Laparoscopic Division of Median Arcuate Ligament for the Celiac Axis Compression Syndrome—Two Case Reports with Review of Literature

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Abstract Median arcuate ligament (MAL) syndrome is an uncommon condition caused by the external compression of the celiac trunk by the median arcuate ligament. In the current era of technological advancement, this syndrome may be corrected through the laparoscopic approach. We report two patients who were diagnosed as MAL syndrome and underwent laparoscopic division of MAL fibers at our institute. Both the patients improved symptomatically following the procedure and were discharged on the fourth post-operative day. Also, they remained symptom free during subsequent follow-up period of 1 year and 8 months, respectively. Laparoscopic approach to correct the MAL syndrome is feasible and safe. It may be the preferred modality of treatment in view of its superior visualization and lack of morbidity. However, adequate experience in advanced laparoscopic surgery is required before attempting this procedure.

Keywords Median arcuate ligament · Celiac axis compression · Laparoscopic surgery · Minimal invasive surgery

Introduction

Median arcuate ligament (MAL) syndrome, also known as the celiac axis compression syndrome (CACS), was

first described by Harjola in 1963 [1]. Median arcuate ligament syndrome (MALS) is caused by the external compression of the celiac trunk by the median arcuate ligament. It is a diagnosis of exclusion, characterized by the clinical triad of post-prandial abdominal pain, weight loss, and vomiting. Traditionally, the treatment of this syndrome is surgical division of median arcuate ligament (open or laparoscopic) to relieve the extrinsic compression [2]. Percutaneous endovascular treatment may be considered in selected cases, for which the traditional surgery has failed or the patient is unfit for surgery. We report two cases of median arcuate ligament syndrome presented with chronic abdominal pain and weight loss, which were successfully treated by laparoscopic division of MAL fibers.

Cases and Technique

Case No. 1

A 64-year-old housewife had presented with non-radiating upper abdominal pain associated with vomiting and heart burn since 10 years. The pain was aggravated by food. Oesophago-gastro-duodenoscopy revealed grade II esophagitis. Blood investigations and ultrasound abdomen were normal. Though she improved initially, later she presented with post-prandial pain not relieved with proton pump inhibitors. The CECT abdomen showed compression of the celiac axis with post-stenotic dilatation (Fig. 1). Laparoscopic division of median arcuate ligament fibers was performed and she was discharged on the fourth post-operative day. At her follow-up for last 1 year, she is completely symptom free.

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Fig. 1 Pre-operative CECT showing the celiac artery compression

Case No. 2

A 16-year-old female presented with loss of appetite and nausea of 2 years duration. Her symptoms persisted in spite of receiving proton pump inhibitors. Oesophago-gastro-duodenoscopy was normal. CECT abdomen was done which revealed compression of the celiac axis. She was managed through laparoscopic approach. The symptoms improved in the post-operative period and she was discharged on the fourth post-operative day. She is symptom free during last 8 months follow-up.

Surgical Technique

Under general anesthesia the patient is placed in supine position with legs split and the surgeon stands in between the patient's legs. CO₂ pneumoperitoneum is created using Veress needle technique and abdominal pressure is maintained at 14 mm of Hg. A 10-mm camera port is placed at the umbilicus. A 5-mm epigastric port is placed through which a Nathanson liver retractor is inserted to lift the left lobe of the liver. Two 5-mm cannulas are introduced in the right and left upper abdomen. An additional 5-mm cannula is introduced in the left lateral abdomen. After placing all the trocars the patient is placed in a reverse trendelenburg position with right or left tilt as required. We use a 30° scope for better visualization of the gastroesophageal junction.

The pars flaccida is divided first, both crura are dissected and the esophagus is looped with penrose drain. Right crus of the diaphragm is skeletonized next, the abdominal aorta is exposed and traced downwards to identify the origin of the celiac axis (Fig. 2). Also, the left gastric and the hepatic artery dissection helps in identifying origin of the celiac axis on the aorta. Stomach is retracted to left to gain better exposure. Near

Fig. 2 Dissection till Origin of the celiac artery

the origin of the celiac axis the abnormally inserted median arcuate ligament fibers are noted. Entire fibro-fatty tissue on either side of the celiac axis origin is removed to bare the celiac axis origin completely (Fig. 3). Once these maneuvers are completed, the celiac axis is clearly visualized without any residual kinking.

Discussion

The MAL fibers normally cross the aorta cephalad to the origin of the celiac trunk. The origin of the celiac trunk undergoes variable caudal migration in embryogenesis and may vary in location from the level of 11th thoracic to first lumbar vertebra. In cases where the MAL inserts unusually low or the celiac axis is located unusually high or the MAL crosses anterior to the celiac artery, these fibers may compress the origin of the celiac artery causing MAL syndrome [3]. However, some patients are asymptomatic due to sufficient collateral supply from the superior mesenteric circulation.

MAL syndrome is most commonly detected between 20 and 40 years of age, particularly in thin women. MALS is a diagnosis of exclusion characterized by the clinical triad of post-prandial abdominal pain, weight loss, and vomiting [1]. Physical examination is usually normal. Radiographic evidence of external compression of the celiac artery is needed

Fig. 3 At the end of the surgery

to confirm the diagnosis. Recent reports suggest CT angiography as diagnostic method of choice [3].

The goal of treatment is restoring normal blood flow in the celiac axis [2]. This is achieved through surgical release of the MAL fibers. Improvement in the symptoms following surgery may be in part due to interruption of the sympathetic fibers resulting in relief of vasospasm and thereby increased blood flow through the celiac artery.

Traditionally open surgery was the mainstay therapy. With the advent of minimally invasive surgery, laparoscopic approach is being preferred to open technique. Benefits of laparoscopy include better visualization of the aortic region and complete division of all the fibers of MAL, the key to successful resolution of symptoms. Laparoscopy also offers shorter hospital stay; faster return to a regular diet, ambulation, and work; as well as better cosmetic results. One hundred and twenty one cases of laparoscopic release of MAL have been reported in the literature by many authors. Immediate symptomatic improvement was noted in 95.86 % ($n=116$) while recurrence of symptoms was seen in 5.78 % ($n=7$) patients [4]. Intraoperative laparoscopic Doppler ultrasonography helps in confirming the adequacy of operative decompression by documenting improvement in the celiac artery flow velocities before and after the division of crural fibers [5].

Percutaneous angioplasty with stenting has been successful in only a few studies. Hence, a long term of prognosis of this procedure is still unknown. It may be beneficial in some select cases such as those with a failure of traditional surgery, or unfit for surgery.

Conclusion

MALS presents with distressing symptoms and is a diagnosis of exclusion. Surgical sectioning of MAL fibers restores celiac axis blood flow with optimum relief of symptoms. Laparoscopic approach is the preferred treatment modality.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

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