
PICTORIAL ESSAY

Imaging Features of Median Arcuate Ligament Syndrome

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ABSTRACT

Median arcuate ligament syndrome presents as abdominal pain. It usually occurs in young people, who presents with abdominal pain associated with eating. This pictorial review deals with 2 such patients who showed typical imaging features revealed by ultrasound, computed tomography, magnetic resonance imaging, and conventional angiography.

Key Words: Angiography; Celiac artery; Constriction, pathologic; Tomography, X-ray computed; Ultrasonography

中文摘要

正中弓狀韌帶綜合徵的影像學特徵

鄒起華、郭啟欣、黃麗莎、馮漢盛、王旺根

正中弓狀韌帶綜合徵患者病發時會有腹痛。此症好發與年青人，進食時有腹痛。本文複習兩個正中弓狀韌帶綜合徵病例，兩例在超聲波、電腦斷層造影、磁力共振、及血管造影都有典型的影像學特徵。

INTRODUCTION

The median arcuate ligament is a fibrous arch that unites the diaphragmatic crura on either side of the aortic hiatus. It usually passes superior to the origin of the celiac artery. In 10 to 24% of subjects, however, the ligament may cross anterior to the proximal portion of the artery; occasionally, the ligament may actually compress the celiac axis, compromising blood flow and causing symptoms.

The median arcuate ligament syndrome was first described in 1963 by Harjola.¹ It typically occurs in young patients (aged 20-40 years) and is more common in thin women. Affected individuals may suffer from epigastric pain (especially after eating) and weight loss, and physical examination may reveal an audible midepigastric abdominal bruit that varies with respiration.^{2,3} Confirmation of the diagnosis relies on radiological features. The symptoms are probably

related to the compression of the celiac axis, resulting in a compromise in blood flow.

CONVENTIONAL ANGIOGRAPHY

Conventional angiography reveals a characteristic superior indentation along the proximal celiac axis, usually about 5 mm from its origin at the abdominal aorta. Typically, any compression caused by this indentation is less apparent during inspiration, when the celiac axis assumes a more caudal orientation as the lungs expand (Figure 1), whilst during expiration, compression increases.⁴ Isolated compression of the celiac axis during expiration may not be clinically significant, unless accompanied by typical symptoms.

COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING

With the advance of technology, the median arcuate ligament syndrome has been observed with Doppler

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ultrasound and computed tomography (CT).^{2,5} For a complete CT angiographic evaluation in patients in whom the syndrome is suspected, 3-dimensional imaging is necessary. Typically, the sagittal plane is optimal for visualising the proximal portion of the celiac axis. Characteristically, CT angiograms demonstrate focal narrowing in the proximal celiac axis (Figure 2a), which has a hooked appearance (Figure 2b). This can help distinguish the condition from other causes of celiac artery narrowing, such as atherosclerotic disease.⁴ As CT is typically performed during inspiration, any observed focal narrowing may be clinically significant. Associated poststenotic dilatation or collateral vessels may suggest other pathological conditions and warrant

further investigation. Findings from magnetic resonance imaging are similar to those of CT (Figure 3).

ULTRASOUND DOPPLER

In ultrasound Doppler, with celiac artery stenosis, peak systolic velocities in the celiac artery are high and usually greater than 200 cm/s (Figure 4a and 4b), and the aorta/celiac artery ratio is greater than 3.0 during both inspiration and expiration.⁶ With median arcuate ligament syndrome, the abnormal Doppler findings are evident on expiration (Figure 4c) but normal during inspiration (Figure 4d).⁷ Wolfman et al⁸ suggested that the celiac artery should be investigated not only in full inspiration and expiration, but also with the patient in the erect position. Abnormal findings with median arcuate ligament syndrome were only found in expiration, because with inspiration, the celiac artery descends in the abdominal cavity. This results in a more vertical orientation of the celiac artery, which often relieves the compression. With the patient in an erect position, the celiac artery descends further in the abdominal cavity, resulting in an even more vertical orientation and relief of compression by the ligament.

TREATMENT

Traditionally, median arcuate ligament syndrome has been treated by laparoscopic division of the median arcuate ligament to relieve the extrinsic compression. Successful percutaneous angioplasty and stenting of the celiac artery has also been described. In a study by Silva et al,⁹ stenting was employed in 4 patients with extrinsic compression of the celiac artery with excellent immediate success. Only 1 of the 4 patients had a 3-year



Figure 1. Narrowing of the celiac artery of patient A (arrow).

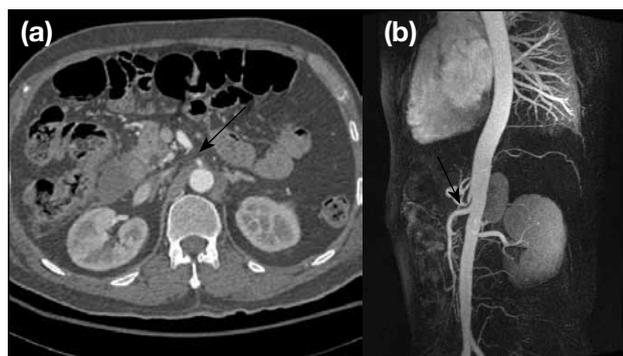


Figure 2. Patient A: (a) Narrowing of celiac artery (arrow) in a computed tomographic scan with curve reformation appearing along the celiac trunk. (b) Typical hook-like appearance of the celiac artery (arrow) revealed by magnetic resonance angiography.

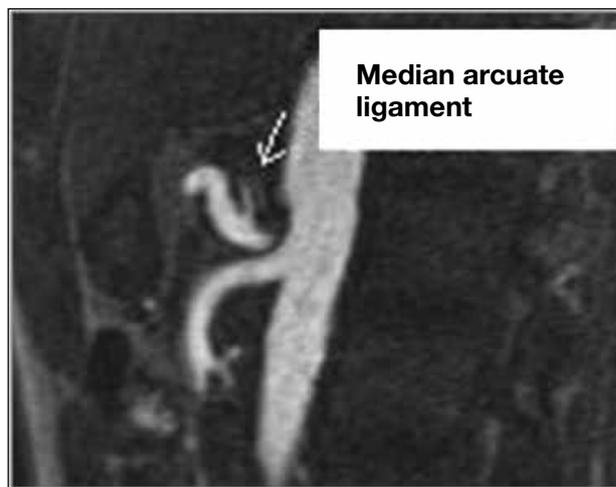


Figure 3. The median arcuate ligament can be seen in the magnetic resonance imaging in patient A.

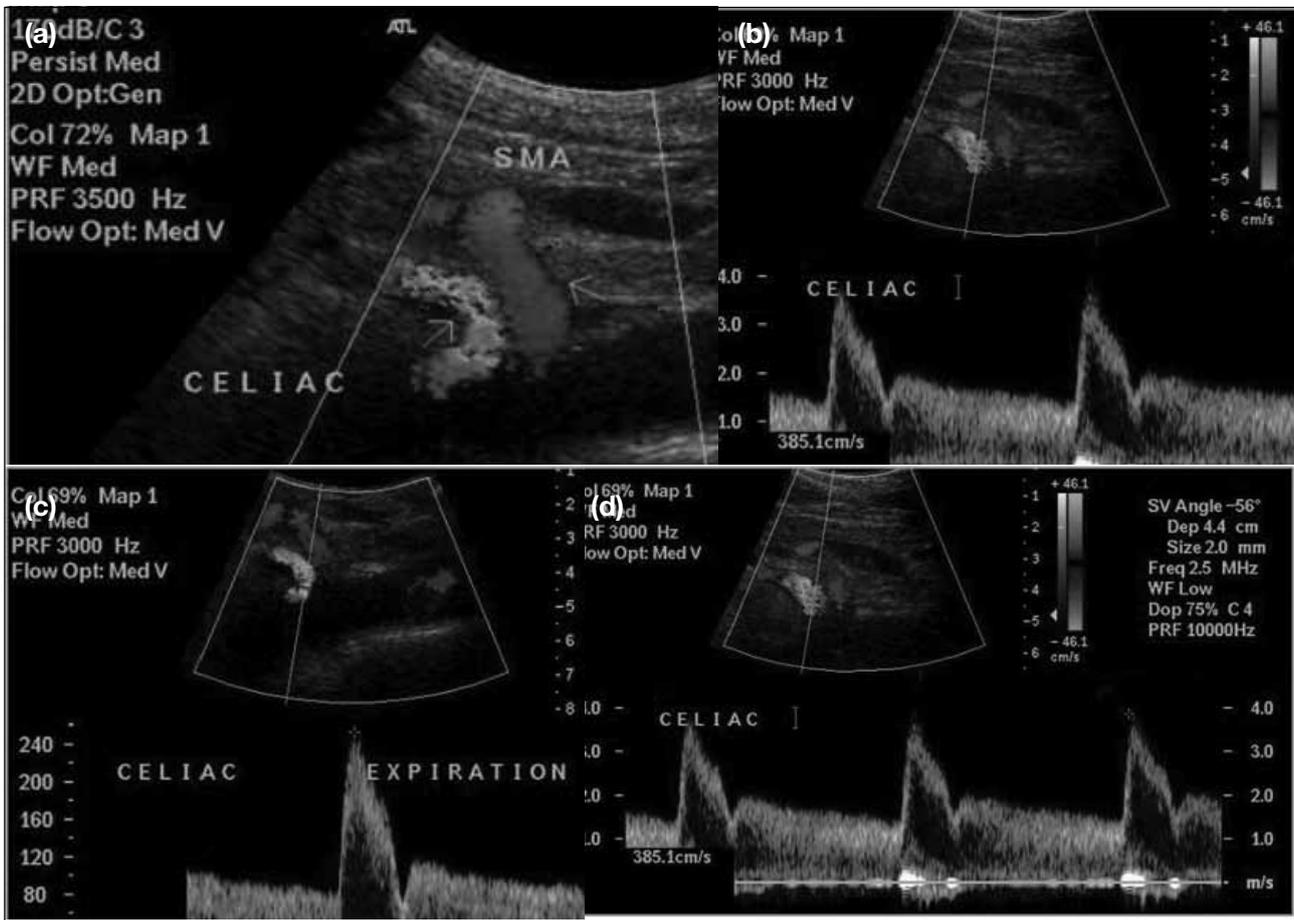


Figure 4. Patient B: (a) Ultrasonographic Doppler showing aliasing of the colour Doppler at the proximal celiac artery. (b) The peak systolic velocity (PSV) in the celiac artery is above 300 cm/s. (c) During expiration, the PSV of the celiac artery is above 200 cm/s. (d) During inspiration, the PSV in the celiac artery is normal (<200 cm/s).

symptom-free follow-up. The long-term outcome of the other 3 patients was not discussed. Outcomes from percutaneous revascularisation of this condition have not been reported, but this may be an acceptable option in selected patients.

CONCLUSION

Median arcuate ligament syndrome should be included in the differential diagnosis of chronic abdominal pain, weight loss, and vomiting in young patients. As technology advances, more and more CT and ultrasound examinations are performed for patients. We, radiologists, may be the first to flag the possibility of median arcuate ligament syndrome in individual patients and need to be aware of this condition and its radiological features.

REFERENCES

1. Harjola PT. A rare obstruction of the celiac artery. Report of a case.

Ann Chir Gynaecol Fenn. 1963;52:547-50.

2. Sproat IA, Pozniak MA, Kennell TW. US case of the day. Median arcuate ligament syndrome (celiac artery compression syndrome). *Radiographics.* 1993;13:1400-2.
3. Dunbar JD, Molnar W, Berman FF, Marable SA. Compression of the celiac trunk and abdominal aorta. *Am J Roentgenol Radium Ther Nucl Med.* 1965;95:731-44.
4. Horton KM, Talamini MA, Fishman EK. Median arcuate ligament syndrome: evaluation with CT angiography. *Radiographics.* 2005;25:1177-82.
5. Petten RM, Coldwell DM, Ben-Menachem Y. Ligamentous compression of the celiac axis: CT findings in five patients. *AJR Am J Roentgenol.* 1991;156:1101-3.
6. Lim HK, Lee WJ, Kim SH, et al. Splanchnic arterial stenosis or occlusion: diagnosis at Doppler US. *Radiology.* 1999;211:405-10.
7. Erden A, Yurdakul M, Cumhur T. Marked increase in flow velocities during deep expiration: A duplex Doppler sign of celiac artery compression syndrome. *Cardiovasc Intervent Radiol.* 1999;22:331-2.
8. Wolfman D, Bluth EI, Sossaman J. Median arcuate ligament syndrome. *J Ultrasound Med.* 2003;22:1377-80.
9. Silva JA, White CJ, Collins TJ, et al. Endovascular therapy for chronic mesenteric ischemia. *J Am Coll Cardiol.* 2006;47:944-50.