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Original Research Paper

Radiology

ROLE OF IMAGING IN VASCULAR COMPRESSION SYNDROMES

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ABSTRACT **AIMS AND OBJECTIVE:** Role of imaging in vascular compression syndromes. **METHODS:** This is a retrospective analysis of forty two (42) patients evaluated over 2 year period from July 2018 to July 2020 , referred from the Departments of Vascular & Endovascular Surgery and Surgical Gastroenterology and evaluated by CTA on 128 MDCT Scanner (Somatom Definition AS Plus/Siemens Medical System Germany), DSA on Universal Angiography System (Axiom Artis FA/Siemens Medical Solutions, Germany) and MRI on MAGNETOM Skyra 3TMRI machine (Siemens). **RESULTS:** Vascular compression was seen in 23 patients. Among these Eagle Syndrome (1), Thoracic Outlet Syndrome (6), Nutcracker Syndrome (2) (anterior and posterior), Median Arcuate Ligament Syndrome (6) and May-Thurner Syndrome (3). The second category Compression of adjacent structures by a vascular structure was noted in 19, including SMA Syndrome (8), Neurovascular compression syndromes (7), Vascular rings (2), Retro-caval ureter (2). **CONCLUSION:** Vascular compression syndromes are uncommon entities and potentially easily missed, particularly in a nonspecific clinical setting. It is important to know these syndromes and which vascular structure is involved in each process. This information plays an active role in the endovascular treatment of these pathologies. Because vascular compression syndromes are caused by external compression, surgical decompression or endovascular management is likely to be required.

KEYWORDS : CT Angiography, Digital Subtraction Angiography

INTRODUCTION

Vascular compression syndromes are divided into two groups. The first category includes cases where a vessel is compressed by another structure such as Eagle Syndrome, Thoracic Outlet Syndrome, Nutcracker Syndrome (anterior and posterior), Median Arcuate Ligament Syndrome, May-Thurner Syndrome. The second category includes cases where a vascular structure (vein or artery) compresses other adjacent structure, including SMA Syndrome, Ovarian vein syndrome, Neurovascular compression syndromes, Vascular rings, Retro-caval ureter, UPJ obstruction by crossing vessel, Malignant origin of RCA from left coronary sinus. Chronic entrapment in these entities may give rise to arterial ischemia and embolism, venous stasis and thrombosis in young,otherwise healthy patients. Anatomical abnormalities and repetitive trauma less often are considered as contributing factors.

Digital Subtraction Angiography (DSA) is the gold standard while CT angiography (CTA) is an alternative non-invasive imaging modality.

AIMS AND OBJECTIVES:

1) To present structural imaging abnormalities of vascular compression disorders.
2) To provide brief notes about the clinical and pathophysiological correlation of the radiological findings.

MATERIALS AND METHODS:

This is a retrospective analysis of forty two (42) patients evaluated over 2 year period from July 2018 to July 2020 , referred from the Departments of Vascular & Endovascular Surgery and Surgical Gastroenterology and evaluated by CTA on 128 MDCT Scanner (Somatom Definition AS Plus/Siemens Medical System Germany) , DSA on Universal Angiography System (Axiom Artis FA/Siemens Medical Solutions, Germany) and MRI on MAGNETOM Skyra 3TMRI machine (Siemens).

STUDY POPULATION:

Vascular compression was seen in 23 patients. Among these Eagle Syndrome (1), Thoracic Outlet Syndrome (6), Nutcracker Syndrome (2) (anterior and posterior), Median Arcuate Ligament Syndrome (6) and May-Thurner Syndrome (3). The second category Compression of adjacent structures by a vascular structure was noted in 19, including SMA Syndrome (8), Neurovascular compression syndromes (7), Vascular rings (2), Retro-caval ureter (2).

DISCUSSION

VESSEL AS COMPRESSEE:

(1) THORACIC OUTLET SYNDROME:

PATHOPHYSIOLOGY: Compression of subclavian vessels and brachial plexus in costoclavicular space or interscalene triangle by cervical ribs, an elongated transverse process of the C7 vertebra, congenital fibrovascular bands and aberrant scalene muscle anatomy.

It is a dynamic syndrome with symptoms that usually manifest during elevation and abduction of the arm, particularly with sustained movement.

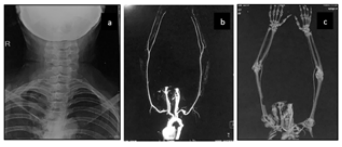

FIGURE 1: 22 Y/F, c/o intermittent pain in left upper limb since one year, (a) Radiograph showing bilateral cervical ribs, (b) MIP, (c) VRT images showing compression of bilateral subclavian arteries and pseudoaneurysm arising from left subclavian artery

(2) MEDIAN ARCUATE ARTERY SYNDROME:
PATHOPHYSIOOGY: Compression of the celiac artery by the abnormally low median arcuate ligament. Contributing anatomic factors may be a higher than normal celiac origin or lower than normal diaphragmatic crura.

Clinical features include postprandial epigastric pain, nausea, and weight loss.

Radiologic findings: characteristic superior indentation on the proximal celiac artery

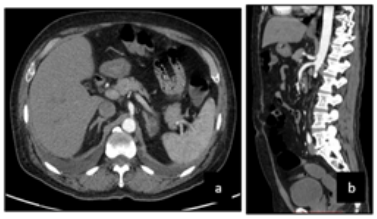

FIGURE 2: 31 Y/M, c/o postprandial epigastric pain since 6 months, (a) CECT axial (b) sagittal images showing short segment narrowing just distal to the origin of celiac trunk.

(3) MAY-THURNER SYNDROME:
PATHOPHYSIOLOGY: Compression of left common iliac vein (CIV) between the right common iliac artery anteriorly and the fifth lumbar vertebra posteriorly.

The most frequent symptom is left lower extremity swelling, which may or may not be due to deep vein thrombosis.

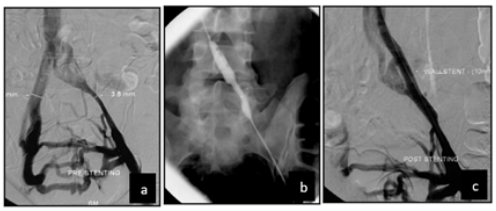

FIGURE 3: 35 Y/M, c/o swelling of left lower limb since 3 years, (a) DSA image showing compression of left CIV by right CIA, (b),(c) post stenting DSA images showing patent left CIV.

(4) POPLITEAL ARTERY ENTRAPMENT SYNDROME:
PATHOPHYSIOLOGY : Symptomatic compression or occlusion of the popliteal artery due to a developmentally abnormal positioning of the popliteal artery in relation to its surrounding structures such as with the medial head of gastrocnemius (MHG) or less commonly with popliteus or fibrous bands.

Symptoms are typically those of intermittent claudication. Most individuals, however, are asymptomatic, and the true clinical syndrome is far less common.

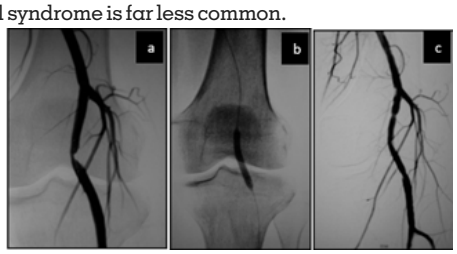

FIGURE 4: 29 Y/M, c/o digital ischemia of left 3rd and great toe, (a) DSA image showing short segment narrowing of popliteal artery , (b),(c) post stenting DSA images showing patent popliteal artery.

(5) NUT-CRACKER SYNDROME:
PATHOPHYSIOLOGY: Entrapment of the left renal vein between the superior mesenteric artery and the aorta. Contributing factor may be a narrow angle of origin of the superior mesenteric artery from the aorta.

Intermittent asymptomatic gross haematuria is the usual manifestation. In men, reflux from the left renal vein to the left testicular vein may lead to varicocele. In women, reflux to the ovarian vein may cause pelvic congestion syndrome.

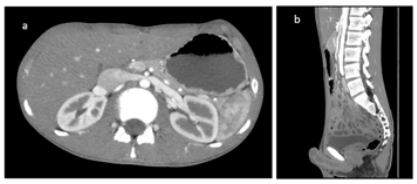

FIGURE 5: 16 Y/M c/o intermittent hematuria since 3 months, (a) CECT axial image showing compression of left renal vein between SMA and aorta, (b) CECT sagittal image showing narrow aorto-mesenteric angle.

VESSEL AS COMPRESSOR:
(1) SMA SYNDROME:
PATHOPHYSIOLOGY: Compression of the third part of the duodenum between the superior mesenteric artery and aorta. Seen in any condition associated with weight loss.

Symptoms include postprandial epigastric pain and fullness, nausea, vomiting, weight loss. The pain typically be relieved by lying in the prone or right decubitus position

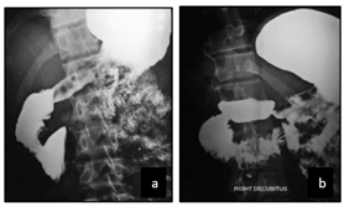

FIGURE 6: 14 Y/F, c/o abdominal pain and vomitings, Barium meal spot radiographs showing vertical impression over 3rd part of duodenum (a) that is relieved with right decubitus position (b).

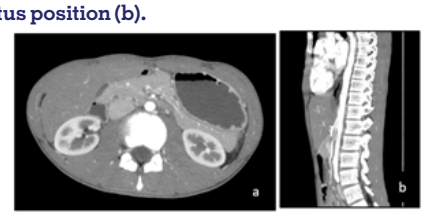

FIGURE 7: 14 Y/F, (a) CECT axial and (b) sagittal images showing dilated stomach and proximal duodenum, narrow aorto mesenteric distance.

(2) NEUROVASCULAR COMPRESSION SYNDROMES:
PATHOPHYSIOLOGY: Compression or distortion of a cranial nerve due to a redundant or aberrant vascular structure. Typically caused by arteries that directly contact the cisternal portion of a cranial nerve.

Presentation can range from trigeminal neuralgia or glossopharyngeal neuralgia, hemifacial spasm, tinnitus, and vertigo.

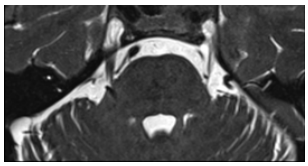

FIGURE 8: 48 Y/F, c/o severe pain over right side of face, FIESTA axial image showing vascular loop abutting cisternal segment of Right trigeminal nerve

(3) VASCULAR RINGS:

PATHOPHYSIOLOGY: Congenital vascular encirclement of the oesophagus and or trachea by anomalous/aberrant vessels. Anomalies include double aortic arch, right aortic arch with aberrant left subclavian artery and left ligamentum arteriosum, aberrant right subclavian artery and pulmonary sling.

Many vascular rings are asymptomatic although they can present with wheezing, recurrent respiratory infections and dysphagia lussoria.

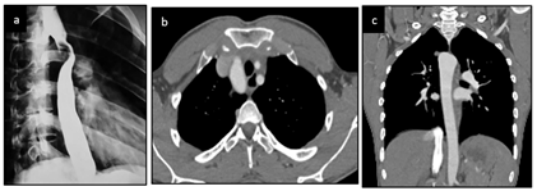

FIGURE 9: 22 Y/M , c/o dysphagia since 3 years, (a) Spot barium swallow radiograph showing narrowing of thoracic oesophagus, (a) CECT axial and (b) coronal images showing aberrant left subclavian artery arising from right sided aortic arch causing compression of esophagus.

(4) ANOMALOUS COURSE OF CORONARY ARTERIES:

PATHOPHYSIOLOGY: Anomalous origin of right coronary artery with an interarterial course between the aorta and the pulmonary trunk may be associated with myocardial ischemia and may be the cause of sudden cardiac death, arrhythmia, and syncope.

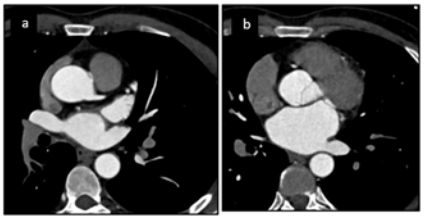

FIGURE 10: 38 Y/M, c/o intermittent chest pain, CT coronary angiogram axial images showing malignant origin of right coronary artery from left coronary sinus and coursing between aorta and pulmonary trunk.

(5) VASCULAR COMPRESSION OF THE URETER:

PATHOPHYSIOLOGY: Compression of the ureter may rarely occur if the ureter takes a retrovascular (retroiliac or retrocaval) course. Compression can also occur at the point of intersection of the ureter with a dilated or aberrant ovarian vein or testicular vein.

Obstruction from ureteral compression can be mild with minimal or no symptoms, or it can be severe, resulting in flank pain, haematuria, or pyelonephritis.

FIGURE 11: 26 Y/M, c/o right loin pain since 3 months, (a) IVU showing 'J' shaped right ureter and mild right hydroureteronephrosis, (b) CT axial image showing retrocaval ureter.

CONCLUSION:

Vascular compression syndromes are uncommon entities and potentially easily missed, particularly in a nonspecific clinical setting. It is important to know these syndromes and which vascular structure is involved in each process. This information plays an active role in the endovascular treatment of these pathologies. Because vascular compression syndromes are caused by external compression, surgical decompression or endovascular management is likely to be required.

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