC, Arterial atheroma, aneurysm Ureter: Calculi, TB, Schistosomiasis Bladder: Calculi, TCC, Schistosomiasis

Intravenous Urography (IVU/IVP)

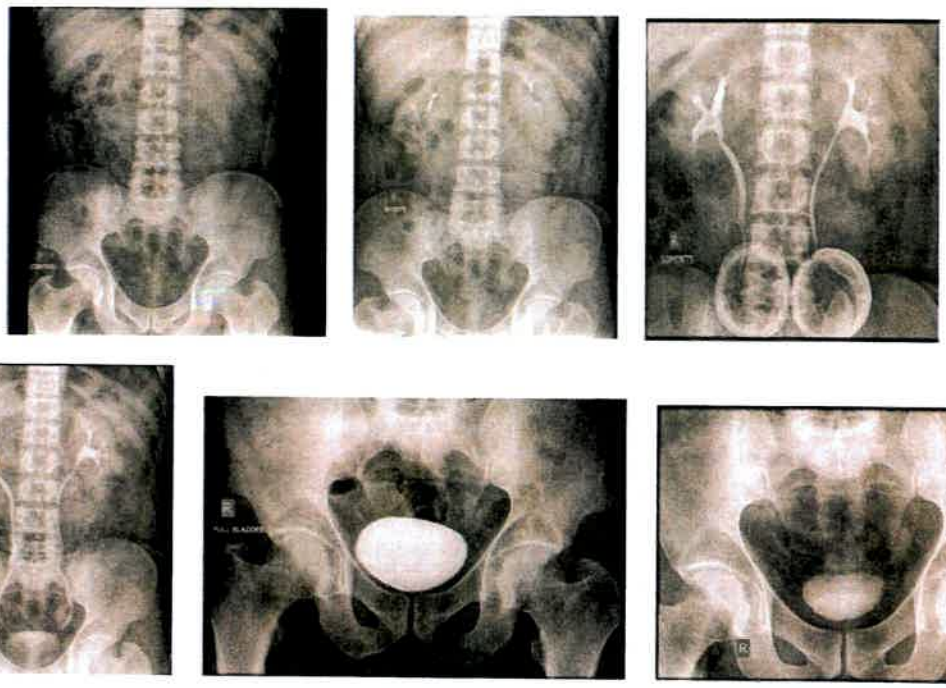
- Indications:
  - Urolithiasis
  - Ureteric fistulae/ strictures
  - Renal Infections, e.g Tuberculosis

(Gold standard- early changes; irregularity of calyces, papillary necrosis, etc)

- Pre-procedure work-up
  - S. Cr
  - Fasting 4-6 hr
  - Bowel preparation (laxatives- activated charcoal / Castor oil)
  - Void prior to examination

IVP Technique

Standard technique of Intravenous Pyelography	
Preliminary imaging	KUB Radiograph
IV contrast 50ml (1mg/kg) (350mg/ml Iohexol) injected	
Nephrographic Phase (1 min)	Collimated to kidneys- Size (upto 3 lumbar vertebrae), outline, position
Pyelographic Phase (5-min KUB)	Assess temporal symmetry and progress of opacification
	Apply Abdominal compression
10 min- Pyelographic Images (5 min after compression)	Calyceal distension
Release compression after 10 mins of applying	
15 min- Ureteric image supinefull length (immediately after release of compression)	Visualization of ureters
15 min Ureteric image Prone full length	Visualization of ureters
Full Bladder	
Post-void image	



Retrograde Pyelography	Antegrade Pyelography	Nephrostogram
• Ureteral orifice cannulated via cystoscope (Urologist) • Contrast instilled into the ureters. • Done by urologist during PCN placement.	Invasive Procedure Calyx puncture with 22G needle under USG guidance	• Indwelling PCN catheter. – Used to assess the level of Obstruction in case of non - functioning kidneys. – Post OP cases of PUJI obstruction to check patency – Status of urinary fistulae post diversion. – Post Antegrade DJ stenting to see patency.

Ultrasound- Grayscale

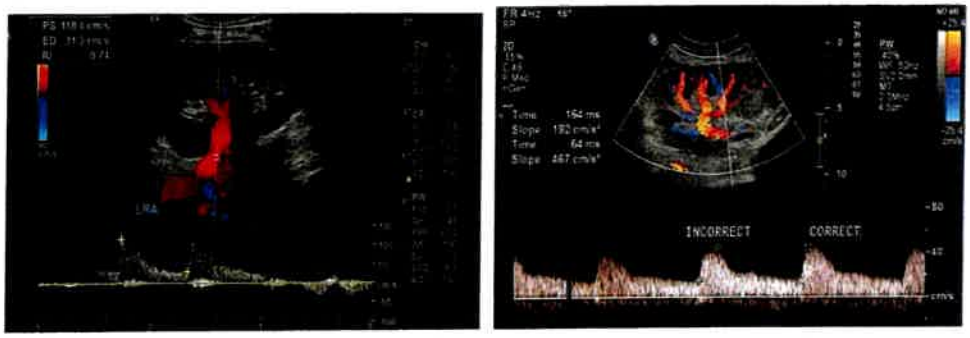
- Size

Normal Kidney Length in Adults	
Adult Female (cm)	Adult Male (cm)
RK- 10.7 (9.5-12) LK-11 (9.9-12) Range 8-12cm < 8cm small Kidney	11.2 (10.1-12.4) 11.5 (10.4-12.6) Range 8-12cm < 8cm small Kidney

- Outline
- Position

- Cortical Thickness (<1cm abnormal)
- Cortical echogenicity (compared to liver/spleen)
- C-M Differentiation
- Calculi – Y/N (size, number, location)
- Hydronephrosis- Y/N (If yes- Grade of HDN)
- Ureter dilated – Y/N (If yes, Level of obstruction)
- Cyst/Mass

Ultrasound – Doppler



- Renovascular Hypertension
- Evaluation of Transplant kidney
- Renal Vein thrombosis
- Miscellaneous – Trauma, AVM, AV fistula
- Evaluate:
  - Main renal Artery
  - Segmental Renal Arteries

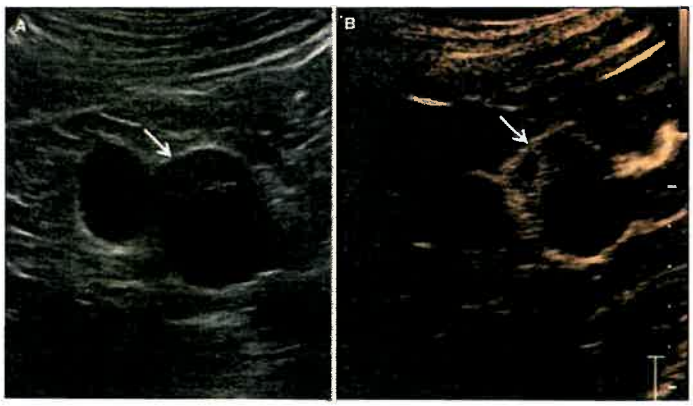
Renal Artery Doppler

Normal Renal Artery indices	
Indices	
PSV	<180 cm/s
Resistance index	<0.7
Acceleration time	>70 ms
Acceleration index	<300 cm/s^2
Renal Artery /Aorta ratio (RAR)	<3.5

Structured reporting of Renal Artery Doppler	
Right	Left
Size Cortical Thickness and echogenicity C-M Differentiation Calculi - Y/N (size, number, location) Hydronephrosis- Y/N (If yes- Grade) Cyst/Mass	Size Cortical Thickness and echogenicity C-M Differentiation Calculi - Y/N (size, number, location) Hydronephrosis- Y/N (If yes- Grade) Cyst/Mass
Renal Doppler	
Main Renal Artery	

Structured reporting of Renal Artery Doppler	
PSV RI	PSV RI
At ostium Mid-level At hilum	At ostium Mid-level At hilum
Segmental Renal Arteries	PSV RI AT AI
PSV RI AT AI	
Upper Pole Mid pole Lower pole	Upper Pole Mid pole Lower pole

Contrast Enhanced Ultrasound



- SF_6 Microbubbles – Sonovue/ Sonazoid / optison
- Safe in CKD- lung excretion
- Role (EFSUMB)
  - Characterization of Indeterminate renal masses
  - **Complex Cystic masses (Bosniak grading)**
  - Renal Infarcts
  - Abscess
  - Tumor Ablation under USG guidance

Ultrasound Elastography

- Experimental
- Intra-renal fibrosis- CKD
- Stiffer tissue- More shear wave velocity
- Standardisation required

CT Scan:

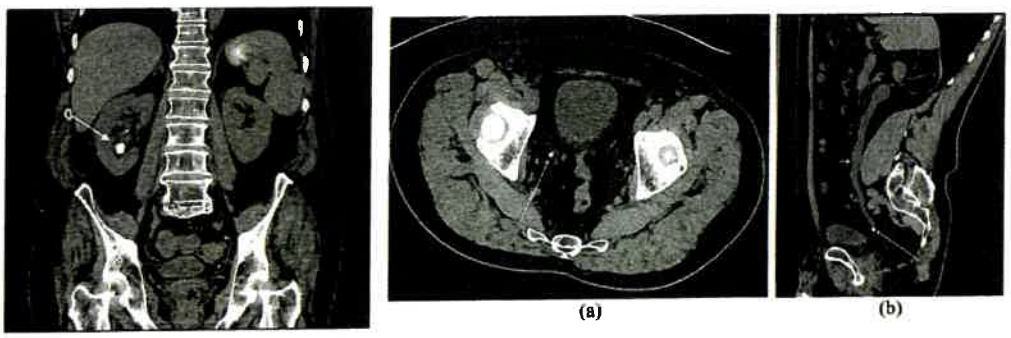
NCCT | Multiphase CT - Renal Protocol | CT Urography | Dual energy CT | CT Angiography

Renal Calculi

- Workhorse for renal Imagibg
- Infections
- Masses
- Congenital anomalies
- Renal Trauma

Split bolus CT urography

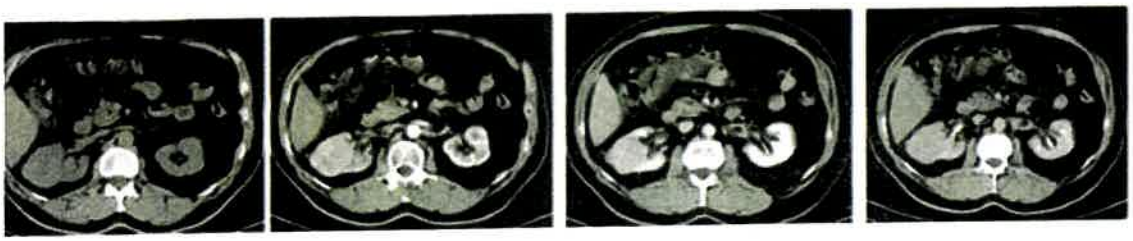
NCCT KUB



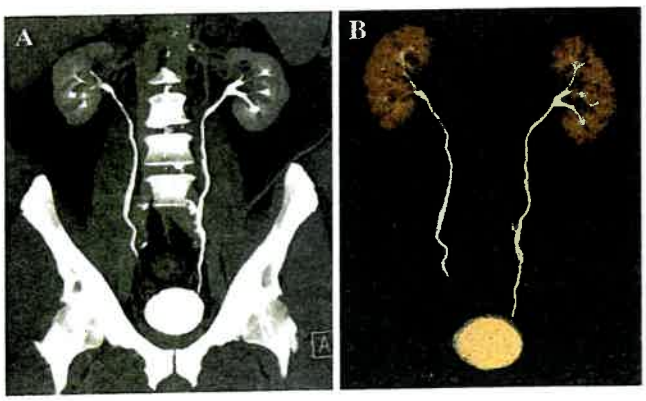
- IOC for Renal/ureteric/bladder Calculi
  - Size
  - Location
  - Attenuation
  - Associated HDN/HDUN
- Parenchymal Calcifications
  - TB, Medullary sponge kidney
- Tumoral Calcification- RCC

Multiphase CECT – Renal protocol

NCCT	Corticomedullary phase	Nerphrography Phase	Excretory phase
	40s after Contrast (20-30 sec after bolus trigger)	100s after contrast	15 min after constrast



CT Urography



- Visualization of collecting system
- Conventional CT urography
  - Contrast injected and NCCT taken after 15 mins
  - Split Bolus CT urography
  - Triple Split bolus CT urography

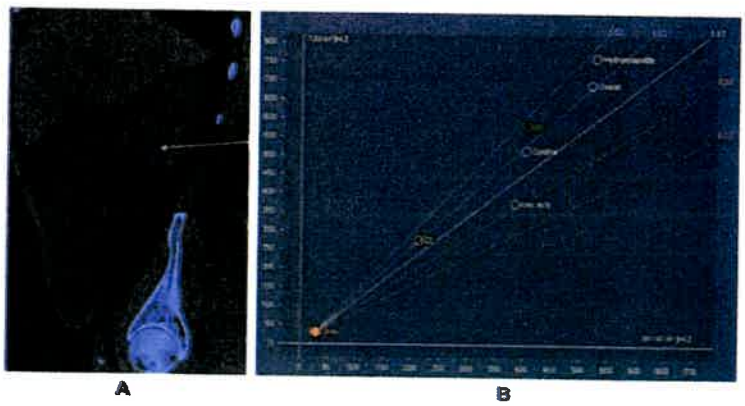
Split Bolus CT Urography

- NCCT
- 30 cc of non-ionic contrast media IV → wait for 15 mins
- Second bolus 100ml – delay of 100s – Nephrographic phase
- Allows both renal parenchyma (NP) and collecting system (EP) to be images simultaneously
- Reduced radiation exposure

Triple Bolus CT Urography

- 1st bolus- 30ml at 2ml/s – opacification of excretory system
- 2nd bolus of 50ml after 7min at 1.5ml /s – Renal Parenchyma
- 3rd Bolus of 65 ml at 3ml/s after 20s – Arterial Anatomy
- Reduces the Radiation exposure

Dual Energy CECT



- Acquisition of high energy and low energy data sets (140 kvP and 80 kvP
- Dual source vs single source
- VNC images, Iodine Maps
- Uses:Characterization of renal Mass
- Characterization of renal Stones

CT Angiography