Surgical Treatment of Median Arcuate Ligament Syndrome: Case Report and Review of Literature

Milutin Kotarac¹, Nebojša Radovanović², Nebojša Lekić¹, Zoran Ražnatović¹,
Vladimir Djordjević¹, Dragana Lekić³, Dragan Sagić²,⁴
¹Clinic for Digestive Surgery, First Surgical Clinic, Clinical Center of Serbia, Belgrade, Serbia;
²University of Belgrade, School of Medicine, Belgrade, Serbia;
³Institute for Mother and Child Health Care of Serbia “Dr Vukan Ćupić”, Belgrade, Serbia;
⁴Institute for Cardiovascular Diseases “Dedinje”, Belgrade, Serbia

INTRODUCTION
Median arcuate ligament (MAL) syndrome, also known as celiac artery compression syndrome (CACS) is a rare disorder caused by compression of the celiac artery by median arcuate ligament of the diaphragm, which leads to mesenteric ischemia and chronic abdominal angina. The typical clinical triad of symptoms includes postprandial epigastric pain, weight loss and vomiting. The gold standard for MAL syndrome diagnosis is selective angiography, while in symptomatic patients with angiographically verified stenosis the optimal therapy is surgical treatment.

CASE REPORT
A 40-year-old male patient was presented with epigastric pain, followed by dyspepsia and weight loss. The upper endoscopy showed gastric and duodenal distention with prominent folds of gastric mucosa and slow peristalsis. Selective angiography showed stenosis (90%) of initial segment of the celiac trunk. Adhesiolysis with the transection of the median arcuate ligament was performed. Due to repeated symptoms, the patient was reoperated on the 10th postoperative day with performed adhesiolysis and gastrostomy for gastric nutrition. Two months later, the patient was rehospitalized for closure of gastrostomy. At five years follow-up, selective angiography showed no stenosis of the initial segment of the celiac artery.

Conclusion Despite the existing controversy concerning pathophysiological mechanism, the clinical presentation and treatment modalities of patients with MAL syndrome, it is evident that careful selection and adequate surgical treatment may significantly reduce symptoms in these patients.

Keywords: celiac artery; median arcuate ligament; diaphragm; arterial occulsive disease

[Correspondence to: Vladimir DJORDJEVIĆ
Clinic for Digestive Surgery
First Surgical Clinic
Clinical Center of Serbia
Dr Koste Todorovića 6
11000 Belgrade
Serbia
vladimir.djordjevic@kcs.ac.rs]
it was present in expiration while it disappeared during the deep inspiration.

Angiography of the visceral arteries in the anteroposterior projection showed the entire celiac trunk, but gastroduodenal artery could not be viewed (Figure 1). The gastroduodenal artery was visualized retrogradely via the superior mesenteric artery (hepatic “steal”) due to lower pressure in the celiac trunk system (Figure 2).

Selective angiography showed dynamic stenosis of the celiac artery due to diaphragmatic ligament compression; during expiration extrinsic compression reduced the celiac artery lumen for 80% (Figure 3A). During the forced inspiration, the lumen of the celiac artery was decompressed with reestablished adequate blood flow (Figure 3B).

After adequate preoperative assessment, adhesiolysis with transection of the median arcuate ligament was performed (Figure 4).
However, early remission was followed by repeated symptoms; abdominal pain, nausea followed by vomiting, and the patient refused any oral nutrition. Therefore, the patient was reoperated on the 10th postoperative day, with performed adhesiolysis and gastrostomy for gastric nutrition. Postoperative course was without complications, intrahospital stay was prolonged in order to stabilize the patient's condition and nourishment, and the patient was discharged on the 45th postoperative day. Two months after discharge, the patient was rehospitalized for the closure of gastrostomy, and was back on oral nutrition with normal digestive functions.

Selective angiography of the celiac trunk was performed five years after the operation, which showed no reduction in the lumen of the initial segment of the celiac artery during expiration (Figure 5). Also, selective angiography of the upper mesenteric artery failed to show reverse blood flow via the gastroduodenal artery (Figure 6) which corroborated well with the finding of the patent ostium of the celiac artery and its successful decompression.

DISCUSSION

MAL syndrome is a rare disorder caused by extrinsic compression and narrowing of the celiac artery by a relatively low insertion of the median arcuate ligament of the diaphragm. The exact pathophysiological mechanism underlying this disorder is still unclear [6, 7, 8]. Namely, although celiac artery shows reduced blood flow, the superior and inferior mesenteric artery are widely patent, which should provide a normal intestinal perfusion. Therefore, there are two proposed theories which tend to elucidate the existing symptoms of MAL syndrome. According to the first theory, compression of the mesenteric artery leads to mesenterial ischemia, either directly or indirectly, via “steal phenomenon” by the collaterals which connect the superior mesenteric and celiac artery [9]. Still, there are rare cases of co-existing stenosis of the celiac artery and superior mesenteric artery was reported by Sianesi et al. [10].

The second neurogenic theory implies the involvement of the celiac ganglion and plexus and its subsequent stimulation, which may lead to splanchnic vasoconstriction [11]. In the majority of patients extrinsic compression of the celiac artery is caused by the median arcuate ligament, but several cases of celiac ganglion fibrosis have been described as a potential cause of extrinsic celiac artery compression [12, 13], which confirms the latter.
pathogenesis theory of this syndrome. Albeit, controversies still exist, since it has been reported that 13-50% of healthy subjects may exhibit a certain degree of angiographically visible compression of the celiac artery during expiration [6].

MAL syndrome is typically presented in young to middle-age adults, although it has been described in infants and children [14]. It is characterized by a clinical triad of postprandial epigastric pain, weight loss and vomiting.

The typical manifestation of abdominal angina is seen only in about 40% of patients, while more than 80% of cases have symptoms which vary from postprandial cramp-like abdominal pain to non-specific epigastric pain [15].

The gold standard of the diagnostic method for MAL syndrome is selective angiography performed in inspiration as well as in expiration. Treatment modalities include endovascular and surgical procedures (open or laparoscopic surgery). Although percutaneous transluminal angioplasty with stent implantation is a less invasive procedure, it often does not solve the problem of the underlying extrinsic compression of the celiac trunk and frequently requires surgical interventions.

Classic treatment for MAL syndrome is represented by open surgery with celiac artery decompression. The largest series of surgically treated patients with MAL syndrome included 51 patients [16]. Surgical modalities included celiac trunk decompression in 16 patients, decompression and dilatation in 17 patients, and decompression and reconstruction either by primary reanastomosis or interposition of the graft in 18 patients. The best results of symptoms relief were achieved in cases of decompression and certain forms of celiac revascularization (76%). Also, Grotemeyer et al. [17] in their series of 18 surgically treated patients observed that open surgical therapy in its various forms is a safe and reliable procedure with either no mortality or low morbidity rate.

Since the beginning of laparoscopic era, there have been numerous reports of different laparoscopic techniques for treating patients with MAL syndrome [18, 19, 20]. Baccari et al. [21] (2009) have reported a successful laparoscopic decompression of the celiac artery in a group of consecutive patients with complete resolution and symptom-free period of 28.3 months. Despite the postoperative effectiveness of laparoscopic procedures, no long-term follow-up is still available.

Tsujimoto et al. [22] have used intraoperative Doppler ultrasound for the confirmation of the decompressed celiac artery after successful laparoscopic intervention in patients with MAL syndrome. Recently, several authors have reported robotic-assisted treatment of MAL syndrome as a new, safe and efficacious modality treatment [23, 24, 25].

Although MAL syndrome has been described in the 1960s, controversies concerning pathophysiological mechanism, clinical presentation and treatment modalities still exist. Regardless of the controversial viewpoints, the majority of authors agree that symptomatic patients with angiographically confirmed celiac artery compression will benefit more from surgical treatment.

In this paper we presented a case of a 40-year-old symptomatic patient with angiographically verified stenosis of the celiac artery that was surgically treated. The patient had no symptoms during a 5-year follow-up period, which can be considered as a long-term follow-up.

Many questions regarding MAL syndrome have not been clarified yet, but it is evident that careful selection and adequate treatment can significantly reduce symptoms in these patients while the choice of treatment must depend on the specific clinical situation for each patient.

REFERENCES

Хируршко лечење синдрома медијалног аркуатног лигамента дијафрагме – приказ болесника и преглед литературе

Милутин Котарац1, Небојша Радовановић1,2, Небојша Лекић1, Зоран Ражнатовић1, Владимир Ђорђевић1, Драгана Лекић3, Драган Сагић2,4
1Клиника за дигестивну хирургију, Прва хируршка клиника, Клинички центар Србије, Београд, Србија;
2Универзитет у Београду, Медицински факултет, Београд, Србија;
3Институт за здравствену заштиту мајке и детета Србије “Др Вукан Чупић”, Београд, Србија;
4Институт за кардиоваскуларне болести “Дедиње”, Београд, Србија

КРАТАК САДРЖАЈ

Увод Синдром медијалног аркуатног лигамента дијафрагме, такође познат као синдром компресије целијачког трункуса или Данбаров (Dunbar) синдром, редак је поремећа узрокован компресијом целијачке артерије медијалним аркуатним лигаментом дијафрагме који доводи до мезентеричне ишкиемије и хроничне анги не абдомена. Типично клиничко тројство симптома укључује постпранцијални епигастротом лоб, губитак тежине и повраћање. Златни стандард у дијагностици овог синдрома је селективна ангиографија, док је за болеснике који имају симптоме и ангиографски потврђену стенозу оптимални третман хируршко лечење.

Приказ болесника Мушкараца стар 40 година пожалио се на бол у епигастриту праћен диспепсијом и губитком тежине. Ендоскопски преглед горњих органа указала је на надутост желяца и дуоденума с истакнутим наборима гастричке мукоезе и спором перисталтиком. Селективна ангиографија указала је на стенозу (90%) иницијалног сегмен-

ta целијачког трункуса. Обављена је ахдезелизи за пресецање медијалног аркуатног лигамента. Због поновољених симптома, болесник је опет оперисан десетог дана након прве операције, када је урађена ахдезелиза и креирана нутритивна гастростомија. Два месеца касније болесник је поново примљен на болничко лечење, како би се извршило затварање нутритивне гастростомије. Пет година након хируршког лечења контролном селективном ангиографијом није утврђена стеноза иницијалног сегмента целијачке артерије.

Закључак Упркос опречним ставовима у вези с патолошким механизма настанка и клиничком сликом Данбаровог синдрома, те облицима лечења болесника с овим обовољењем, јасно је да пажљив одабир одговарајућег хируршког приступа може значајно умањити симптоме код ових болесника.

Кључне речи: целијачка артерија; медијални аркуатни лигамент; дијафрагма; артеријска окулузивна болест

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