CALCUTTA ACADEMY OF RADIOLOGY

CALCUTTA ACADEMY OF RADIOLOGY NEWSLETTER, VOLUME III, ISSUE VI, DECEMBER 2022

INSIDE

Calcutta Academy of Radiology

Dear friends, colleagues, juniors & seniors; we are happy to publish 17th. Edition of CAR newsletter.

From this issue we will be publishing a series of articles on Uroradiology. Here is the first article on anatomy of urinary tract. It will be followed by different topics on Uroradiology.

This issue would not have been without the help of Dr. Bhavin Jankharia, Dr. Mayukh Bhattacharya and Dr. Mohul Dutta. We sincerely thank all of them.

Classical duodenal leiomyoma on Barium study.

Dr. Viral Parekh

Dr. Bhavin Jankharia,
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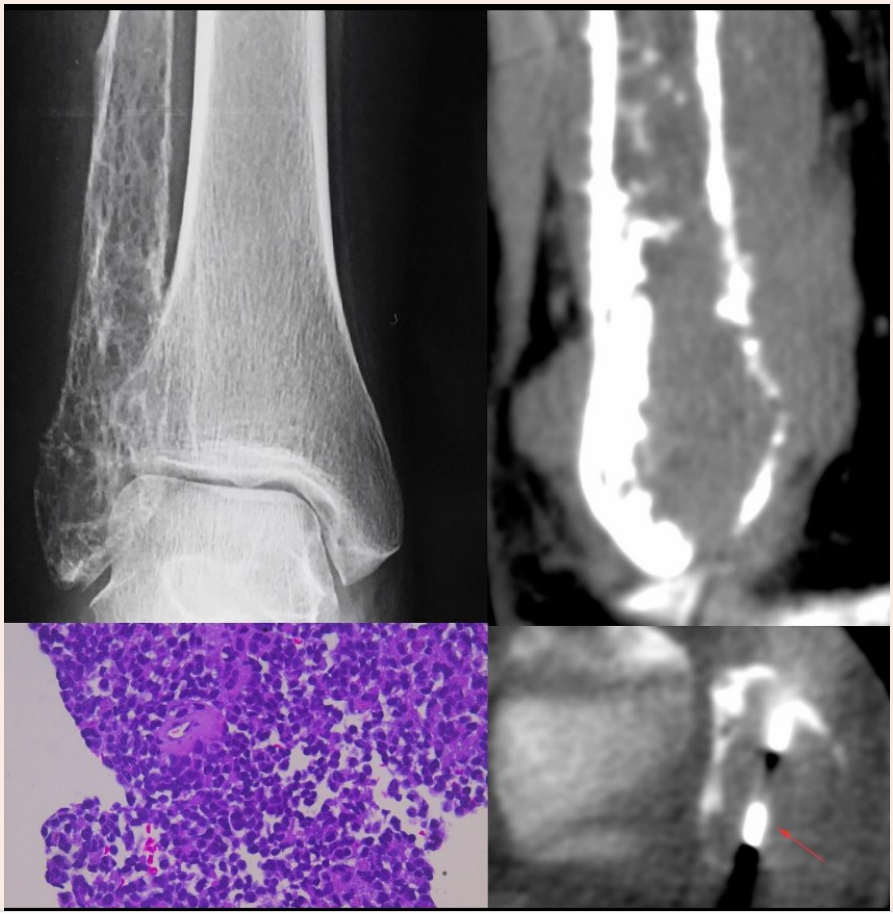
Dr. Bhavin Jankharia needs no introduction to the Radiology fraternity. As you all know he is a renowned Radiologist and academician and has contributed immensely in propagating Radiology education. Presently, he is a Consultant Radiologist at Picture This by Jankharia. He is also a Trustee of Radiology Education Foundation. He has consented to share some of his work with us, which will help all the Residents as well as practicing Radiologists. Here is some information about him in brief.

- He has written 5 books, 35 chapters, 57 articles (PubMed listed)
- Presented 32 posters
- More than 1500 invited lectures over 27 years
- Editor-in-Chief, Indian Journal of Radiology & Imaging (2007-2012)
- Latest Book (2019): Computed Tomography of Interstitial Lung Diseases
- Hon. Visiting Consultant – Radiology – Tata Medical Centre, Kolkata

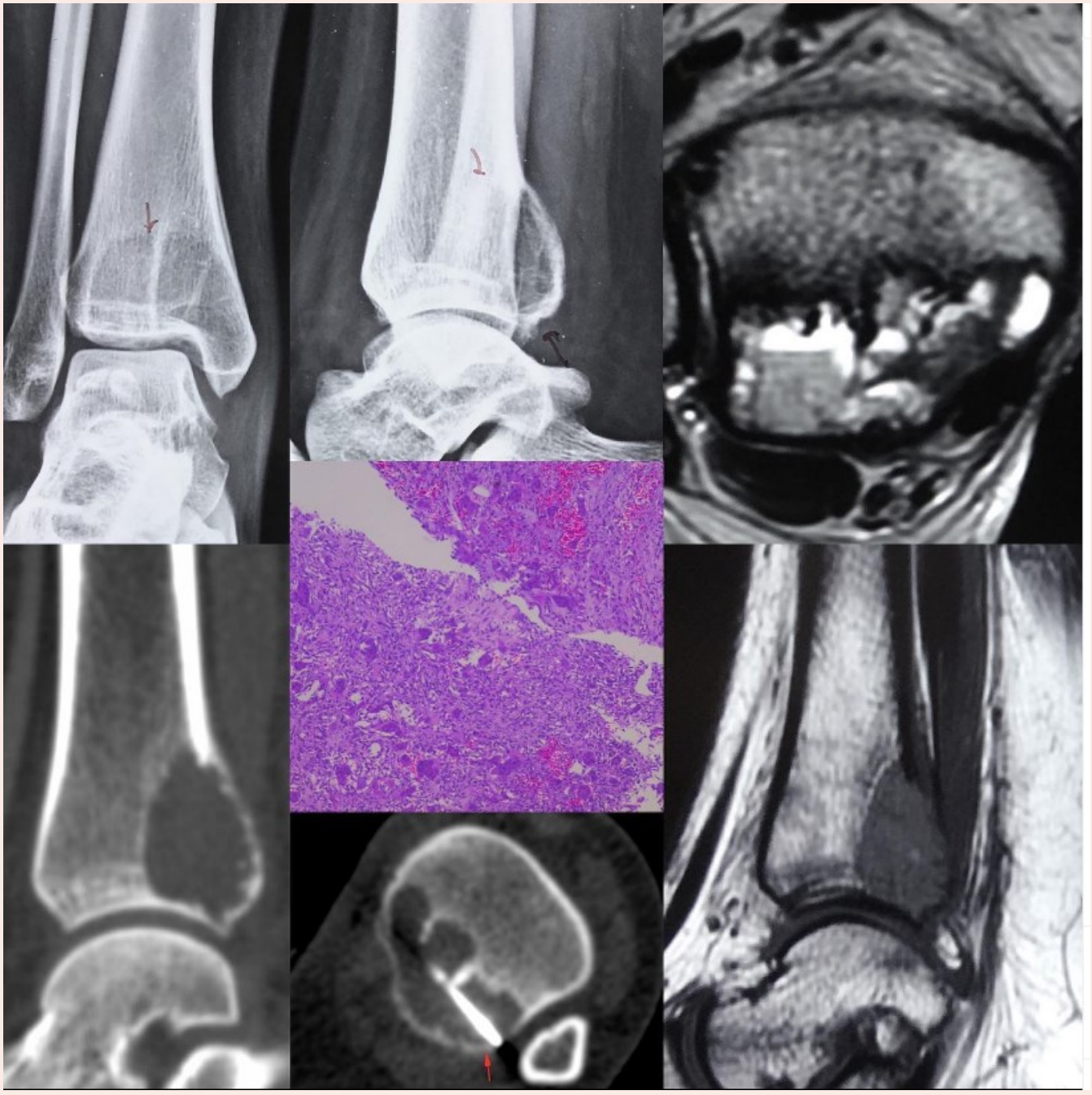
Case I - Ewing Sarcoma Fibula `



This is a 33-years old lady who presented with an osteolytic lesion in February involving the distal fibula. An FNAC was done at the time, which showed inflammation and she was treated symptomatically. When she did not improve, they came back six months later and the radiograph showed progression of disease with a permeative lesion. A CT scan done at the time of the biopsy also shows a permeative lesion with irregular periosteal reaction. This is consistent with the diagnosis of Ewing sarcoma / osteosarcoma, if the patient had been younger. In a 33-years old, the diagnosis is indeterminate.

A biopsy was done and confirmed the diagnosis of Ewings sarcoma. The histopathology slide shows round cells.

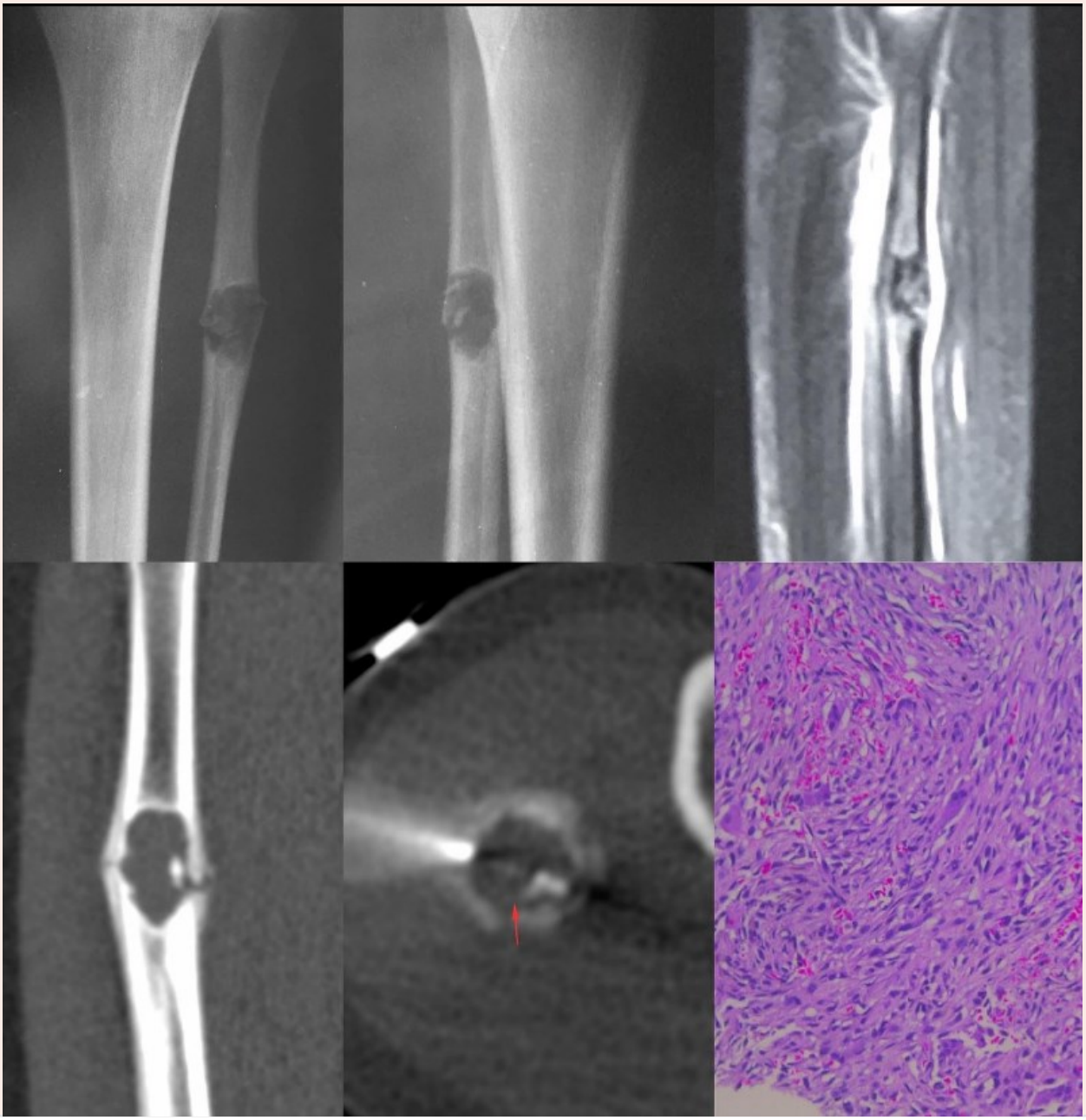
Case II - Distal Tibia GCT with ABC Transformation



This is a 16-years old girl with a mature skeleton who had an osteolytic lesion in the distal tibia with a narrow zone of transition extending up to the articular surface. The MRI shows fluid-fluid levels, suggesting an aneurysmal bone cyst (ABC) component, but the plain radiograph appearance is typical of a giant cell tumor (GCT). The CT scan shows an expansile lesion without abnormal trabeculation, again a finding in favor of GCT. A CT guided biopsy was done and histopathology shows a classic GCT with ABC transformation

Dr. Bhavin Jankharia, MD

Case III - An Unusual Fibular Fibro-Osseous Lesion



This 12-years old boy presented with pain in the leg after playing football. The plain radiograph shows an expansile, osteolytic lesion with a sclerotic rim, suggesting that it is benign. It is likely cortical, but this is difficult to be sure about. There seems to be a pathologic fracture, the reason why the boy is now symptomatic.

An MRI was done. It shows a STIR dark lesion with marrow edema, consistent with a fibro-osseous lesion with a pathologic fracture. The CT scan done prior to the biopsy shows the pathologic fracture well with some bone fragment along the posterior endosteal margin.

The likelihood was of an osteofibrous dysplasia given the location.

A biopsy was done. The final diagnosis was non-ossifying fibroma.

Dr. Bhavin Jankharia, MD

Circumportal pancreas – an interesting anatomic variant

Dr. Mayukh Bhattacharya, MD

Congenital abnormalities and anatomic variants of the pancreas (CAAVPs) are a varied spectrum of both rare and not so uncommon anomalies. Many of the CAAVPs are incidentally detected with the ever increasing use of advanced modalities like multidetector CT and MRI. Some of the conditions like pancreas divisum, annular pancreas etc. may present with symptoms ranging from vague abdominal discomfort to pancreatitis. We present an interesting anomaly of pancreas in this article. A 65 year old female patient presented post cholecystectomy status with upper abdominal pain. Her blood parameters were mostly unremarkable apart from borderline elevated serum lipase level. A pancreatic protocol CECT was done subsequently. CT showed abnormal band of pancreatic tissue encasing superior mesenteric vein and artery after passing behind portal vein. Pancreatic ductal tree was faintly visualized throughout with MPD coursing anterior to portal vein (anteportal type). However, a minimally dilated branch duct was delineated in the retroportal pancreatic tissue component showing curvilinear course joining MPD in head as well as distal body region. The body and tail of pancreas were superior to splenic vein. A final diagnosis of anteportal suprasplenic type circumportal pancreas (CP) was made .

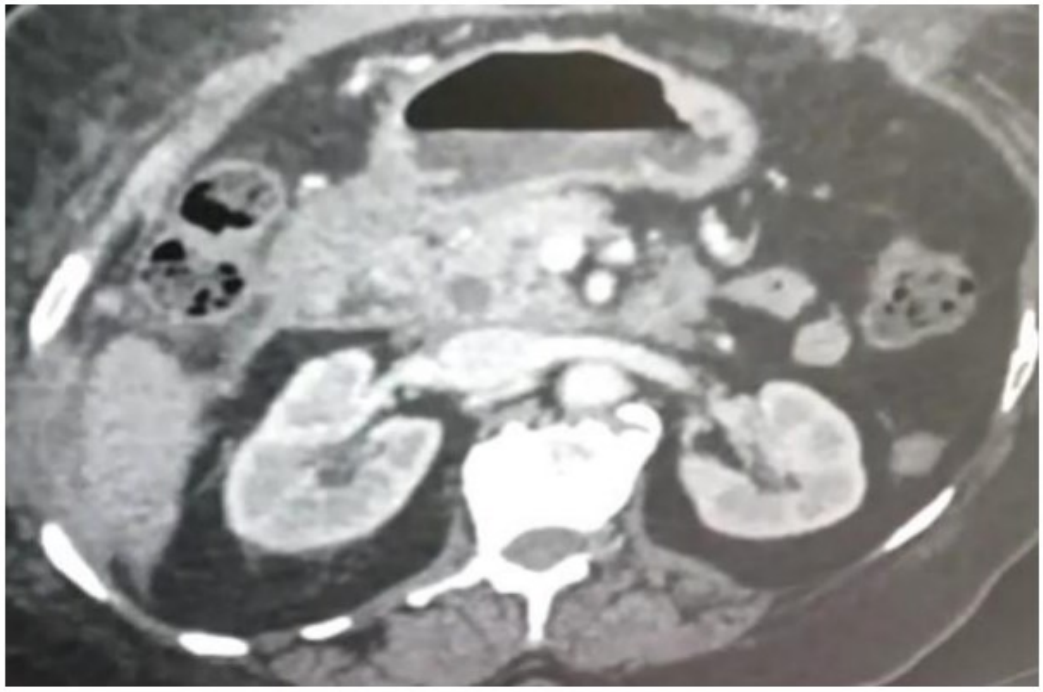


Diagram 1. Circumportal pancreatic tissue encasing superior mesenteric vessels in axial CECT section (pancreatic study phase).

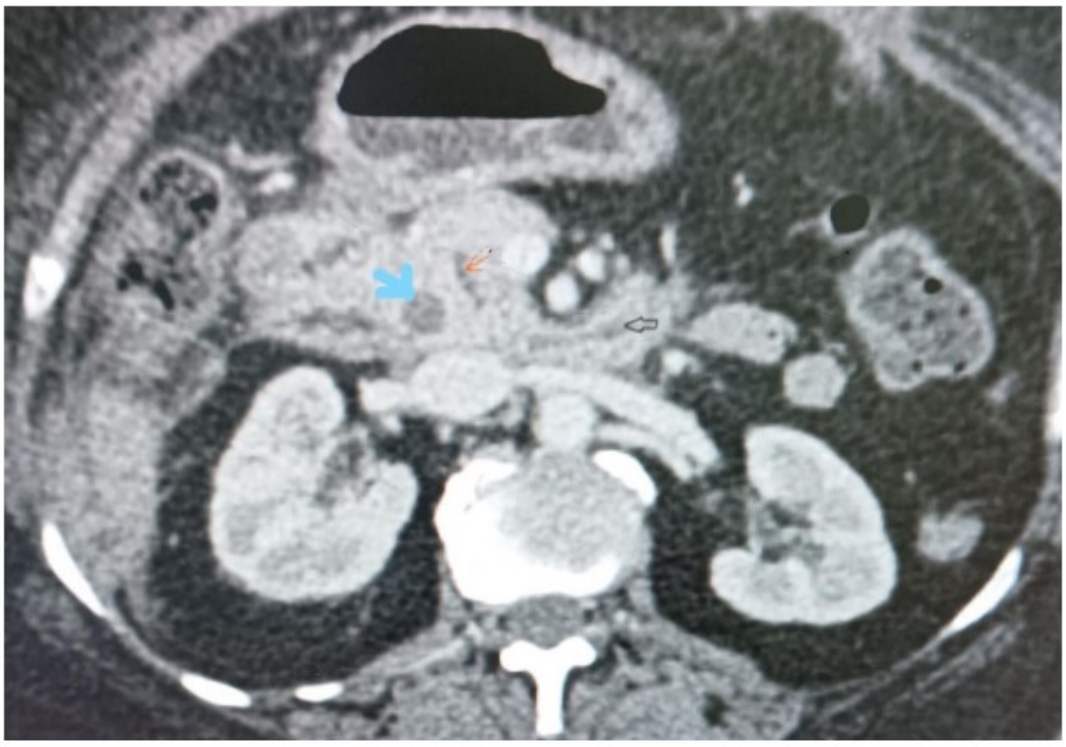


Diagram 2. Anomalous retroportal pancreatic tissue with dilated ductal branch (indicated by small open arrow). Anteportal MPD in head pancreas (shown by small orange arrow) and dilated CBD (pointed by blue arrow).

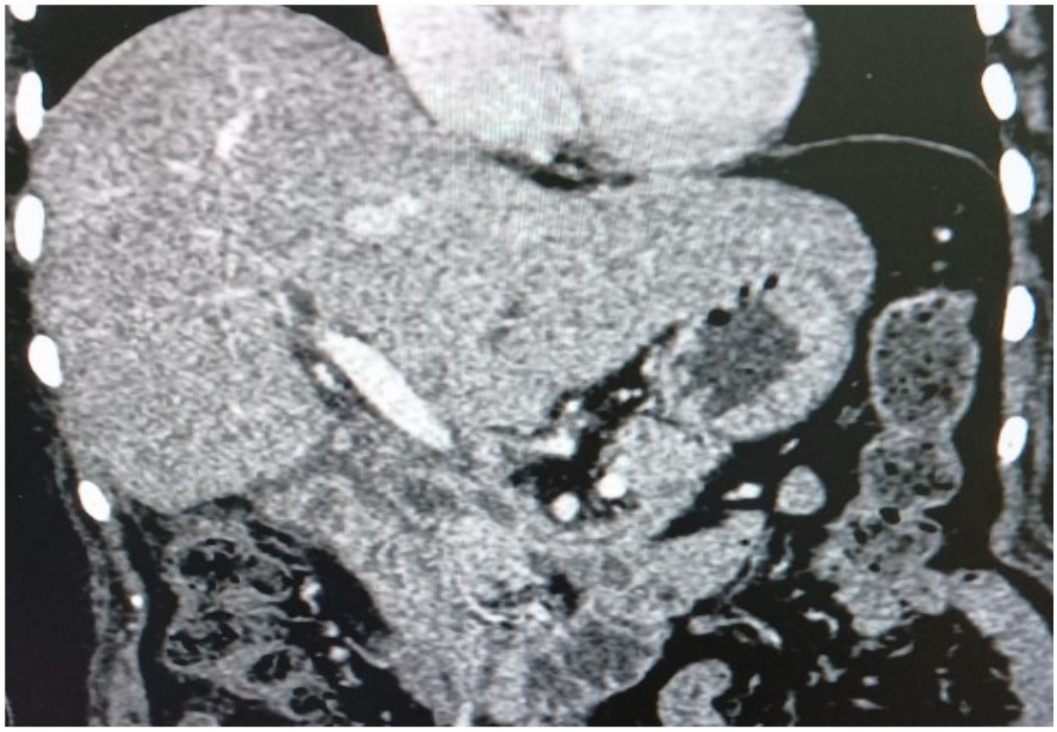


Diagram 3. Coronal reformatted section of CECT upper abdomen showing cicumportal pancreas.

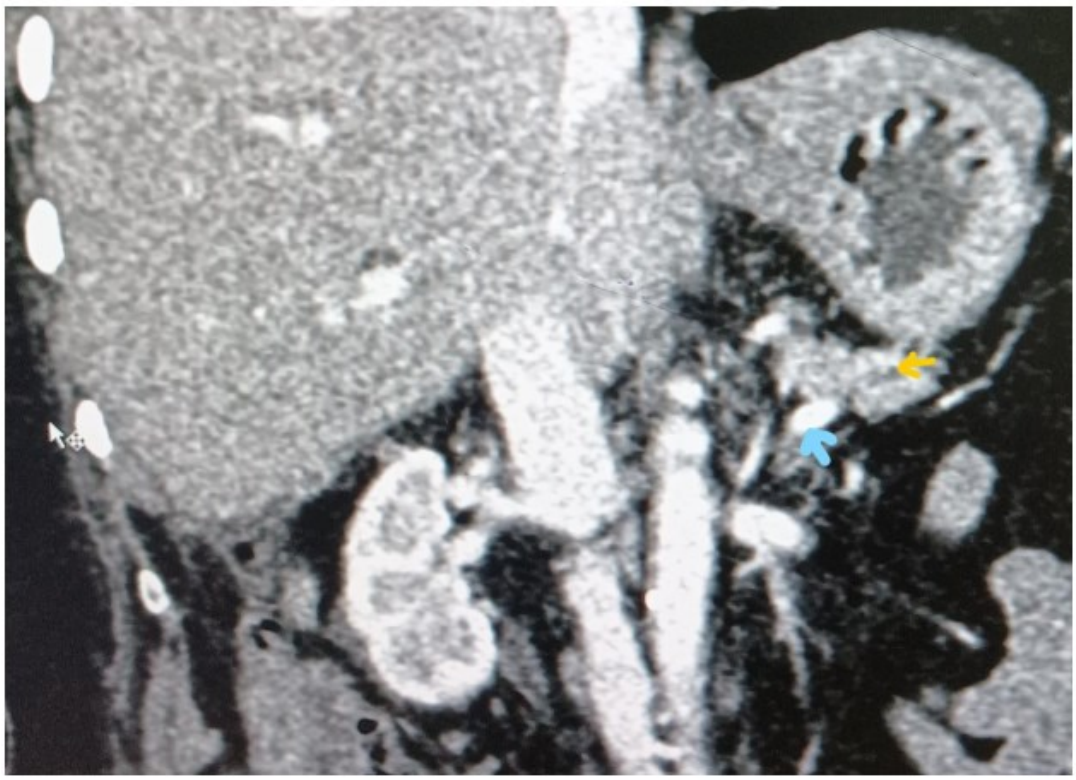


Diagram 4. Coronal CECT section showing infrasplenic type of pancreatic fusion with tail above splenic vein level. Blue arrow denoting splenic vein, orange arrow depicting tail of pancreas.

DISCUSSION:

Circumportal pancreas (CP) is one among multiple types of CAAVPs which has a prevalence of 1.1 % to 2.5%. It is thought to result from anomalous fusion of dorsal and ventral pancreatic buds. It is of four different types depending on location of MPD and relation of splenic vein with fused pancreas. The types are: anteportal suprasplenic, retroportal suprasplenic, anteportal infrasplenic and retroportal infrasplenic. Retroportal MPD (RMPD) is rarer variant. Concomitant vascular variations are reported. There is also a very rare mixed type of pancreas fusion with both supra and infrasplenic components. The most common vascular variation is replaced right hepatic artery originating separately from superior mesenteric artery. It is notable that circumportal pancreas is much easier to detect than RMPD and can even be identified on noncontract CT. Patients with this condition are mostly asymptomatic. However, when patients with CP and RMPD undergo imaging, it is of paramount importance to trace the course of the main pancreatic duct in its entirety, particularly in cases requiring surgery to avoid complications. Also, these conditions are undetected on ERCP.

CONCLUSION:

CAAVPs like circumportal pancreas are not very uncommon and radiologists reporting cases of suspected pancreatic pathology must keep this condition in mind. Failure to report these anomalies may lead to unnecessary surgical interventions and resultant complications.

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1. Various Congenital Abnormalities and Anatomic Variants of the Pancreas: A Pictorial Review. Kim SS, Shin HC, Hwang JA. J Belg Soc Radiol. 2019 Jun 28;103(1):39. doi: 10.5334/jbsr.1780.

2. Circumportal pancreas: prevalence, subtypes and vascular variations of 55 patients. Yilmaz E, Celik A.Surg Radiol Anat. 2018 Apr;40 (4):407- 413. doi: 10.1007/s00276-018-1975-7. Epub 2018 Jan 27

Anatomy of The Urinary Tract

Dr. Bijon Kundu and Dr. Mohul Dutta

EMBRYOLOGY

Normal urinary structures develop through of a series of complex, staged embryologic processes. Because of this complexity of urinary tract development, congenital abnormalities occur commonly, in up to 10% of individuals. Because the kidneys and ureters develop simultaneously, an in-utero event causing one malformation often affects other areas of the urinary tract. Therefore, the presence of one urinary tract anomaly greatly increases the likelihood of coexistent Genito-urinary anomalies; if one congenital anomaly is detected in the urinary tract, there is a 75% chance of a co-existent anomaly. In addition, development of the Genito-urinary tract spans the period of organogenesis, during which other major organ systems are developed. Therefore Genito-urinary anomalies are commonly seen coexisting with congenital abnormalities of other organ systems, especially the musculoskeletal system, central nervous system, cardiovascular system, and gastrointestinal tract. Finally, because the urinary and genital systems are closely related embryologically, their development is interdependent, and anomalies of the genital system often coexist with urinary tract anomalies, and vice versa.

During gestation three partly overlapping but different systems are formed in a distinct craniocaudal and temporal sequence: the pronephros, the mesonephros and lastly the metanephros or definitive kidney (6th week of gestation). Initially situated at the lumbosacral transition, the metanephros later migrates cranially in relation to the development of the organ, especially with the rapid increase in the length of the vertebral column. Once the definitive kidney has been formed, the ureteric bud of the mesonephric duct and the metanephrogenic blastema cooperate. The former gives rise to the ureter, the pelvis, the calices, and the collecting duct system, while the latter develops into the renal tubules, and then the nephrons. During the 4th and up to the 7th week of gestation, the terminal portion of the posterior intestine, the cloaca, is subdivided by a septum forming the anorectal canal (posterior) and the primitive urogenital sinus (anterior). The posterior intestine sinus later subdivides into a larger upper portion, the future urinary bladder, and a smaller lower portion, the definitive urogenital sinus. In males the latter, in turn, develops into a small pelvic portion forming the inferior part of the prostatic urethra, and a longer phallic component which later gives rise to the spongy urethra. In females the inferior portion of the primitive urogenital sinus gives rise to a small portion of the urethra, the inferior fifth of the vagina and the vestibule.

THE KIDNEYS

The kidneys are retroperitoneal organs located in the perirenal space and present a longitudinal diameter of 9–12 cm and a transverse diameter of 3–5 cm and a weight of 250–270 g. The kidney initially develops opposite to the future S2 vertebra, but eventually comes to rest opposite the L1 or L2 vertebra. In the supine position, the medial border of the normal kidney is much more anterior than the lateral border, so that the kidneys lie at an angle of about 30° from the horizontal. The upper pole ofeach kidney is situated more posteriorly than the lower pole. The right kidney, anteriorly, has a relation with the inferior surface of the liver with peritoneal interposition and with the second portion of the duodenum without any peritoneal interposition since the second portion of the duodenum is retroperitoneal.

The left kidney, anteriorly, has a relation with the pancreatic tail, the spleen, the stomach, the Ligament of Treitz and small intestine, and the left colic flexure and left colon. Over the left kidney, there are two important peritoneal reflections, one vertical corresponding to the splenorenal ligament (connected to the gastro-diaphragmatic and gastrosplenic ligaments) and one horizontal corresponding to the transverse mesocolon. Posteriorly both kidneys present a relationship with the diaphragm, with the lateral margin of the psoas muscle, with the aponeurosis of the transverse abdominis muscle, and with the lumbar muscle. Superiorly, both kidneys have a relation with the adrenal glands, while the right kidney is separated from the inferior surface of the liver by the interposition of a double peritoneal sheet which derives from the reflection of the peritoneum to the inferior limit of the coronary liver ligament that delimitates the hepatorenal space or Morrison Pouch.

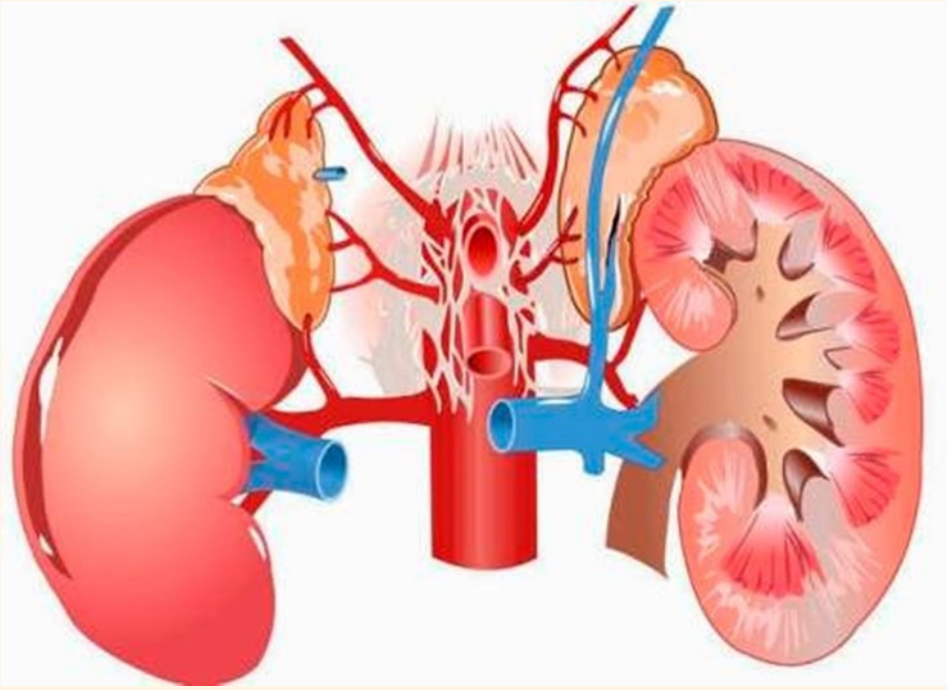


Fig. 1 Gross anatomic diagram of the kidneys

The renal parenchyma is composed of different components. The renal capsule is a tough fibrous layer surrounding the kidney (fibrous renal capsule) and covered by a thick layer of perinephric adipose tissue (fat renal capsule). The kidney is covered by the renal capsule formed by the fibrous and adipose renal capsule. The fibrous capsule represents the connective tissue investment of the kidney, continuous through the hilum to line the renal sinus. The adipose capsule represents the investment of fat surrounding the fibrous capsule of the kidney, continuous at the hilum with the fat in the renal sinus. The renal cortex is the outer portion of the kidney between the fibrous renal capsule and the renal medulla. In the adult, it forms a continuous smooth outer zone with a number of projections (cortical columns) that extend down between the pyramids. The renal cortex is the part of the kidney where ultrafiltration occurs. It contains the renal corpuscles and the renal tubules except for parts of the loop of Henle, which descend into the renal medulla. It also contains blood vessels and cortical collecting ducts. The renal column (or Bertin Column or Column of Bertin) is an extension of the renal cortex between the renal pyramids, and it allows the cortex to be better anchored. Each column consists of lines of blood vessels and urinary tubes and a fibrous material.

The renal medulla is the innermost part of the kidney. The renal medulla is split up into a number of sections, known as the renal pyramids, about 8-18 in number. The broad base of each pyramid faces the renal cortex (outer medulla), and its apex, or papilla (inner medulla), points internally. The pyramids appear striped because they are formed by straight parallel segments of nephrons. Renal pyramids (or Malpighian Pyramids) are cone-shaped tissues of the kidney, and the renal papilla is the location where the medullary pyramids empty urine into the renal pelvis. Histologically, it is marked by medullary collecting ducts converging to channel the fluid. Segmentation and duplications of the renal pelvis and/or ureters are secondary to segmentation of the Wolffian Duct which forms the collecting system. The renal pelvis is generally triangular, and it tapers smoothly to its junction with the ureter defined as ureteropelvic junction. The pelvis exits from the kidney anteromedially. The right renal pelvis is usually located opposite to the L2 vertebra, and the left renal pelvis is usually 0.5–1 cm higher. The renal calyx is a concave structure receiving the tip of the papilla of the renal medulla, and the fornices represent the side projections of the calyx surrounding the papilla. Two wide cup-shaped major renal calices are subdivided into 7–14 minor calices. Each single calyx or multiple minor calices drain by means of an infundibulum into the renal pelvis. The renal sinus is the compartment that surrounds the pelvicalyceal system of the kidney, is filled by peripelvic fat, and communicates medially with the perinephric space. It contains the vascular and nervous structures that enter within the renal sinus, the lymphatics, the renal pelvis, and the surrounding fat. Cysts and sinus lipomatosis are the commonest abnormalities in this space.

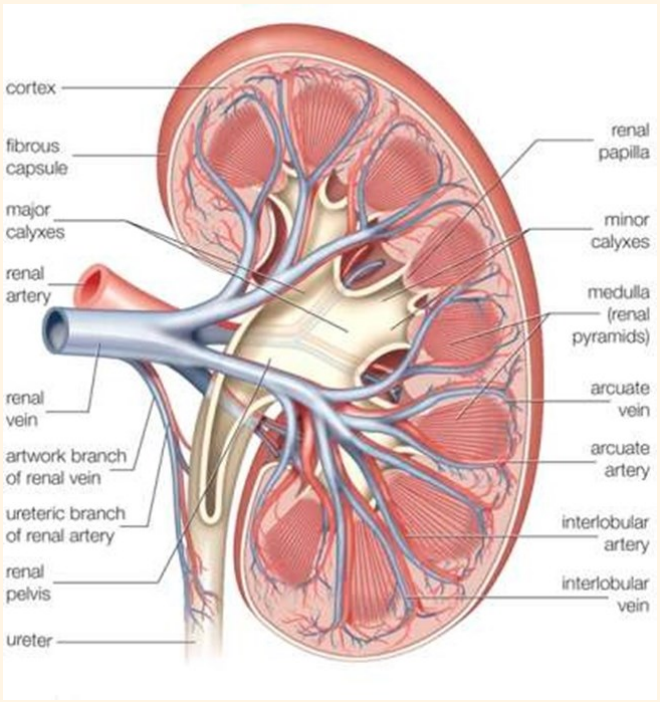


Fig. 2 Coronal anatomy of the left kidney

In each kidney, the main renal artery divides into the posterior and anterior branches that run posteriorly and anteriorly to the renal pelvis. The superior, anterior-superior, anterior-inferior, and inferior vascular areas of each kidney are supplied by the segmental arteries originating from the larger anterior branch. The posterior vascular area is supplied by the smaller posterior branch of the main renal artery. The junction of the anterior and posterior branches of the main renal artery in the renal parenchyma creates a relatively a vascular plane (Brodel's Line), which is the preferred track of placing percutaneous nephrostomies and should be considered when performing biopsies of a native or transplanted kidney. The superior, anterior superior, anterior inferior, inferior and posterior vascular areas of the kidney are vascularized by the segmental arteries of the same name, which subdivide into interlobar arteries. Each interlobar artery penetrates the kidney through a Column of Bertin and divides at the corticomedullary junction into arcuate arteries, which eventually run parallel to the surface. The arcuate arteries, in turn, supply interlobular arteries that penetrate the cortex perpendicularly to the renal surface. Branching from each interlobular artery are numerous small arterioles, the afferent arteries.

The fibres of the nervous renal plexus, including sympathetic nervous fibres triggering vasoconstriction, course along the renal artery to reach each kidney. The renal branches of the Vagus nerve are small branches providing parasympathetic innervation to the kidney. Sensory input from the kidney travels to T10–11 levels of the spinal cord. The renal lymphatics have not been fully documented in humans. Lymphatic vessels are abundant around the intrarenal arteries/veins, while they are scarce in the interstitium around the glomeruli or between the tubules since the lymphatic system begins in the cortical interstitium around the glomeruli or between the tubules. Lymph nodes for the kidneys include the renal hilar nodes and the abdominal paraaortic (peri- aortic) nodes including the interaortocaval, paracaval, precaval, retrocaval, pre-aortic, and retro-aortic lymph nodes. The ureters are drained prevalently by the renal hilar and paracaval lymph node groups.

THE RETROPERITONEUM

The retroperitoneum is a complex structure limited anteriorly by the posterior parietal peritoneum and posteriorly by the fascia transversalis. The fascia transversalis fuses anteriorly with the parietal peritoneum and posteriorly with the muscular fasciae of the Psoas and Quadratus Lumborum muscles. The retroperitoneal space is divided into three fundamental spaces: the anterior pararenal, the perirenal, and the posterior pararenal. This classical division of the retroperitoneal space has been extensively revised in the recent years. In particular, it has been underlined that the retroperitoneum, namely, the anterior pararenal space, communicates with the mesentery and mesocolon through the connective tissue involved in the peritoneal folds. The renal fasciae, namely, the anterior and posterior renal fasciae, represent the fundamental anatomical structures for the division of the retroperitoneal space, and they are clearly visible on computed tomography and magnetic resonance imaging. The renal fasciae are usually not thicker than 3 mm. If renal fasciae appear thicker than 3 mm, this is often due to a retroperitoneal space disease, corresponding mainly to acute pancreatitis, renal pathologies, and abdominal aorta aneurysm rupture.

The anterior renal fascia space is limited anteriorly by the posterior sheet of the parietal peritoneum and posteriorly by the anterior renal fascia known also as Gerota's Fascia. Superiorly, it extends to the dome of the diaphragm and hence to the mediastinum and, inferiorly, communicates with the pelvis and the posterior pararenal space. It contains the pancreas, the second (descending), third (transverse), and fourth (ascending) loops of the duodenum, and the descending and ascending colon tracts. The ascending and descending colon are retroperitoneal and not abdominal organs because they do not have a 'meso' formed by the peritoneal folds. The right and left sides of the anterior pararenal space communicate across the midline.

The perirenal space is a retroperitoneal space, limited anteriorly by the anterior renal fascia and posteriorly by the posterior renal fascia (Zuckerkandl's Fascia). The two renal fascia fuses to form the continuation of fascia laterally and blend loosely with the peri- ureteric connective tissue medially. Actually, the latero-conal fascia represents the lateral continuation of the posterior renal fascia, while the posterior and anterior renal fasciae may be detached by a collection in the anterior pararenal space. The anterior renal fascia fuses anteriorly with the fibrous tissue surrounding the main blood vessels, namely, the inferior vena cava and abdominal aorta, so that the right perirenal space does not communicate with the left perirenal space above the iliac region. The perirenal space abuts the bare area of the liver on the right

and the subphrenic space on the left and communicates with mediastinum via the diaphragm hiatus. The anterior and posterior renal fasciae enclose a gradually tapering cone-like space produced by the embryologic ascent of the kidneys from the pelvis to the adult retroperitoneal position. Superiorly, the two renal fasciae are fixed to the diaphragmatic fascia above the adrenal glands, while inferiorly, they blend with the iliac fascia and do not fuse and enable a free communication between the anterior and posterior pararenal space and the perirenal space. In the other regions, the anterior and posterior renal fasciae merge, and a collection in the anterior or posterior pararenal space does not extend directly to the perirenal space. Sometimes, the anterior renal fascia, which overlies the upper portion of the right kidney and adrenal gland, may be deficient and allow communication of the perirenal space with the hepatic bare area. The perirenal space contains the kidneys, adrenal glands, proximal ureters, perirenal fat, lymphatic vessels, and blood vessels. Within the fat surrounding the kidney in the perirenal space, there is a network of thin fibrous septa and bridging septa (Kunin septa) that connect the renal capsule with the anterior and posterior renal fasciae. The left and right perirenal spaces do not communicate with each other across the midline due to the interposition of the perivascular space which contains the inferior vena cava and the abdominal aorta and is filled by the connective tissue derived from the fusion of the right and left anterior and posterior renal fasciae across the midline. The perirenal spaces communicate with the pelvic space which is located below the peritoneum.

The posterior pararenal space is a retroperitoneal space that is limited anteriorly by the posterior renal fascia and posteriorly by the fascia transversalis. Laterally, it continues with the pre-peritoneal compartment containing fat. It is potentially in continuity anteriorly with the pre-peritoneal fat of the anterior abdominal wall; it contains only fat and does not contain any parenchymal organ. Itis open toward the pelvis inferiorly but limited superiorly by the fusion of the posterior renal fascia with the fascia of the Quadrates lumborum and psoas muscles.

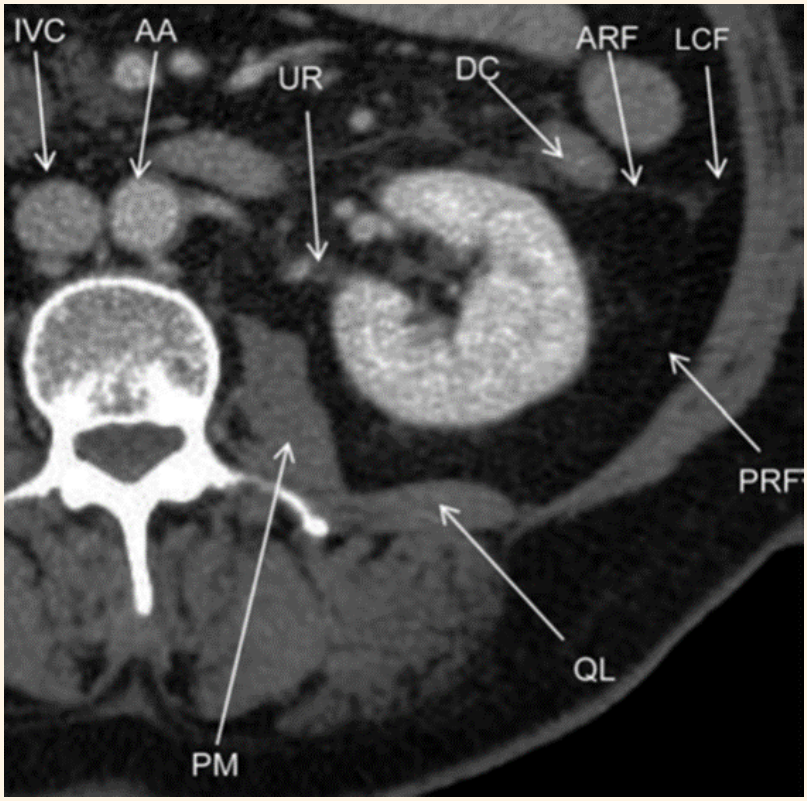


Fig. 3 Computed tomography.

Anatomy of the retroperitoneal space. AA abdominal aorta, ARF anterior renal fascia, DC descending colon, IVC inferior vena cava, LCF latero-conal fascia, PRF posterior renal fascia, PM psoas muscle, QL Quadratus lumborum muscle, UR ureter

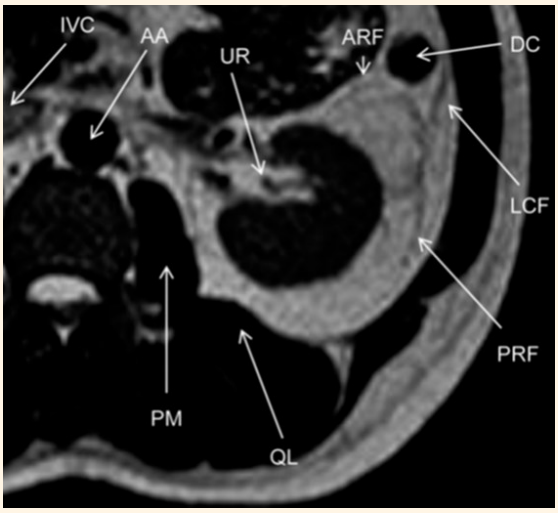


Fig. 4 Magnetic resonance imaging

T2-weighted sequence. Anatomy of the retroperitoneal space. AA abdominal aorta, ARF anterior renal fascia, DC descending colon, IVC inferior vena cava, LCF latero-conal fascia, PRF posterior renal fascia, PM psoas muscle, Quadratus lumborum muscle, UR ureter

THE URETERS

The ureter starts at the uretero-pelvic junction (UPJ) and courses in a caudal direction through the retroperitoneum reach the posterior wall of the bladder. The length of the adult ureter varies from 28 to 32 cm and diameter from 4 to 6 mm (outer diameter), and from 2 to 4 mm (inner diameter), depending on the level at which it is measured. In the absence of peristaltic activity, three normal narrowings are described: the first is at the uretero-pelvic junction, the second where the ureter crosses the iliac vessels, and the third corresponds to the intramural portion. The ureter is divided into three parts: the abdominal or lumbar, the iliac, and the pelvic portion.

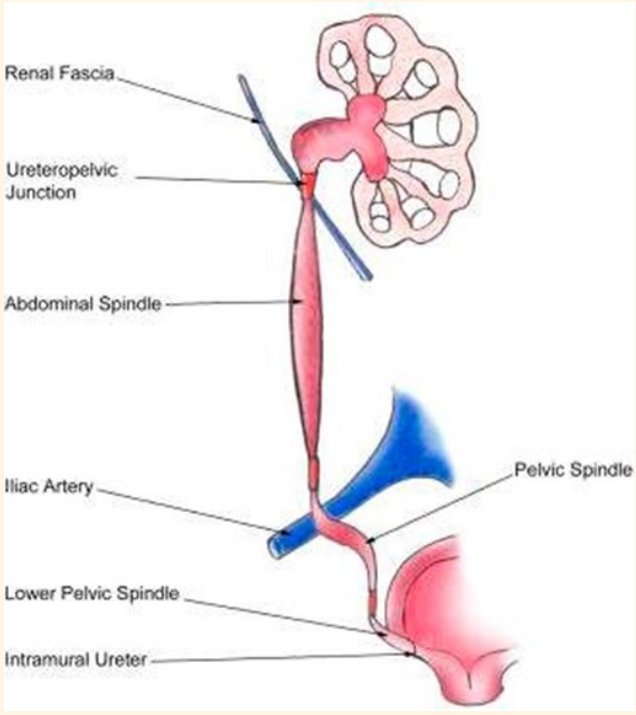


Fig. 5 Normal constrictions of the ureter

The abdominal portion is approximately 15 cm in length. It starts at the uretero-pelvic junction and courses vertically to the pelvic rim. Its initial part is located at the level of the transverse process of the second lumbar vertebra and lies, surrounded by fat, on the fascia iliaca, which separates the ureter from the body of the psoas muscle. The genitofemoral nerve branch of the lumbar plexus is in direct relation to the ureter at the level of the third lumbar vertebra. The genitofemoral nerve crosses the ureter from below. On the right, the ureter is behind the second part of the duodenum and the line of attachment of the mesentery. On the left, the ureter is in relation to the left mesocolon. The gonadal vessels (testicular or ovarian) are directly in contact with the ureter. The gonadal artery crosses the ureter from above at the level of the third lumbar vertebra. The gonadal veins have a different course: the left gonadal vein is located outside and courses along the ureter, crossing it from above near the UPJ; the right gonadal vein crosses the ureter from above at the level of the third lumbar vertebra

Medially, the lumbar ureters are situated outside the aorta on the left and the inferior vena cava on the right.

The iliac portion crosses the brim of the pelvis, usually over the bifurcation of the common iliac vein on the right side and over the common iliac artery on the left side. The iliac portion is a very short and narrow segment, with a slight lateral and posterior concave course. Through the posterior peritoneum, the iliac portion is in close relation to the terminal ileum and appendix on the right side and the meso-sigmoid colon on the left.

The pelvic portion measures about 14 cm. immediately after crossing the iliac vessels, the ureter runs backward and laterally in a vertical course along the side wall of the true pelvis, just lateral and anterior to the internal iliac artery until the level of the ischial spine. Then it turns forward and medially towards the bladder in a horizontal course, just medial to the obturator nerve and superior vesical artery. The ureteral ending lies below the tip of the coccyx. The vertical portion courses between the obturator muscle and the peritoneum. The anatomical relationships are different in male and female subjects for both the vertical and the horizontal portion. The relations of the female pelvic ureter are complex. In its vertical portion, the ureter is dorsal to the ovary, medial to the ovarian vessels, and later alto the sacrouterine ligament. The horizontal portion is located inside the broad ligament and runs close to the uterine artery, which goes obliquely forward. After crossing the broad ligament, the ureter lies lateral to the uterine cervix and above the lateral fornix of the vagina. During its course, the ureter is accompanied by the vaginal artery, venous plexus, and lymphatics, and is crossed below by the round ligament. In its vertical portion, the male pelvic ureter is located lateral to the rectum and is crossed ventrally by the vast difference at the level of the ischial spine. In its horizontal portion, the ureter turns medially and enters the posterolateral wall of the bladder, lateral to the seminal vesicles. It is crossed below by the vesicoprostatic arteries.

The intramural ureter crosses the vesical wall obliquely, so that it creates a complex anatomical system to prevent vesicoureteral reflux. The length of the intramural ureter is about 15 mm. It runs through longitudinal and circular muscular layers of the bladder inside the so-called sheath of the ureter, which links the ureteral wall to the bladder wall. After crossing the vesical wall, the ureter becomes an intravesical structure for about 1 cm. This portion lies directly under the mucosa and can be collapsed by increase of the bladder pressure.

The rich vascularization of the ureteral wall explains the frequency of metastatic disease around and along the ureter. Ureteral blood vessels are also used as collateral pathways in case of occlusion of arterial or venous retroperitoneal vessels. Arterial supply is provided by branches of the renal artery, the gonadal artery, the common iliac artery, and the vesical or uterine arteries. This supply is variable, partly in its upper part. In the lumbar part, arterial supply is provided by a branch of the renal and gonadal arteries and by a direct aortic branch. The pelvic portion is supplied by branches that may arise from the common iliac artery or the internal iliac artery (vesical, uterine,middle rectal or vaginal). Ureteral arteries form a continuous longitudinal plexus in the adventitia, supplying the muscular is and mucosa by smaller perpendicular branches. Similarly, venous drainage is assumed by sub-adventitial plexuses, which drain into lumbar, iliac, renal, vesical, and gonadal veins. Venous plexuses are particularly well developed in the lowermost part of the ureter, allowing communications between vesical and internal iliac veins. Lymphatic drainage is important and is in continuity with lymphatics of the bladder and kidney. It consists of widely anastomosed vessels located mainly in the adventitia and communicating freely along the entire ureter. Nerves are derived mainly from the renal testicular or ovarian and hypogastric plexus.

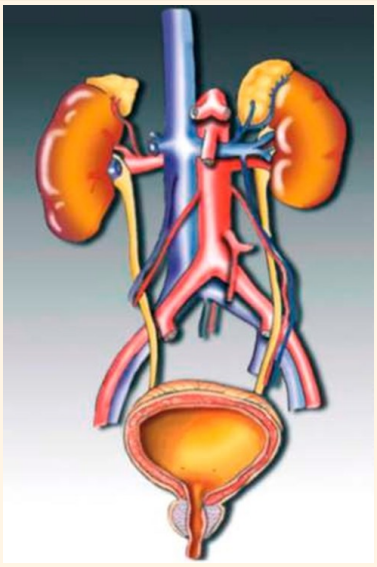


Fig. 6 General topographic anatomy and main relationships of the ureters (Netter 1973).

THE URINARY BLADDER

The urinary bladder is situated extra peritoneally. An understanding of urinary bladder disease requires an anatomic description of the trigone of the bladder, a triangular region whose anterior apex is represented by the internal urethral orifice and posterior base is formed by the two ureteric orifices. The latter have a major oblique axis converging towards the medial line and are characterized by the presence of a

posterior fold which, as the bladder fills, presses the walls of the ureters, thus partially acting like a valve. Posterior to the trigone, the inter-ureteric ridge formed by the submucosal oblique intramural course of the ureters delimits the bladder bed. In elderly males, this may be lower than the trigone. This position is accentuated in prostatic hypertrophy, where the urethral orifice is not the lowest point of the bladder, thus leading to incomplete emptying.

The relations of the bladder with the reproductive organs are anatomically important. In males, the bladder is related to the prostate, the seminal vesicles, and the distal segments of both ductus difference, through which the fundus, when distended, comes into contact with the rectum. In females, the bladder is closely related to the uterus which rests on the apex of the bladder. The serous peritoneum covers the superior surface of the bladder and is reflected on the anterior surface of the uterus. Hence there is a peritoneal space between the two organs, such that the uterus may be easily raised from its contact with the bladder. The fundus of the bladder is continuously related with the cervix up to the level of the fundus of the vagina. These structures separate the bladder from the recto-uterine pouch and the rectum, which is therefore not in contact with the bladder.

The bladder wall, the thickness of which varies from 3-4 mm when distended to10–15 mm when empty, consists of a mucosa (transitional epithelial tissue), submucosa, muscular is propria and adventitia. The muscular coat is particularly well developed and forms the detrusor muscle of the bladder. This is made up of three ill-defined layers of varying thickness. At the level of the trigone the musculature is thicker and has characteristics different from the other regions (the bundles are more compact and barely separated by connective tissue) such that it has been identified as a distinct structure known as the trigonal muscle.

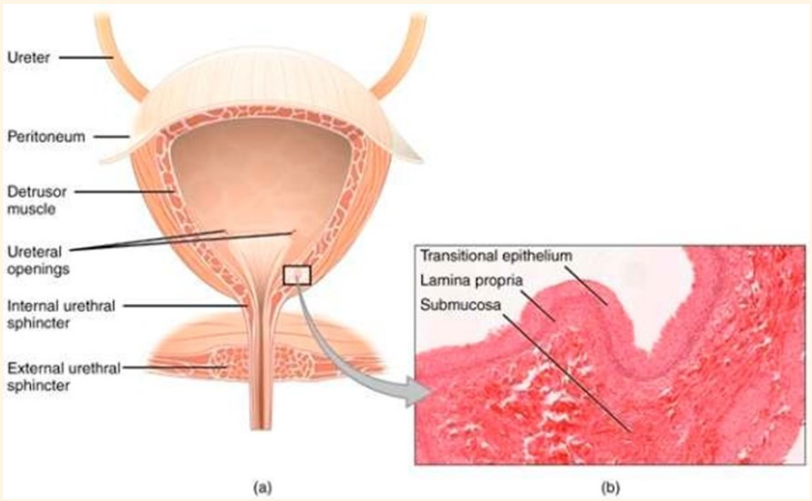


Fig. 7a Coronal section of the urinary bladder with b) bladder wall microstructure.

THE URETHRA

In the adult male the urethra is a muscular tube with an average length of 18–20 cm. Only in its proximal segment does it exclusively convey urine (urinary urethra, which corresponds to the entire female urethra). Distally, from the seminal colliculus (or verumontanum), i.e., the opening of the ejaculatory ducts to the urinary meatus, the urethra also conveys semen (common urethra). In relation to the adjacent organs, the urethra is subdivided into three segments: prostatic, 3–3.5 cm in length; membranous,1–1.5 cm in length, which includes the urogenital diaphragm; and spongy,13–15 cm in length, which is contained in the corpus spongiosum and in turn is divided into bulbous and pendulous urethra (Fig. 1.9).

The female urethra (Figs. 1.6, 1.8) is a tubular structure 4–5 cm in length, arising from the urinary bladder, which opens into the anterior part of the vestibule of the vagina. The narrow lumen at its extremity, where it measures 7 mm, can easily be dilated allowing a surgeon to introduce instruments as large as 2 cm in diameter.

Microscopically, in the adult male the mucosa of the prostatic and membranous parts of the urethra is essentially composed of transitional epithelium, although there are also areas of prostatic epithelium. In the spongy part, the layer consists of pseudo stratified or squamous epithelial tissue. The submucous coat contains the bulbourethral and peri-urethral glands. Moving distally along its course the urethra is surrounded by the musculature of the bladder neck, the prostate, the urogenital diaphragm (external sphincter), and lastly the corpus spongiosum of the penis.

The female urethra is composed of three layers: mucous, submucous, and muscular. The mucosa consists of the transitional epithelium of the urinary tract in its superior

part and pavement epithelium similar to that of the vestibule of the vagina in its inferior part. It rests on a supporting layer of loose connective tissue abundant with elastic fibres. The mucosa contains small mucous-secreting acinar glands similar to the glands of the male urethra. The submucous layer is made up of connective tissue vascularized by a fine plexus of thin-walled veins. The muscular layer consists of an internal layer of smooth muscle (longitudinally and circularly arranged muscle fibres) and an external sleeve of striated muscle (external sphincter) which arises from the perineal trigone that surrounds the urethra immediately below the urinary bladder

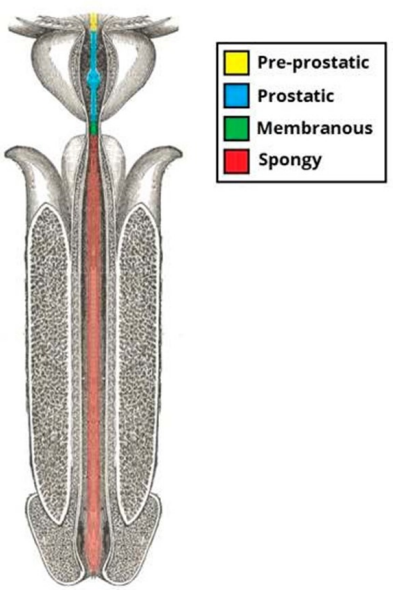


Fig. 8 Coronal anatomy of the male urethra.

Preventive/diagnostic role of Radiologists in drug trafficking

Dr Anup K Sadhu MD

The author, during early 90s had the experience to undertake radiological investigations mainly of the suspects who smuggled gold to India or exporting to other countries in illegal way.

The security staffs of Airport authority of India used to bring the suspects to the department of radiology where the suspect was screened under IITV.

That was the only investigation we had to do at least one in a week—the security personnel , apparently had no idea about drug trafficking. They were happy if the suspect had metallic foreign bodies in the G I tract.

How many coins sir? Its 50 in number . The happy security personnel used to leave with much grandeur.

They had no idea (nor had we) that illicit drugs are also smuggled with the gold coins as cover.

By the time police personnel became aware of various narcotics available in Calcutta; West Bengal and Northeast was flooded with Heroin, LSD, charash, Mandrax, amphetamine.

If someone has strolled past elite park street areas in the eighties, could well remember heroin addicts lying on the pavement. Gradually the drugs entered the colleges and universities spoiling careers of many.

We have noticed during screening some shadows appeared and we interpreted them as faecoliths or insignificant material.

Today, radiologists have been increasingly encountering internal concealment of illegal drugs. The packages commonly contain powdered solid drugs such as cocaine, heroin, methamphetamine, and hashish, but they may also contain cocaine in the liquid form. The second type of package has recently been more commonly encountered and poses a greater diagnostic challenge.

Imaging methods play pivotal role in the diagnosis, follow-up, and management. Abdominal X-ray, ultrasonography, CT and MRI are used for the imaging purposes. Among the methods, low-dose CT is state-of-the-art in these cases. It is of paramount importance that radiologists have a full knowledge of the imaging characteristics of these packages and accurately guide physicians and security officials.

Illicit drugs may be concealed by different ways and described in different terms. The term body packing refers to the act of swallowing a great amount of narcotic material stuffed in a high number of packages, consequently, to be concealed in the lumen of the gastrointestinal system and transported to the target destination without being caught by security measures. Drug carriers engaged in this profession are called body packers

They are also called drug mules, swallowers, internal carriers or couriers.

Body pushers, on the other hand, fulfil the task of drug transport by placing typically larger drug-filled packages into their rectum or vagina

However, a single person can be both a body packer and body pusher at the same time A body packer can carry 50–100 packages, each containing 8–10 g of narcotic agents, weighing up to 1 kg in a single transport However, the number of packages and the number of drugs can be highly variable, and cases have been reported of individuals carrying more than 200 packages. The packages can be detected anywhere in the gastrointestinal tract of a body packer.

Drug-filled packages may be handmade or manufactured. Mechanically manufactured packages tend to have a uniform shape and dimension. Packages contain solid powder of drugs tightly packed with a synthetic material (e.g. condoms, plastic wraps/bags, latex glove fingers, balloons, aluminium foil, cellophane)

Security officers often cannot accurately detect body packers. Rather, some persons with certain features are considered suspects and taken into custody. Physicians encounter body packers during medical examination after their arrest or custody, or in the case of a drug-induced intoxication or adverse event, such as gastrointestinal obstruction requiring surgical intervention.

In suspected cases, radiologic imaging has to be used to confirm the diagnosis of body packing. Plain abdominal radiography, contrast-enhanced abdominal radiography, ultrasonography, CT and MRI have been used in the diagnosis of these cases. Among these, abdominal X-ray and ultrasonography can reportedly be used as screening tests.

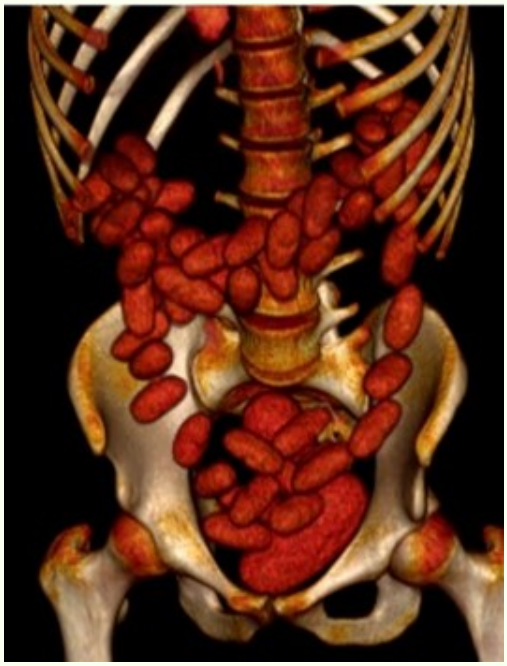
Plain film

	Solid substance/powder	liq. cocaine
Radiodensity	lucent to radiopaque	radiopaque
Specific signs	double condom sign	thin lucent lines
USG	hyperechoic smooth	hyperechoic irregular
CT	hypo/iso/hyperdense	hyperdense
	There are few specific signs though not much reliable	
MRI	Hypointense in T1/T2	variable
	No specific sign in either case	

Emergency room physicians and radiologists encounter increasingly more cases of drug smuggling in body spaces. Radiologic imaging techniques assume a vital role in the diagnosis, follow-up and treatment of these cases. Drug smugglers may use some confusing methods to puzzle security officers and physicians. Moreover, this subject also involves some difficult medicolegal and ethical issues for radiologists and other healthcare professionals.

Hence majority of Radiologists do not undertake investigation of traffickers unless the radiologists is a Government servant or been forced by the law to carry out investigations.

It is of paramount importance for the management of body packers, body stuffers and body pushers that radiologists have a thorough knowledge of the imaging signs of each smuggling type and different packages. The radiologic diagnosis of body stuffers is more challenging and abdominal radiograms may fail to diagnose them because they carry fewer smaller packages. Abdominal plain film and ultrasonography could be used as the initial imaging methods for screening purposes in body packers. The main problem with these methods is, however, their low negative-predictive value. Low dose CT is the gold standard imaging used when complications arise or for confirmatory purposes in difficult cases. It is also recommended as a pre-discharge imaging method. In particular, low-dose CT shall be preferred to avoid large amounts of radiation. The diagnostic role of MRI in suspected cases is a subject that needs more research, and this modality is not yet part of the routine radiologic algorithm. Despite this, it may be selected along with ultrasonography in paediatrics and females who are pregnant.



A book picture showing solid drug containers

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4	PET CT in Neurology - Dr. Sikandar Sk.
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We have a new blog , where we publish cases, quizzes and various other education materials. Please

We are on YouTube

You can send your good case to us. We will publish it in our channel.

CAR
Calcutta Academy Of Radiology
A Platform For Radiology Education & Interaction

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A Platform For Radiology Education & Interaction

Calcutta Academy of Radiology was formed on international day of Radiology in 2019, that is on 8th. November, 2019 to promote Radiology education, keeping in mind Residents as well practicing Radiologists.

Since then we are on WhatsApp and Telegram, where thousands of cases have been discussed by members from all over the world and in the process we are sharing our experiences and helping each other. These social media platforms have turned out to be great learning tools.

We had organized a half day CME also on GI Radiology in February, 2020. Another CME on Neuroradiology was organized in July 2022, We have plans to organize more such CME programmes in future .

We are on YouTube also where we regularly post teaching videos and in the process try to propagate Radiology as much as possible.

We are on WhatsApp and Telegram

Next issue will be published in February, 2023

We will be bringing out such Newsletters with a frequency of one issue every two months. So, next issue will be published in February 2023.

We are hereby inviting good interesting cases and original work from our fellow Radiologists, which will be published on merit basis.

So, I request all of you to contribute to this Newsletter. Please send your material in Word format with good quality images. Please send your photograph and details of your place of work with email address also.

Your material should reach us by 15th. Of January, 2023. You can send the word file to our abovementioned email address or you can WhatsApp it to above-mentioned three phone numbers.

On our YouTube channel, we are presenting a new case every week and there is good response to such teaching videos. I hereby request all Radiologists to share their teaching videos with us and if they contain good teaching material, we will surely publish it on our channel. So friends, during this trying time , stay away from depression by engaging yourself in academic activities.

Our Telegram group is lagging behind in academic activities as compared to two WhatsApp groups, so I request all of you to join our Telegram group.

Telegram can add up to whopping 200,000 members. So, if we post our study material there; it will reach to and benefit huge number of members.

So friends, take care and be safe.

So, see you all in next issue of CAR newsletter.

So long,

Anup Sadhu, Bijon Kundu and Viral Parekh.

We are thankful to all the contributors for sharing their experiences and literature with us and in the process helping the Radiological fraternity.