Median arcuate ligement syndrome: accurate diagnosis by 64 slice MDCT mesenteric angiography

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Purpose

Describe proper imaging technique of 64 slice MDCT Mesenteric angiography and classic signs on MDCT angiography for confident non-invasive diagnosis of median arcuate ligament syndrome (MALS).

Methods and materials

Retrospective evaluation of 20 patients was carried out over a period of last 5 years who were having:

1. Chronic post prandial epigastric pain, vomiting, weight loss
2. No obvious epigastic, hypochondriac or lower chest pathologies were detected on routine imaging (USG, CT abdomen and/or MRCP)
3. Normal upper GI scope
4. Narrowing of ostio-proximal coeliac artery on CT angiography with normal rest mesenteric arteries

These patients were closely followed for a period of 1yr. classic imaging signs, intraoperative confirmation and post operative pain relief confirmed the diagnosis of MALS.

Technique of CT angiography-

- All mesenteric angiographies were performed on a 64 slice MDCT scanner.
- 100 CC of non-ionic contrast used for IV injection @rate of 4ml/sec
- No oral contrast given, water is used as a negative contrast medium
- End inspiration scan acquired after proper counselling and prior practise
- collimation 64x0.625, pitch 0.9
- Images are post processed on a dedicated workstation - axial, coronal & sagittal MPRS & MIPS & 3D volume rendered images were reconstructed demonstrating the coeliac artery, SMA & pancreatino-duodenal arcade.

Anatomy of median arcuate ligment (Figures 2 & 3)

MAL is a fibrous ligament that connects the right and left crus of doaphragm at the level of aortic hiatus. It generally lies cephalad to the coeliac artery, however in 10-25% population the ligment may cross anterior to coeliac artery, & might cause compression of the coeliac artery in some of these patients. This may result in compomise of the blood supply and resultant symptoms.
Effect of inspiration & expiration on the position of MAL- (figure 4)

During inspiration the coeliac artery moves caudally due to expansion of lungs and downward displacement of diaphragm and attains a more vertical course, where as in expiration the coeliac artery attains a more cephalad position & horizontally oriented due to upward shift of diaphragm. This leads to crossing of MAL over coeliac artery producing a pseudoimpression on ostioproximal coeliac artery.

Median arcuate ligament syndrome (MALS):

- Also called as coeliac artery compression syndrome.
- First described by Harjola in 1963 (1).
- Characterised by classic clinical triad of post prandial epigastric pain, weight loss and vomiting.
- Commonly found in young patients (20-40 yrs.) with female preponderance (2:1).
- Used to be diagnosed by exclusion and DSA in the past.
- MDCT angiography however now considered as a "gold standard" obviating need for invasive test like DSA.

Classic MDCT imaging findings of MALS: (figures 5 & 6)

- Significant narrowing of coeliac artery about 5-8 mm after its ostium (2).
- Characteristic hooking' of the coeliac artery due impression of MAL along its superior surface (3).
- Post stenotic dilatation of the coeliac artery (3).
- Development of superior pancreatico-duodenal arcade for collateral filling (3).

Differentials of MALS:

- Atherosclerotic / thrombotic narrowing of coeliac artery (figure 7).
- Vasculitis of medium sized arteries.
- Mild narrowing of coeliac artery by MAL in asymptomatic patients (figure 8).
- Pseudo-narrowing of coeliac artery due to acquisition of scan in expiration/patient doing valsala due to nausea/vomiting during IV injection of contrast.

Other imaging modalities used for diagnosis of MAL apart from MDCT Angiography-

1. Color doppler - can depict significantly increased velocities (PSV) in the coeliac artery with aliasing confirming the diagnosis in suspected patients of MAL. It is usually done in inspiration & expiration, in supine and sitting position. Intra-op doppler can be used to confirm adequacy of resection of MAL (4).
2. DSA - considered gold standard before the advent of MDCT angio, but being invasive, less preferred over MDCT angio now a days.
Treatment options for MAL

- Open resection of MAL
- Laparoscopic resection/release of MAL (fig 9 & 10)
- Endovascular treatment- balloon angioplasty/stenting
- Vascular reconstruction

Among these laparoscopic release of the MAL is presently the preferred treatment over open resection in view of minimally invasive procedure with better visualization of the aortic region and complete division of all the fibers of MAL and baring of coeliac axis and early post-op recovery. (5)

Images for this section:

Fig. 2: Axial CT angiography image cranial to the level of coeliac artery at L1 level. MAL (marked with yellow color) seen connecting Rt & Lt crus of diaphragm (marked with arrows)
Fig. 3: CT anatomy of MAL: A]coronal & B)sagittal MPRs of CT angiography demonstrating normal position of MAL marked in yellow color) above the level of coeliac artery
Fig. 4: Relation of coeliac artery & MAL during Inspiration & expiration
**Fig. 5:** Axial(A), Sagittal(B) MIP images of CT mesenteric angiography & 3D volume rendered image in sagittal plane nicely demonstrating the MAL crossing over the coeliac artery (marked by yellow arrows in A & characteristic hooking of the coeliac artery in B & C marked by arrow.)
Fig. 6: A) 3D volume rendered image showing the external impression of MAL on coeliac artery B) coronal MIP image of CT mesenteric angio showing well developed collateral circulation through superior pancreatico-duodenal branches of SMA filling the gastro-duodenal and common hepatic arteries in a case of a MAL
Fig. 7: Sagittal MIP (A) & volume rendered (B) image of CT mesenteric angio showing significant narrowing of ostio-proximal coeliac artery by athero-sclerotic plaque. Note absence of classic hooking of coeliac artery & post stenotic dilatation.
Fig. 8: Saggital MIP(A) & volume rendered image(B) showing mild narrowing of coeliac artery not diagnostic of MALS
**Fig. 9:** Diagramatic image showing laparoscopic release of MAL
Fig. 10: Intra-operative pictures of laparoscopic release of median arcuate ligament
Fig. 11: Follow up CT mesenteric angiogram at 6 months after laparoscopic release of MAL showing complete disappearance of external impression of MAL on coeliaic artery as well as post stenotic dilatation. This patient clinically also showed significant improvement of symptoms.
Results

Fig. 12: Table showing incidence of different causes of coeliac artery narrowing & a bar diagram showing incidence of MAL in both genders in our study population.

References: Dr Sachin Pathak

Conclusion

• MALS is an important but unsuspected and under diagnosed cause of chronic recurrent epigastric pain, weight loss and vomiting especially in young patients.
• High degree of clinical suspicion combined with classic MDCT angiography findings non-invasively and accurately depicts this condition obviating need for invasive test like DSA.

Personal information

References