Celiac axis compression by median arcuate ligament on computed tomography among asymptomatic persons

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Abstract
Background/Aim Compression of celiac artery by median arcuate ligament (MAL) may cause abdominal symptoms. This study looked at the prevalence of this finding in asymptomatic persons.
Methods Abdominal angiograms of 155 healthy asymptomatic voluntary kidney donors aged 18–65 years, done as part of the standard pretransplant work up, were reviewed retrospectively.
Results Celiac axis compression, defined as greater than 50% luminal narrowing of the celiac artery by the MAL was found in eight (5.1%) of 155 angiograms.
Conclusion The high frequency of this finding re-emphasizes the need for caution in attributing abdominal symptoms to such compression based on imaging findings alone.

Keywords Computed tomography · CT angiography · Medial arcuate ligament · Mesenteric ischemia

Introduction
Median arcuate ligament (MAL) is a fibrous arch bridging the two diaphragmatic crura on either side of the aortic hiatus. It is usually located superior to the origin of the celiac axis. However, in 10–24% of people, it crosses over the proximal portion of the celiac axis, causing a characteristic indentation [1]. Occasionally, the MAL can cause hemodynamically significant compression of the proximal celiac axis to cause symptoms, referred to as MAL syndrome (MALS). The compression is accentuated during expiration when retroperitoneal contents move cephalad in relation to the MAL. The two main theories used to explain the pathogenesis of symptoms are mesenteric ischemia and neurogenic stimulation caused by compression of the celiac ganglion and plexus [2] (Fig. 1).

Although the MALS was first described in the 1960s, its pathogenesis, diagnosis and management continue to be controversial. With the increasing use of newer non-invasive cross-sectional imaging modalities in patients with abdominal symptoms, this anatomic abnormality is being reported more frequently. However, it may be difficult to ascribe the symptoms to MALS. In some studies using different investigative modalities, celiac axis compression by MAL has been shown to occur in 4–24% of the general population. We present here data on retrospective analysis of CT angiograms done in a group of asymptomatic persons to determine the prevalence of celiac axis compression by MAL.

Methods
Abdominal CT angiograms of voluntary kidney donors under the age of 65 years referred for pretransplant workup between April 2006 and October 2007 were retrospectively reviewed. Those from persons with any gastrointestinal symptoms were excluded.

All scans had been carried out on a Philips six-slice CT scanner (Brilliance, Philips Medical Systems, The Netherlands), during full inspiration in supine position. Arterial phase axial images had been acquired at 0.75 mm slice thickness with 0.4 mm overlap, after an injection 120 mL of a non-ionic contrast agent at the rate of 3 mL/sec using a
pressure injector. Venous phase images had also been obtained with 5 mm collimation. In addition, 2 mm sagittal and 3-dimensional reconstructions were done. Two radiologists reviewed these images for relation of celiac axis to MAL. MAL was taken as compressing the celiac artery, if the latter had a pinched appearance on axial imaging with more than 50% luminal narrowing and had a hooked appearance on sagittal reconstruction images. In angiograms with this finding, the vertebral level at which the MAL crossed the celiac axis origin, post-stenotic dilatation and presence of collaterals were also looked for.

Results

Of the angiograms from 155 subjects (age range = 20–65 [median 39] years; 61 men), eight (5.1%) fulfilled the criteria for celiac artery compression by MAL. This finding was not found in any of the 28 persons aged <30 years, 3/49 of those aged 31–40 years, 2/42 of those aged 41–50 years, and 3/36 of those aged 51–65 years.

In all the 8 subjects with celiac axis compression, the origin of the celiac artery was above the first lumbar vertebra. In 6 persons, MAL was located below the level of L1, indicating that a low insertion of MAL was responsible for the compression. Only three angiograms showed post-stenotic dilatation of the celiac artery, and none showed significant collaterals.

Discussion

Several methods have been used to look for MAL, such as autopsy studies, conventional angiography, CT angiography, ultrasonography with Doppler and magnetic resonance imaging. Conventional angiography shows a characteristic indentation along the proximal celiac axis and persistence of narrowing during inspiration, presence of post-stenotic dilatation. Presence of collateral circulation and opacification of celiac artery during SMA angiography suggest severe compression. Limitations of this technique include the need for images in the lateral projections and inability to identify the MAL. CT angiograms can not only show both the artery and the MAL and their relationship with each other, but also identify post-stenotic dilatation of the artery and collateral vessels to help determine hemodynamic significance of the arterial narrowing. Sagittal reconstructions of images to show the characteristic hooked appearance of the artery on a ‘lateral’ view provides additional confirmation of the finding (Fig. 1a and b). In addition, it can identify other causes of arterial narrowing, such as atherosclerosis. Thus, this investigation can obviate more invasive conventional angiography in most patients with suspected MALS.

Our findings are in keeping with previous studies showing that 4–24% of healthy persons have evidence of celiac axis compression by MAL [3]. In fact, our study may have underestimated the frequency of celiac artery compression by MAL, since the images had been acquired in full inspiration. If the images had been obtained in expiration, the prevalence of a positive finding may well have been even higher. However, the absence of collaterals in our subjects indicates that none of them had a hemodynamically significant compression despite diagnostic appearance on CT images. Thus, our data suggest that an imaging appearance of celiac artery compression by MAL may be common among healthy persons and hence may not have much clinical consequence.

In conclusion, our data re-emphasize the fact that demonstration of celiac artery compression by MAL in a patient with abdominal pain does not necessarily mean that this finding is responsible for the symptoms. Thus, the diagnosis of MALS should be made with abundant caution.
References

