In Focus: Clinical Imaging of the Median Arcuate Ligament through Cadaveric Exploration

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The median arcuate ligament (MAL) is at the core of a current controversy piqued by increased research queries regarding its contribution to the pathogenesis of coeliac artery compression syndrome. As our own curiosity was aroused by these queries, we decided to contribute to the discourse by providing a clear visual documentation of the MAL, obtained through cadaveric dissection in the Alfaisal University anatomy laboratory. We believe that reviewing the anatomy of the MAL, and the crura that form it, is crucial in this context. The cadaver was of a 50-year-old male and had been preserved in formalin. We used Grant's Dissector Manual as a reference throughout the dissection, which was comprehensively documented in digital photographs as well as on video. Upon entering the lesser sac, we explored the stomach bed structures. We skeletonised the coeliac trunk up to the point of its emergence from the aorta. The peritoneum, the fascia covering the aorta, the wall, and the crura, as well as nearby sympathetic ganglia were carefully removed, resulting in the view seen in Figure 1. As much as we wished to leave the displayed anatomical features undisturbed per Figure 1, we also wanted to reveal the muscular and tendinous components of the diaphragmatic crura, to illustrate how their medial margins meet to form the MAL. Accordingly, some fascicles of the left crus were displaced backward, and a few of the right crus were removed (Figure 2). Normally, the highest end of the MAL wraps the anterior and lateral aspects of the aorta at the T12 vertebra, forming with the body of this vertebra the aortic hiatus (Figures 2 and 3). Due to MAL's wide and diverse placement, this ligament may lie low, compressing or distorting the coeliac trunk [1]. The coeliac trunk, also known as the ceoliac artery or truncus coeliacus, is a vessel arising from the aorta. It passes beneath the MAL at the T12 vertebral level, which is also the point at which the aorta enters the abdominal cavity. Its three main branches are the left gastric artery, the common hepatic artery, and the splenic artery. The coeliac trunk provides a circulatory supply to the foregut, specifically the liver, pancreas, gall bladder, spleen, and distal oesophagus, up to the second portion of the duodenum [1]. Coeliac artery compression syndrome is commonly referred to as coeliac axis syndrome, median arcuate ligament syndrome (MALS), Dunbar syndrome, or Harjola-Marable syndrome. This distinctive condition arises from the compression of the coeliac artery by the median arcuate ligament [1]. Another factor that could contribute to the compression is the fibres of the coeliac ganglia [2]. Despite having been identified several decades ago, the existence of this syndrome is still disputed by several researchers. Harjola was the first to document the clinical importance of coeliac artery compression in a living person. In his 1963 paper, the author discusses the case of a 57-year-old man who experienced abdominal pain after eating. Further examination revealed that his symptoms were caused by the compression of the coeliac artery by a fibrotic coeliac ganglion, and the surgical excision of said ganglion led to the disappearance of the symptoms [3]. In 1967, Dunbar et al. released a series of cases in which comparable symptoms arose from external compression of the coeliac artery by fibres of the median arcuate ligament. Clinical improvement was observed after the surgical division of these fibres [4]. Patients with this condition typically present between the ages of 20 and 40, and it may also cause mesenteric ischaemia in certain people. Postprandial discomfort is the most prevalent complaint, in addition to nausea or vomiting and epigastric pain, which causes weight loss. Standing is usually the best way to reduce the pain, while lying down worsens it [1].

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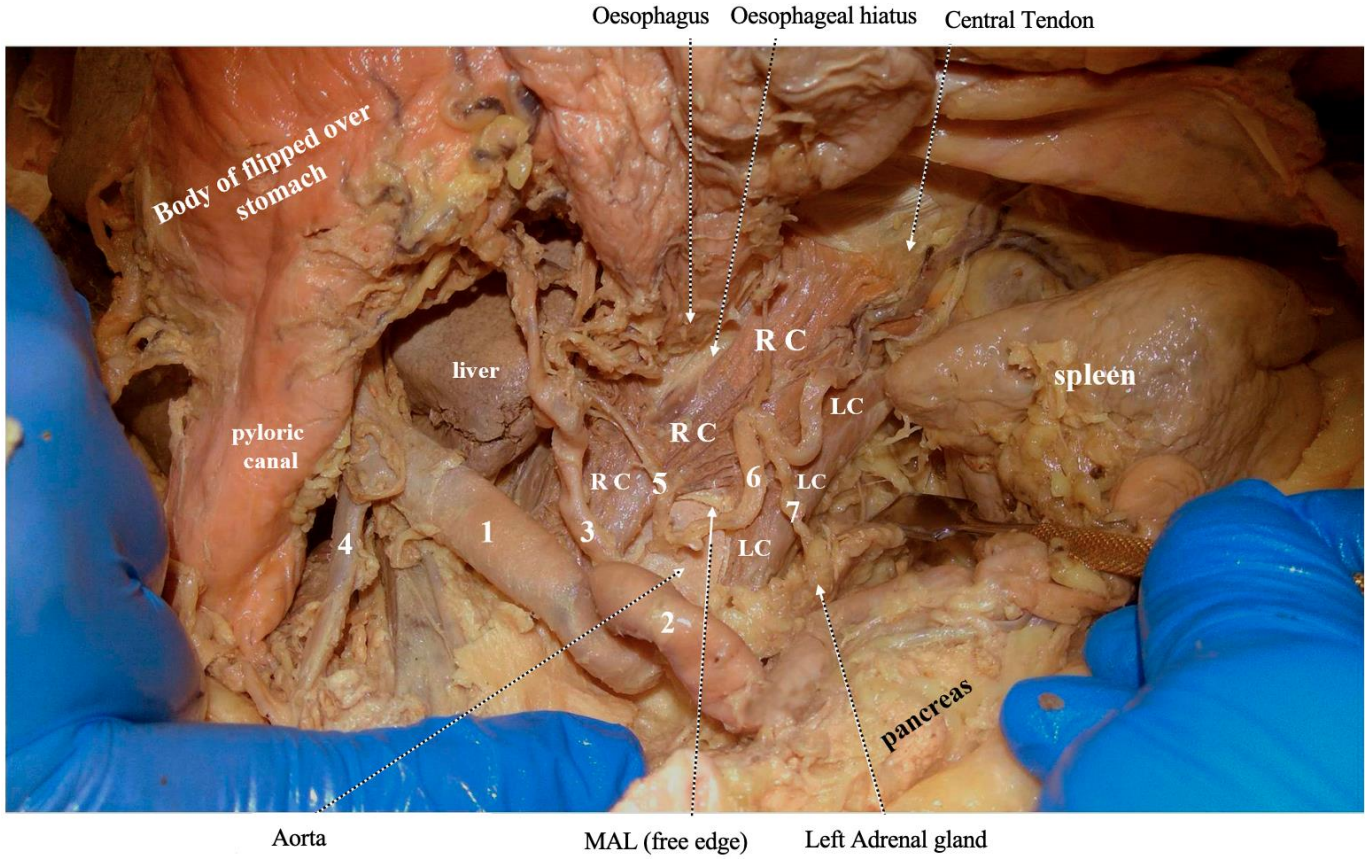

Figure 1. A gross image of the diaphragm's right and left crura, as well as the median arcuate ligament. RC: right crus of diaphragm, LC: left crus of diaphragm. Arteries: 1. common hepatic, 2. splenic, 3. left gastric, 4. gastroduodenal, 5. right inferior phrenic, 6. left inferior phrenic, 7. left superior adrenal.

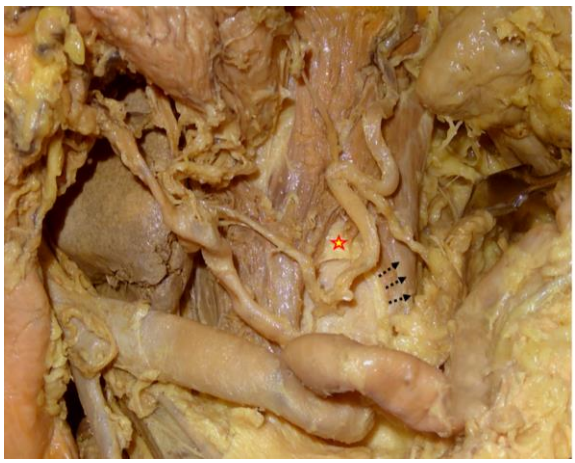

Figure 2. The margin of the tendinous component of the left crus is exposed by displacing backwards - in the direction of the arrows - a strip of fascicles of its muscular component. This demonstrates how the margin of each crus runs anteromedially, contributing to the free edge of the MAL. At the star, a group of fascicles of the right crus were removed, showing an area of the portion of the MAL formed by the meeting of the tendinous components of both crura which are resting on the anterior aspect of the aorta.

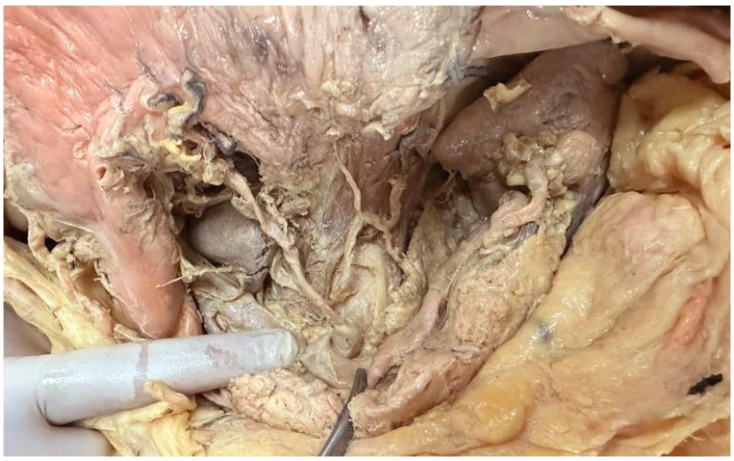

Figure 3. Partial exposure of the MAL and its arching edge. Normally, at the level of T12, the MAL wraps the aorta anteriorly and bilaterally, forming with the body of this vertebra the aortic hiatus. The coeliac trunk is clearly demonstrated: the distance between it and the highest point of the arching edge of the MAL is 1.8 cm.

Intermittent mesenteric ischaemia is thought to be caused by the compression of the coeliac artery by the MAL. Nevertheless, this theory may not fully elucidate the situation, as an extensive collateral network of mesenteric arteries typically exists, connecting the coeliac artery to the superior mesenteric artery. Hence, malfunctioning of the coeliac nerve plexus could play a part in the development of this illness. Nerve failure can result in atypical constriction of the blood vessels supplying the abdominal organs, which can cause ischaemia [5]. Treatment for this illness frequently consists of laparoscopic surgical decompression, which is accomplished by separating the MAL, and is limited to symptomatic individuals [1]. Comprehending the complex connection between the MAL and the coeliac trunk is essential because of the latter's critical function in systemic circulation. This artery, which arises from the aorta and is located below the MAL, supplies blood to vital abdominal organs. Thus, median arcuate ligament compression can have serious impacts on blood vessels and organ function. Our research highlights the limited availability on the internet of comprehensive anatomical illustrations of the MAL, despite the fact that precise anatomical photographs are crucial to clearly show the relationship between this ligament and the coeliac artery. Our focus involves a comprehensive cadaveric anatomical description to address this gap and to emphasise the significance of hands-on learning in anatomy instruction, promoting a more profound comprehension of the complexities related to the median arcuate ligament.

APPENDIX

Access the video and visually explore these structures by following the link provided: [https://youtu.be/6hCzBl9w7XA]

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