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IMAGING FEATURES OF ABDOMINAL VASCULAR COMPRESSION SYNDROMES .

Radiodiagnosis

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ABSTRACT

Some intra-abdominal structures like SMA,Rt SCA and aberrent vessels may compress the adjacent hollow viscera,may be symptomatic or incidental imaging findings. These syndromes aetiopathogenesis is doubtful, will have some classical clinical findings.They are median arcuate ligament syndrome, May-Thurner syndrome, nutcracker syndrome, superior mesenteric artery syndrome, ureteropelvic junction obstruction, ovarian vein syndrome, and other forms of ureteral compression. MDCT is the imaging modality of choice however interpretation of imaging findings should be carefully correlated with clinical findings.

KEYWORDS

MALS- Median arcuate ligament syndrome. SMAS-Superior mesenteric artery syndrome. SCA - Subclavian artery. AMA = Aortomesenteric angle, AMD = Aortomesenteric distance.NCS-nut cracker syndrome

INTRODUCTION

Compression of the proximal celiac artery, transverse duodenum, left common iliac vein (CIV), left renal vein (LRV), ureteropelvic junction (UPJ), and ureter can occur due to their close anatomic relationship to adjacent ligaments as well as bony and vascular structures.

Anatomic or morphologic findings that predispose to such compression may occasionally be encountered in asymptomatic patients who undergo imaging for unrelated causes. Thus, caution should be exercised to avoid over-diagnosis of these syndromes. It is important that the diagnosis of these syndromes not be based on imaging findings alone.

Multidetector computed tomography (CT) is the imaging modality of choice for many of these syndromes due to high contrast ,high spatial and temporal resolution, capacity for obtaining isotropic data sets that allow multiplanar two-dimensional and three-dimensional (3D) postprocessing, remarkable accuracy, widespread accessibility, speed, and relative noninvasiveness.

Ultrasonography is largely operator, patient, and region dependent, although duplex US can provide information on the hemodynamic significance of vascular compressions we report seven cases ie two cases of SMA,two cases of MAlS,a case of SMV compressing duodenum, a case of Retrocaval ureter and a case of NCS with classical imaging and clinical history.

Our aim is to familiarize radiologists with the multidetector CT appearance of these syndromes and the added benefit of MPR in diagnosis.

Median Arcuate Ligament Syndrome:

It is also known as celiac artery compression syndrome or, Dunbur syndrome rare entity characterized by narrowing of the proximal celiac trunk by the median arcuate ligament which results in clinical symptoms of epigastric pain and weight loss.

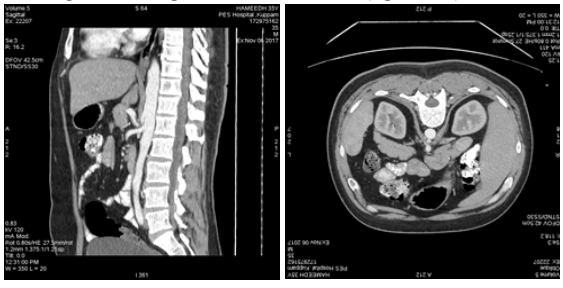
Harjola first described this syndrome in 1963[1] and then Dunbar[2] in 1965.

The median cruciate ligament which courses superiorly over the origin of celiac artery do not produce symptoms, probably due to collateral supply from the superior mesenteric artery in 10 to 14 % of the pts[2].It typically affects young patients of 10 -40 years and females are affected more. Post-prandial abdominal pain, vomiting, and weight loss are the classic clinical symptoms.

Doppler ultrasound showing compressed or narrowed segment of celiac artery, variation of peak systolic velocity during respiration with a marked increase during expiration in PSV to greater than 200 cm/s. A greater than 3:1 ratio of PSV in the celiac artery in expiration compared with the PSV in the abdominal aorta just below the diaphragm is another useful criterion to diagnose MALS[13].

MDCT showing median arcuate ligament thickness of more than 4 mm[3] is considered abnormal. Focal narrowing with hooked appearance is the hallmark which can help distinguish this condition from other etiologies of celiac artery stenosis such as atherosclerosis. Other findings include poststenotic dilatation and collateral vessels such as pancreaticoduodenal arcade from superior mesenteric artery[9] .

We report two cases of of MALS in 26 year and 35 year old male pts showing moderate to severe narrowing of celiac artery by median arcuate ligament with post stenotic dilatation (fig 1 and 2)



A B

Fig 1 [a] Sagittal and [b] axial contrast CT images showing celiac artery compression by the median arcuate ligament with post stenotic dilatation.

Superior Mesenteric Artery Syndrome:

It is a uncommon entity of duodenal obstruction (third part) extrinsically compresed bet SMA and abdominal aorta due to reduced AMA.It is similar to MALS in affecting young pts and females.

Incidence of this condition is 0,013-0.3%[4,5].

Von Rokitanski first described the condition in 1861 later Wilkie described in detail[4,5].

Risk factors include rapid weight loss which decreases fatty pouch between SMA and aorta, corrective scoliosis surgery which causes lengthening of the spine, and hip or body cast that applies external

abdominal pressure. Abnormal high fixed position of ligament of treitz,low origin of SMA There is controversy in aetiopathogenesis and the relationship between anatomical findings and clinical symptoms is not well established.

aortomesenteric angle (AMA) and the aortomesenteric distance (AMD) are reduced in the risk factors[5,6].

The normal AMD(aort0mesentric distance) is typically 10-28 mm and is measured at the level of the horizontal part of the duodenum as it travels between the abdominal aorta and SMA[6]. Aortomesentric angle variation of 25 to 60^0 and AMA of 6 to15^0 and AMD of 2 -8 mm is diagnostic.

Pt will present with postprandial abdomen pain ,vomiting, weight loss which relieves while lying on left lateral and prone position.

Barium study shows dilated stomach, first second part of duodenum with vertical cut off of third part of the duodenum with normal mucosal irregularities and the obstructions relieves while lying in prone position .MDCT will confirm the above findings.

Mega duodenum is the dd which will have similar radiological findings We report two cases of with pain abd vomiting weight loss where barium study showed dilated stomach, first, second part of duodenum with vertical cut off of third part of the duodenum with normal mucosal irregularities and the obstructions relieves while lying in prone position.

We report a case in 46 year male where(fig 3) MDCT showing reduced space between aorta and SMA with two SMV tributary coursing posterior to SMA at L3 causing compression to third part of duodenum with proximal dilatation of the duodenum and stomach between SM vessels and aorta.

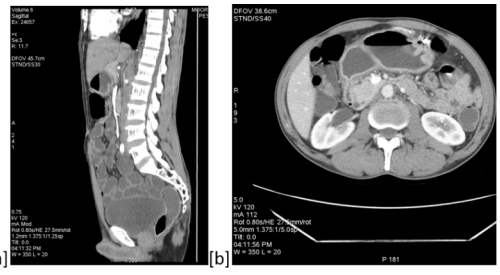


Fig 2 [a]Sagittal and [b] axial contrast CT images showing acute angle of superior mesenteric vein causing compression over the third part of duodenum.

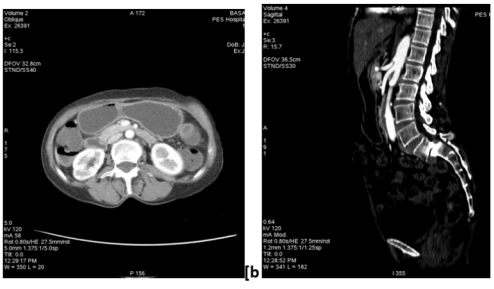


Fig 3 [a] Axial and [b] sagittal contrast CT images showing acute angle of superior mesenteric artery causing compression over the third part of duodenum

Retrocaval Ureter :

A pre-ureteral vena cava, circumcaval ureter or preureteral vena cava, a rare congenital anomaly where ureter classically course medially at L3 behind the inferior vena cava winding around it and then passes laterally in front of it to then course distally to the bladder. Hydronephrosis is due to kinking of the ureter, a ureteric segment that is adynamic or compression against the psoas muscle.

Retrocaval ureter was first reported by Hochstetter. Abeshouse and Tawkin (1952), Muller and Engel (1952), Goodwin et.al (1957)[7] and Rowland et.al (1960) have described the radiological features of circumcaval ureter. The IVC normally develops from the posterior cardinal, subcardinal and supracardinal veins, which undergo sequential development, anastomosis and regression to become the inferior vena cava and azygos venous system. Normally the right subcardinal vein forms the pre-renal IVC, the subcardinal-supracardinal anastomosis forms the renal segment and the right supracardinal vein forms the post-renal IVC. In a circumcaval ureter there is anomalous development of the infrarenal IVC from the right posterior cardinal vein that is embryologically more medial.

Retrocaval ureter may be asymptomatic or may present with flank pain ,UTI,calculus or hematurea usually at 3^{rd} -4^{th} decade in male patients.

Prevalence rate of Circumcaval ureter has a reported autopsy about 0.9 in 1000 with a male to female ratio of 2.8[13].

Salonea[14] described two types of retrocaval ureter.Type I- the ureter crosses behind the inferior vena cava at the level of the third lumbar vertebra and it has an 'S' or fish hook type shape at the point of obstruction. Marked hydronephrosis is seen in 50% of patients. In the less common Type II, the crossover occurs higher at the level of the renal pelvis.

Dilated Medial deviation of the ureter at L3 with hydronephrosis and 'S' or sickle shaped deformity at the level of displacement is the classical IVU findings but retroperitoneal fibrosis, a retroperitoneal mass, previous surgery must be kept in mind as DDs[14]. Retrograde pyelography was the old imaging.

Spiral CT delineation of the ureter and its course in relation to the IVC and location of IVC lateral to the right pedicle of the L3 vertebra were diagnostic of circumcaval ureter we report a case of retro caval ureter ,MDCT shows

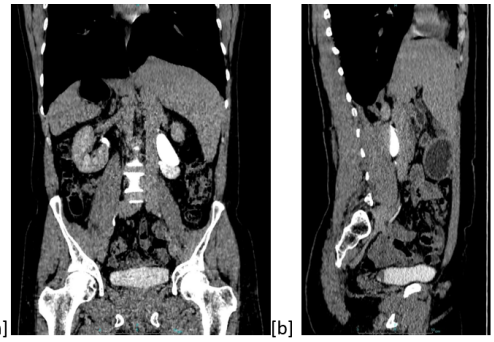


Fig 5 [a] coronal and [b]sagittal contrast images showing retrocaval position of right ureter at the level of L3 vertebra.

UPJ Obstruction by Crossing Vessels, Nutcracker Syndrome:

We report a case of chronic calcified pancreatitis with incidental anterior nutcracker syndrome in a 35 year female.

NCS is the anatomic compression of the LRV that can occur between the SMA and the aorta (“anterior nutcracker”) or, if the LRV has a retroaortic or circumaortic course, between the aorta and an underlying vertebral body and the risk of chronic kidney disease from long-term left renal vein (LRV) hypertension and the risk of LRV thrombosis.(posterior nutcracker).

The NCS is manifested by gross haematuria or microscopic haematuria, left flank pain, varicocele, gonadal vein engorgement, NCS was first described in 1972 by De Schepper[9]. He prevalence of NCS is unknown, it may be slightly higher in females and it is seen in all ages[7].

Less common pathologies and conditions leading to NCS as a result of compression of the left renal vein are Pancreatic neoplasms, Retroperitoneal tumour, Abdominal aortic aneurysm, Overarching testicular artery, Strangulating fibrolymphatic tissue between the aorta and SMA. High disposition of the LRV Imaging is by Doppler ultrasonography, computed tomography, magnetic resonance imaging, intravascular ultrasound (IVUS) and phlebography.

Radiographic features of NCS are Doppler USG are a ratio of AP diameter and PV greater than 5.0 should be the cut-off level for the syndrome with a sensitivity was 80%, specificity 94%, and accuracy

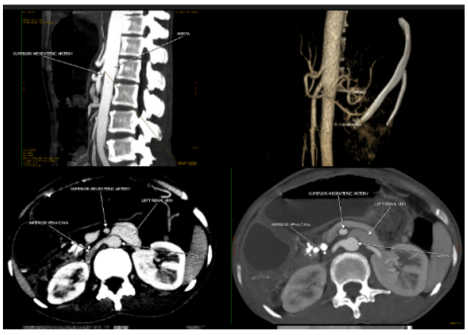
83%[12] ,CT features are[11] 1. Narrowing of the LRV at the aortomesenteric portion (the beak angle <32°)2. Beak sign: severe form of narrowing of the LRV at the aortomesenteric portion3. Left renal vein diameter ratio (hilar to aorto-mesenteric) ≥4.94. Angle between the SMA and aorta <41°5. Collateral venous circulation developed in the retroperitoneum and renal hilum.

Phlebography of venous pressure gradient between the LRV and the IVC ie the pressure gradient of more than 3 mmHg between inferior vena cava (IVC) and LRV, and intravascular ultrasound are the gold standard imaging modalities.

Fig a of top row shows MDCT sag view and **b** of MIP reformat image showing the reduction of the aortomesenteric angle to less than 10°.

Fig c cect axial image **d** nect axial image of middle row shows stricture of left renal vein with post stenotic dilatation and calcified pancreas.

A b



C d

May-Thurner Syndrome(, also known as iliac vein compression syndrome and Cockett syndrome , consists of obstruction of the left common iliac vein caused by the crossing right common iliac artery) are other abdominal vascular compression syndromes described.

CONCLUSION:

The abdominal vascular compression syndromes discussed here are uncommon and are potentially easily missed on radiologic examinations, particularly in a nonspecific and vague clinical setting. Hence, knowledge of the typical imaging findings and associated clinical symptoms is essential so that the they can be carefully sought and excluded. However, because these findings may also exist in healthy individuals as anatomic variants, it is important to correlate radiologic findings with clinical symptoms to identify the subset of patients who will benefit from treatment.

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