

# A Case Series on Superior Mesenteric Artery Syndrome Surgical Management, Single Institution Experience

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## ABSTRACT

Compression of duodenum by Superior Mesenteric Artery (SMA) causing proximal intestinal obstruction is an uncommon condition. Treatment of this condition involves conservative management initially followed by surgical management in those patients who have persistent symptoms. This case series evaluates surgical management and outcome of six patients after one year, who presented with SMA syndrome and describes a brief review of literature. Three patients underwent open duodenojejunostomy and the rest three underwent laparoscopic duodenojejunostomy. All patients had uneventful postoperative recovery. Postoperative requirement of analgesics was less in laparoscopic group versus open group. All the three patients in laparoscopic group could be mobilised out of bed on the day of the surgery itself. Mean duration of hospital stay was seven days for open surgery group and three days for the laparoscopy group. Outcome in terms of resolution of abdomen pain and vomiting was similar in both the groups. Four patients were asymptomatic after one year of follow up. A high index of clinical suspicion is needed for the diagnosis of SMA syndrome. Laparoscopic approach is feasible, safe, less morbid and effective as compared to open surgery. In the presence of facilities and surgical expertise, laparoscopic duodenojejunostomy should be considered the procedure of choice for SMA syndrome. Majority of patients remain symptom free at one year follow up.

**Keywords:** Aortomesenteric angle, Duodenojejunostomy, Laparoscopic approach

SMA syndrome, caused by compression of duodenum by SMA causing proximal intestinal obstruction is an uncommon condition. It should be treated by conservative management initially followed by surgical management in those patients who have persistent symptoms.

## CASE SERIES

From the hospital case record, a total of six cases were identified during duration of five years from January 2010 to May 2015 [Table/Fig-1]. The mean age of patients was 20 years (17-31 years). The male to female ratio was 2:1. Postprandial vomiting associated with upper abdominal discomfort was the most common presentation. A history of significant weight loss was present in two patients. Associated predisposing factors could be identified in three patients. Two patients had restricted their diet due to concern of their body image resulting in weight loss. One patient had a scoliosis correction surgery six months before the onset of SMA syndrome. In our series patients were operated after a mean period of two months if symptomatic on conservative management.

**Evaluation of patients:** All patients underwent an upper gastrointestinal endoscopy and 320 slice CECT abdomen evaluation [Table/Fig-2,3]. Upper gastrointestinal endoscopy was normal in four patients; two patients had mid dilatation of second part of duodenum. The aortomesenteric angle was assessed on reconstructed arterial images on CT scan [Table/Fig-4]. The mean aortomesenteric angle was 10.5 degrees in six patients (range 7-12.5 degrees).

All the six patients eventually underwent surgical intervention because of persisting symptoms, three each by open and laparoscopy approach.

## Operative Technique

**a) Open approach:** Approach was by upper midline incision.

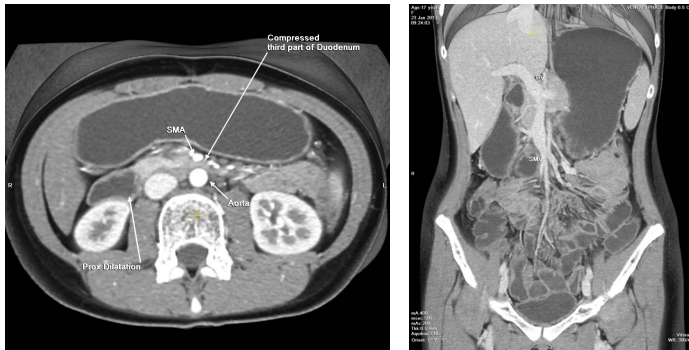
The side to side anastomosis was done between second part of duodenum and a loop of jejunum, about 30 cm distal to duodenojejunal flexure. The anastomosis was performed in two layers in all patients. Wound was closed en masse.

**b) Laparoscopic approach:** The patient was placed in a 20° head-up supine-split leg position. Operating surgeon stood in between the legs of patient, camera assistant on the right side of patient, scrub nurse and second assistant on the left side of the patient. Pneumoperitoneum was established using Veress needle technique. Port position was: 10-mm port at the umbilicus for a 30° telescope, a 5-mm port in the epigastrium for liver retraction, a 10-mm working port in the right subcostal region and a 5-mm working port in the left subcostal region. The transverse colon was lifted up. Dilated duodenum was seen in the infra-colic compartment. SMA pulsations could be seen to the right side of the dilated third part of duodenum. The visceral peritoneum overlying second and third part of duodenum was divided using harmonic scalpel and this part of the duodenum was freely mobilized. A loop of jejunum about 30 cm from the duodenojejunal flexure was brought up to the duodenum. Stay sutures were applied intracorporeally with 2-0 silk to keep both segments in approximation. A small opening was made in both the duodenum and jejunum with harmonic scalpel. One of the jaws of a 45-mm EndoGIA echelon stapler was introduced into the lumen of the jejunum, and the other jaw was introduced into the lumen of the duodenum and stapler was fired [Table/Fig-5]. The common opening thus created was closed intracorporeally using 2-0 Vicryl continuous sutures in a single layer. The duodenojejunal anastomosis was side-to-side, and the size of the lumen was about 4.5 cm. Methylene blue leak test was performed to ascertain the integrity of anastomosis. A 28 Fr tube drain was kept adjacent to the site of anastomosis. 10 mm port sites were closed in layers and 5 mm port sites with steristrips.

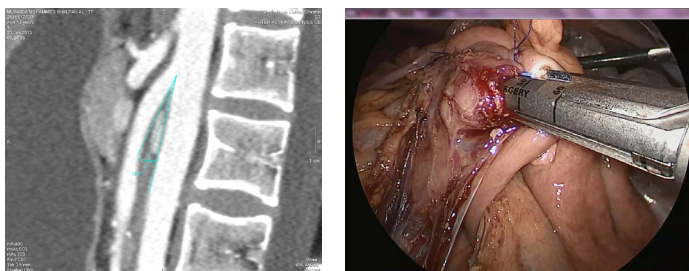
Patients were kept nil by mouth for two days and started on liquid

Cases	Age	Sex	Symptoms	Aortomesenteric angle	Management	Follow up at 1 year
Case 1	17 years	Male	Upper abdominal pain, vomiting	7 degrees	Open duodenojejunostomy	Pain resolved, occasional vomiting
Case 2	17 years	Male	Postprandial bilious vomiting	12 degrees	Laparoscopic duodenojejunostomy	Continues to have vomiting once in a month
Case 3	31 years	Male	Postprandial upper abdominal pain	10 degrees	Open duodenojejunostomy	Asymptomatic
Case 4	20 years	Female	Postprandial non bilious vomiting	11 degrees	Open duodenojejunostomy	Asymptomatic
Case 5	22 years	Male	Postprandial bloating, upper abdominal pain	10 degrees	Laparoscopic duodenojejunostomy	Asymptomatic
Case 6	17 years	Female	Upper abdominal pain, vomiting	12.5 Degrees	Laparoscopic duodenojejunostomy	Asymptomatic.

[Table/Fig-1]: Clinical profile of patients.



[Table/Fig-2]: A 320 slice CECT abdomen axial section showing compressed distal third part of duodenum between SMA and aorta and proximal dilatation. [Table/Fig-3]: Sagittal reconstruction image showing grossly dilated second and third part of duodenum and stomach.



[Table/Fig-4]: CT angiogram showing narrowing of aortomesenteric angle. [Table/Fig-5]: Laparoscopic view of duodenojejunostomy anastomosis being performed with Echelon 45 EndoGIA staplers.

diet on the third day. Drain was removed on postoperative day three. The mean operating time was 105 minutes in the open versus 130 minutes in the laparoscopy group. Postoperative analgesic requirement was significantly low in laparoscopic group compared to open group. All the three patients in laparoscopic group could be mobilised out of bed on the day of the surgery itself while as patients in open group could be mobilised out of bed on the next day of the surgery. Mean duration of hospital stay was four days less in the laparoscopic group compared to the open group. All patients except one had resolution of upper abdominal pain and vomiting at one year follow up [Table/Fig-1].

## DISCUSSION

SMA syndrome is an uncommon cause of duodenal obstruction. It was first described by the Austrian professor C Von Freiherr Rokitansky in 1861 as an autopsy finding, later described in detail by Wilkie in a case series of 64 patients [1,2]. The reported incidence in some studies is about 0.1% to 0.3% [3]. Even though about 400 cases are described in English literature, many had expressed doubt about the true existence of such condition. It often poses a diagnostic dilemma, often diagnosed after excluding other conditions. The SMA usually forms an angle of about 45 degrees (38- 56 degrees) with the aorta. SMA syndrome is presumed to be present if the aortomesenteric angle is less than 25 degrees in adults [4]. The aortomesenteric distance in SMA syndrome is decreased to 2-8 mm (normal is 10-20 mm). Other anatomical causative factors implicated includes the high insertion of duodenum at the ligament of Treitz, low origin of SMA, compression of duodenum due to

Author	Type of study	Number of cases	Surgery	Mean Operating time	Mean hospital stay	Outcome
Pottorf BJ et al., [12]	Retrospective	12	Laparoscopic duodenojejunostomy	72.4 min	4.2 days	92% symptomatic improvement.
Munene G et al., [16]	Review	13	Laparoscopic duodenojejunostomy	84 min	4.5 days	More than 95% symptomatic improvement
Richardson WS et al., [18]	Case series	2	Laparoscopic duodenojejunostomy	113 min	3 days	Both patients symptom free.
Sun Z et al., [19]	Retrospective	14	Laparoscopic duodenojejunostomy	119 min	5.5 days	79 % symptomatic improvement at 20 months.

[Table/Fig-6]: Studies on laparoscopic treatment of SMA syndrome [16,18,19].

peritoneal adhesions [5]. Acquired predisposing factors include scoliosis surgery, spinal trauma, total proctocolectomy with ileal J pouch, application of abdominal casts, body image disorder such as anorexia nervosa, paraduodenal hernias, and abdominal aortic aneurysm [6]. Young females (18-35 years) are frequently affected by this condition. This age and sex distribution is likely related to the over concern with body image and eating disorders [7]. As many as 40% of patients have no apparent explainable cause.

Symptomatology of this condition is often non-specific. Clinical presentation include an acute onset or a more gradual onset of postprandial abdominal fullness and early satiety. Abdominal symptoms are aggravated by supine position and relieved by lateral decubitus or prone position. Patients with significant obstruction of duodenum may present with bilious emesis, weight loss and electrolyte abnormalities [8]. Physical examination findings are often unrevealing, including a patient with thin body habitus, abdominal distention or intestinal obstruction.

Patients with clinical suspicion should undergo further evaluation. Hypotonic duodenography has been described in literature. Findings such as: i) dilatation of the first and second portions of the duodenum, with or without gastric dilatation; (ii) abrupt vertical and oblique compression of the mucosal folds; (iii) antiperistaltic flow of barium proximal to the obstruction; (iv) delay of 4-6 hour in transit through the gastroduodenal region; and (v) relief of obstruction in a prone, knee-chest, or left lateral decubitus position are suggestive [9]. MDCT with three dimensional reconstruction helps to assess the duodenal compression and the aortomesenteric angle and distance more objectively when compared to conventional imaging techniques [10]. In this series the mean aortomesenteric angle was 10.5 degrees in six patients. Upper gastrointestinal endoscopy is useful to rule out other causes of mechanical obstruction. In our series only two patients had duodenal dilatation.

Management of this condition initially involves conservative measures like nasogastric decompression, intravenous rehydration, correction of electrolyte abnormalities and aggressive nutritional

support. Nutritional support may be in the form of parenteral nutrition and/or postpyloric feeding when possible, followed by oral diet as tolerated. Medical treatment may be successful in patients with a short history, moderate symptoms and incomplete duodenal obstruction. Left lateral decubitus, knee chest, or prone positioning decreases the mesenteric pressure on the duodenum and allows temporary alleviation of the duodenal obstruction [11]. No definite time limit has been described for conservative management.

The surgical options include duodenojejunostomy, section of the ligament of Treitz and relocation of the duodenojejunal junction, gastrojejunostomy, duodenal anterior replacement. Gastrojejunostomy does not relieve the proximal duodenal obstruction and patients can continue to have postoperative vomiting [12]. Because SMA syndrome is a rare condition, no randomised trials have compared the various surgical techniques. Duodenojejunostomy was introduced by Starley in 1910 and it has become the most frequent treatment with success rate of 90% [13]. With the advent of laparoscopic era, many of the open procedures could be performed with minimal invasive methods producing similar or better outcome. In 1995, Massoud has described laparoscopic severing of the ligament of Treitz. In 1998 the first laparoscopic duodenojejunostomy was performed by, Gersin KS and Heniford BT [14]. Surgical options should be considered whenever the conservative approach fails or if patient prefers surgical management [15]. A number of case reports and small case series have been published emphasising that laparoscopic duodenojejunostomy is a viable option in the treatment of SMA syndrome, combining the benefits of minimally invasive surgery as well as excellent results [15-17]. Even though it requires expertise, overall the mean duration of hospital stay, requirement of postoperative analgesia and the expenditure are less in the laparoscopic technique while achieving results similar to the open technique. Patient can resume his normal activities at an early date. A list of few similar studies on laparoscopic duodenojejunostomy is provided in [Table/Fig-6] [12,16,18,19].

## CONCLUSION

SMA syndrome is an uncommon entity. Many cases are misdiagnosed. Majority of affected patients are young females. A definite precipitating factor can be identified in majority. A high index of clinical suspicion is needed for diagnosis of this condition. Assessment of aortomesenteric angle and aortomesenteric distance by high resolution CECT imaging gives clue to the diagnosis. Management involves conservative measures aimed at improving bodyweight initially. Surgical intervention is reserved for patients who fail on medical management. Laparoscopic duodenojejunostomy is rapidly becoming the standard procedure of this condition producing excellent outcome comparable with open surgery. Majority of patients will be relieved of symptoms after surgical management.

## Abbreviations used in this literature

SMA – Superior Mesenteric Artery.

CECT – Contrast Enhanced Computerised Tomogram.

MDCT – Multi Dimensional Computerised Tomogram.

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