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MDCT in Evaluation of Abdominal Vascular Compression Syndromes

Dr. Selva Micheal Papou J[1], Dr. Sajith[2], Dr. Joseph Manuel[2], Dr. Dilip S Phansalkar[2]

[1]Final year Post Graduate, Department of Radiodiagnosis, PIMS

[2] Department of Radiodiagnosis, PIMS

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Corresponding author: Selva Micheal Papou J
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Introduction

Vascular structures in abdomen & pelvis may be compressed by adjacent anatomic structures, or they may cause compression of adjacent hollow viscera. Compression of proximal celiac artery, transverse duodenum, left common iliac vein, left renal vein, ureteropelvic junction & ureter can occur due to their close anatomic relationship to adjacent ligaments as well as bony & vascular structures. When symptomatic, such compressions can result in a variety of uncommon syndromes such as Median arcuate ligament syndrome, May Thurner syndrome, Nutcracker syndrome, superior mesenteric artery syndrome, UPJ obstruction, ovarian vein syndrome & other forms of ureteral compression. These heterogeneous group of disorders as "VASCULAR COMPRESSION SYNDROMES" since they all involve either the compression of vascular structures or compression of hollow viscera by vascular structures.

Aims and Objectives

- To familiarize the relevant anatomy and CECT findings of abdominal vascular compression syndromes.

Materials and Methods

- Study design - Case series
- CECT images acquired by 128 slice CT machine
- CECT images are analyzed in arterial phase and by MIP /MPR techniques.

In this paper, we are going to familiarize with five abdominal compression syndromes in terms of its relevant anatomy and MDCT findings

- Median arcuate ligament syndrome
- Superior Mesenteric Artery syndrome
- May Thurner syndrome
- Ovarian vein syndrome
- Nut cracker syndrome

Discussion

Clinical presentation of vascular compression syndrome varies from asymptomatic/nonspecific to obstructive symptoms. Multidetector computed tomography is the imaging of choice to illustrate this vascular compression due to its superior contrast, temporal & spatial resolution, speed, and non-invasiveness compared to conventional angiography & further to prevent complications.

Median Arcuate Ligament Syndorme

Also known as celiac artery compression syndrome or Dunbar syndrome. Ligament -

archlike fibrous band connecting right & left diaphragmatic crura at the level of aortic hiatus, crossing the aorta anteriorly just superior to celiac artery at the level of 1st lumbar vertebra. Compression may result if celiac artery has a more cephalad origin or if the ligament is abnormally low. Compression typically increases during expiration as aorta & celiac artery move superiorly.

MDCT Imaging Findings

Focal narrowing of proximal celiac artery (more pronounced in end expiration). Narrowed segment has a characteristic hooked appearance. This appearance, along with absence of atherosclerotic changes in adjacent aorta & proximal celiac segment, helps to distinguish it from atherosclerotic narrowing. Post stenotic dilatation may be present in severe stenosis and in some cases hemodynamic compensation can be seen in the form of collateral vessels.

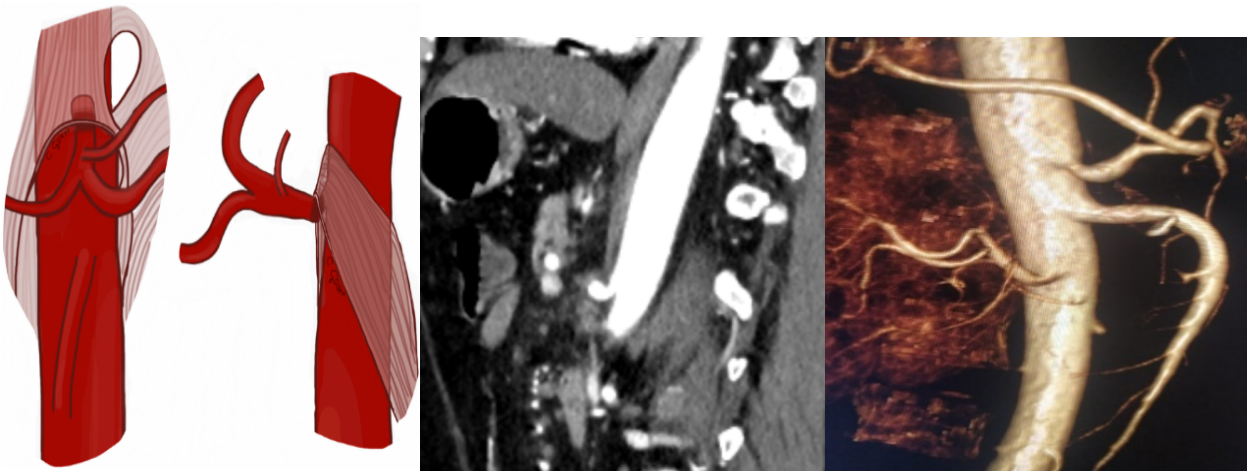

Fig 1a - Drawing illustrating coronal & sagittal views of median arcuate ligament compressing root of celiac artery
Fig 2b - Coronal CT (arterial phase) shows focal narrowing at the origin of celiac artery giving its hooked appearance
Fig 2c – Coronal 3D reconstructed image of same patient shows the focal narrowing

SMA Syndrome

Also known as cast syndrome & arteriomesenteric duodenal compression syndrome. Obstruction of 3rd part of duodenum due to compression between SMA & aorta. Normally, 3rd part of duodenum is surrounded by retroperitoneal fat, which provides a "cushion" for duodenum between SMA & aorta, thereby maintain wide AMA and AMD Normal range of AMA & AMD to be 28°–65° & 10–34 mm, respectively.

MDCT Imaging Findings

Compression of 3rd part of duodenum with upstream severe dilatation of proximal duodenum & stomach. Acute angulation of SMA and a reduced AMD. The AMA and AMD in patients with SMA syndrome have been reported to be 6°–22° and 2–8 mm, respectively.

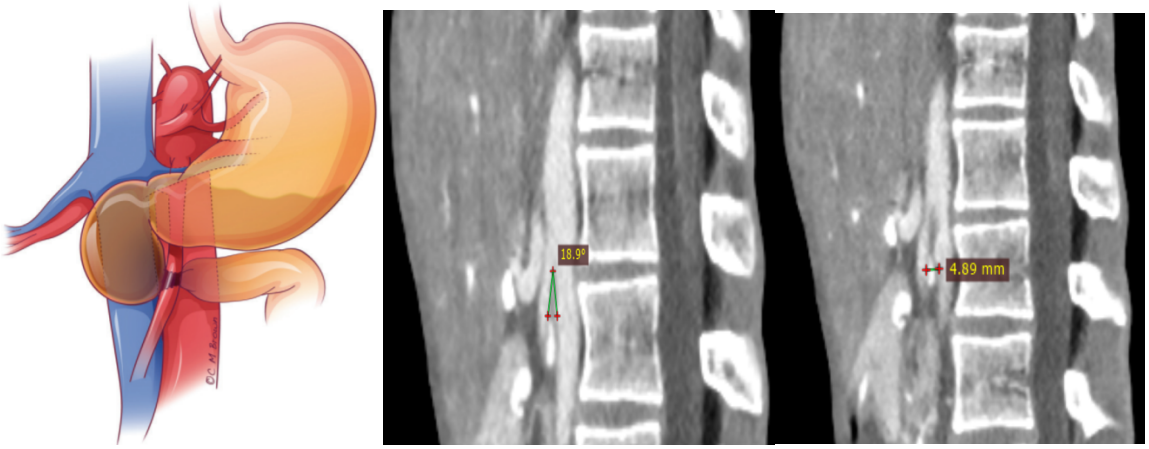

Fig 2a - Drawing illustrates SMA syndrome, with compression of mid-transverse duodenum between proximal SMA & aorta, resulting in proximal duodenal and gastric dilatation
Fig 2b - Coronal CT (arterial phase) shows acute angulation of origin of SMA (AMA angle – 18.9)
Fig 2c – Coronal CT (arterial phase) showing maximum aortomesenteric distance measures ~ 4.3 mm

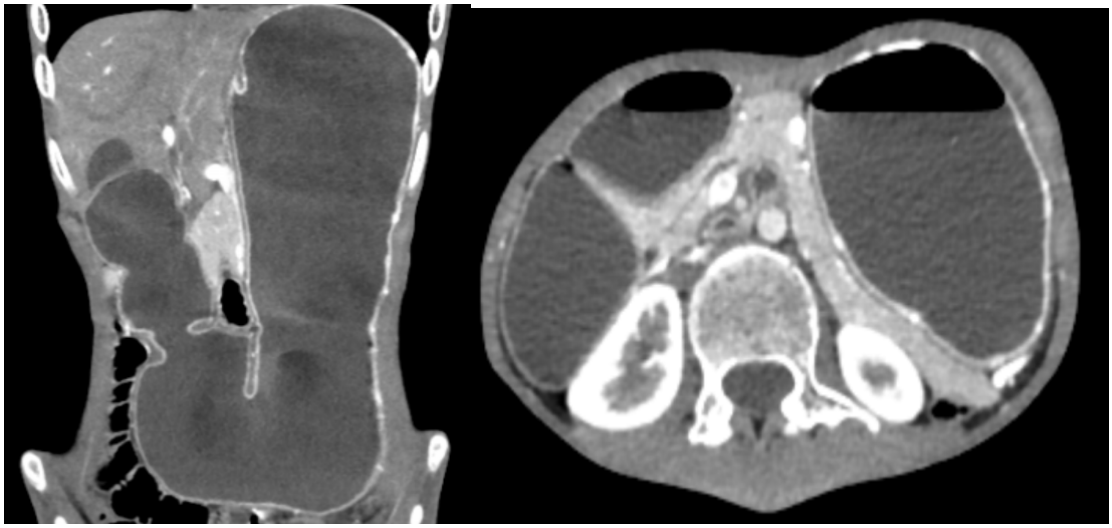

Fig 2d - Coronal CT image showing grossly dilated stomach and duodenum
Fig 2e - Axial CT image showing dilated 2nd part of duodenum & collapsed 3rd part of duodenum

MAY THURNER SYNDROME

Also known as iliac vein compression syndrome & Cockett syndrome. Refers to chronic compression of left common iliac vein between the overlying right common iliac artery anteriorly & 5th lumbar vertebra posteriorly. Resultant chronic venous stagnation results in lower extremity swelling with or without thrombosis of left iliac & femoral veins.

MDCT IMAGING FINDINGS

Multidetector CT performed in the pelvic venous phase shows the iliac vein compression, which is best seen in axial plane. Tortuous venous collaterals crossing the pelvis to drain into the contralateral veins & thrombus formation are also suggestive features.

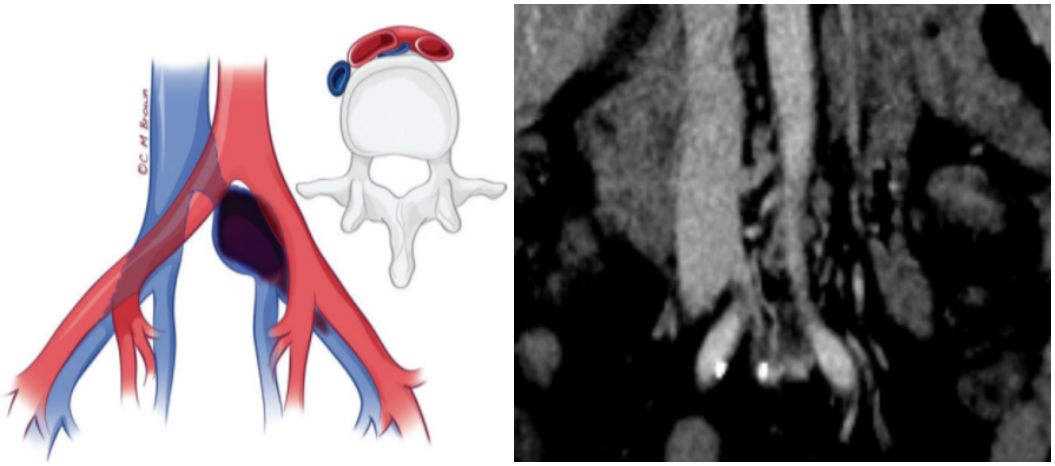

Fig 3a - Drawing illustrates May-Thurner syndrome, showing compression of left CIV between right CIA & anterior surface of underlying vertebral body, resulting in venous congestion.
Fig 3B – Coronal CT (venous phase) shows compression of left common iliac vein by the overlying right common iliac artery

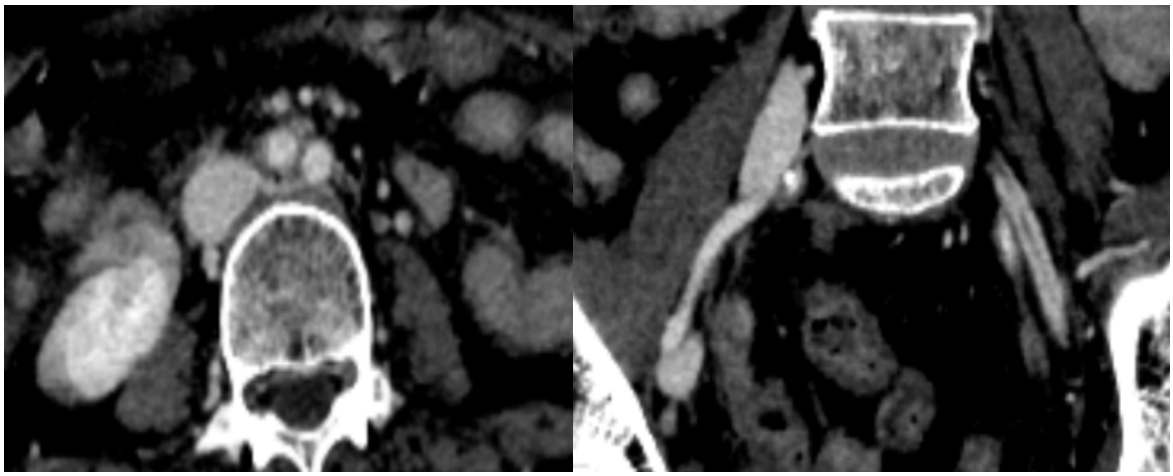

Fig 3c - Axial CECT (venous phase) shows compression of left common iliac vein between right common iliac artery and vertebra.
Fig 3d – Coronal CECT (venous phase) showing central intraluminal filling defect ( )in left external iliac vein

OVARIAN VEIN SYNDROME

Condition where a dilated ovarian vein causes notching, dilatation, or obstruction of ureter resulting in hydroureteronephrosis. Usually secondary to varicosities of ovarian vein or ovarian vein thrombosis & occurs at point where the ovarian vein crosses the ureter.

MDCT IMAGING FINDINGS

Presence of pelvic varicosities, which can appear as dilated, tubular & contrast-enhancing structures adjacent to adnexa that measure more than 4 mm in diameter & dilated ovarian veins measuring > 8 mm in diameter. Reversed flow in ovarian vein can be suggested in the presence of ovarian vein filling on arterial phase MDCT images.

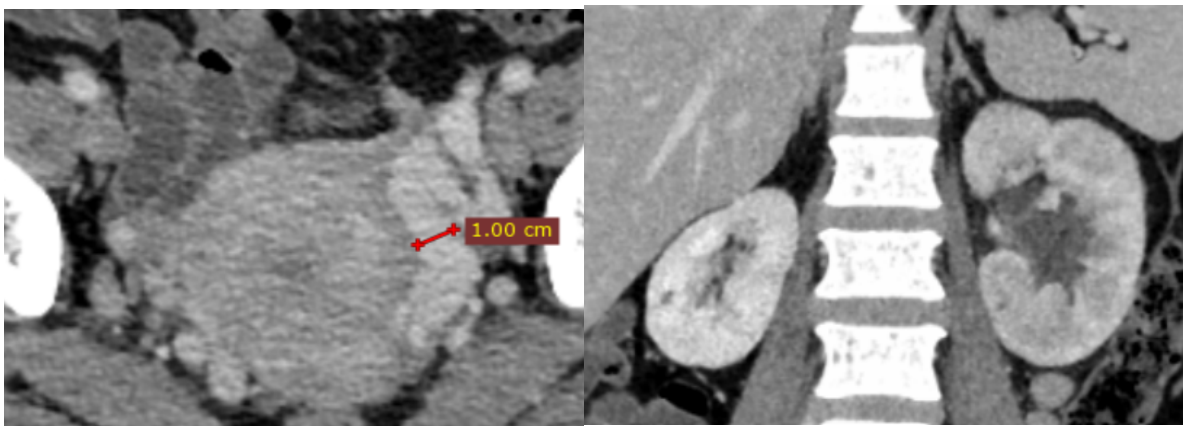

Fig 4a - Axial CECT (venous phase) shows dilated and tortuous left ovarian vein (maximum caliber measures 10 mm)
Fig 4b – Coronal CECT at the level of kidneys shows dilatation of left pelvicalyceal system

NUTCRACKER SYNDROME

Nutcracker phenomenon refers to anatomic compression of RV that can occur between SMA & aorta (anterior nutcracker) or, if LRV has a retro aortic or circumaortic course, between aorta & an underlying vertebral body (posterior nutcracker). Concomitant compression of anterior & posterior LRV - "combined nutcracker syndrome".

MDCT IMAGING FINDINGS

Typical "beak sign" of LRV which consists of an abrupt narrowing of LRV with an acute angle below the aortomesenteric junction. If the AMA decreases to 9–35°, external compression of both the duodenum (SMA syn) & left renal vein (NCS) may occur.

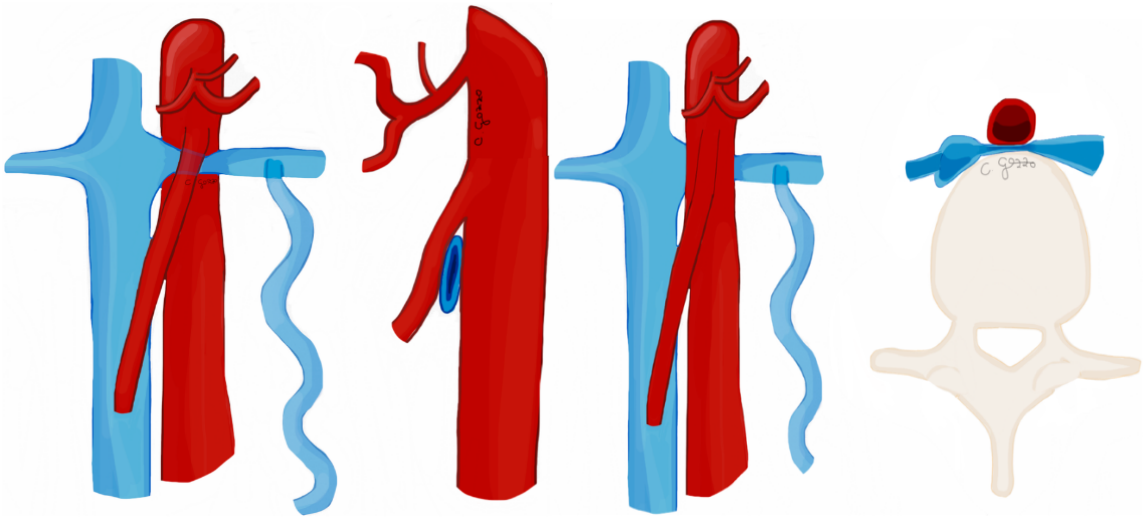

Fig 5a - Drawing illustrates anterior nut cracker syndrome
Fig 5b - Drawing illustrates posterior nut cracker syndrome

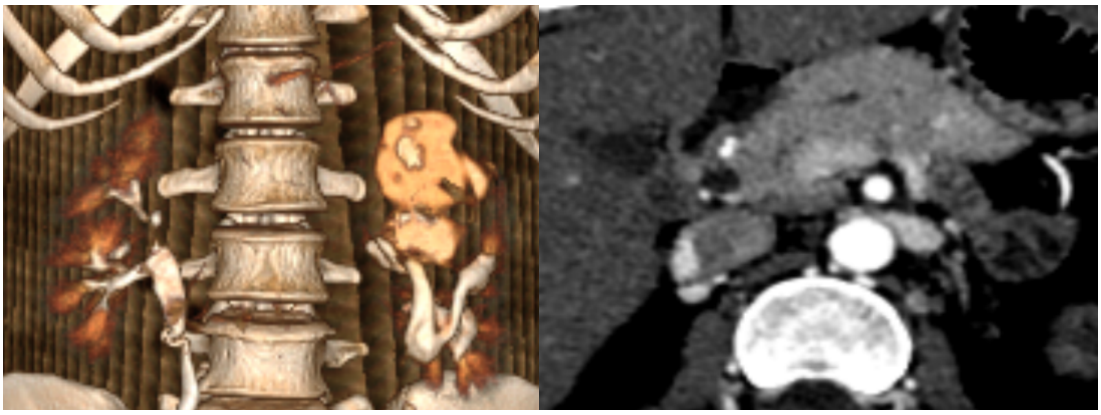

Fig 5c - Coronal 3D reconstructed images showing left duplex collecting system
Fig 5d – Axial CECT (arterial phase) left renal vein draining the lower pole moiety showing beak sign

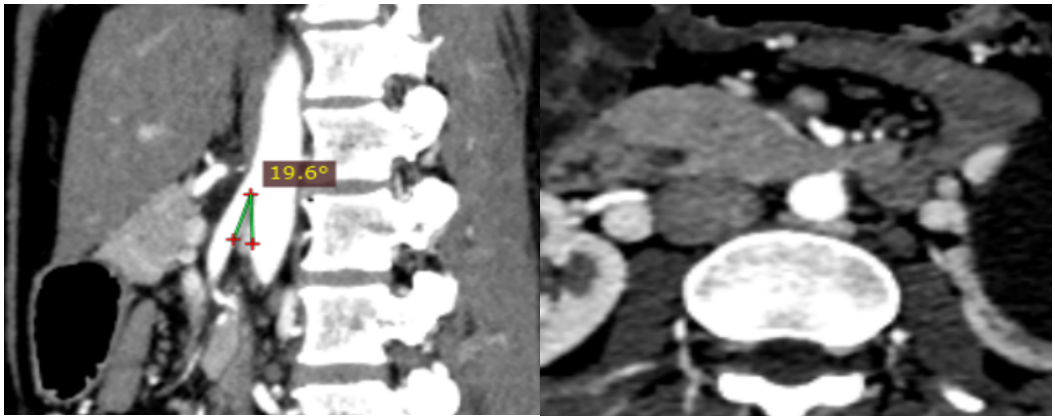

Fig 5e – Coronal CECT (arterial phase) showing reduced aortic – SMA angle
Fig 5f – Axial CECT (arterial phase) left real vein draining the upper pole moiety shows retro aortic course and seen compressed between aorta and adjacent vertebra

Conclusion

In compressive syndromes, it is important to know their most common locations, recognizing that they can be incidental findings in asymptomatic patients. It should be kept in mind that the anatomical alterations detected should only be given weight when accompanied by pertinent clinical correlation. This corelation is important so that asymptomatic vascular compression requires no treatment, intermittent compression with nonspecific clinical manifestation and symptomatic patients will benefit from treatment.

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