

Laparoscopic Duodenojejunostomy as a Management Modality of Superior Mesenteric Artery Syndrome

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Introduction: Superior mesenteric artery syndrome (SMAS) is a rare entity that cause duodenal obstruction. This study analyzes twelve patients underwent laparoscopic Duodenojejunostomy as a management of SMAS.

Patients and methods: We are analyzing data of twelve patients (3 males and 9 females) underwent laparoscopic duodenojejunostomy for SMAS, one of them underwent laparoscopic antrectomy with Roux-en-Y gastrojejunostomy from NOV 2020 to FEB 2023, with mean age 23.3 years.

Results: Twelve patients (3 males and 9 females) were included with mean age 23.3 years. The most common cause was idiopathic in 58.3%. Abdominal pain (91.66%), nausea and vomiting (83.33%) and weight loss (66.6%) were the most frequent symptoms. The mean preoperative BMI was 16.06 ± 2.3 . The mean aortomesenteric angle was 15.8 ± 4.6 . All patients underwent laparoscopic duodenojejunostomy except one patient who underwent laparoscopic antrectomy with Roux-en-Y gastrojejunostomy with no conversion to open surgery.

Conclusion: Superior mesenteric artery syndrome (SMAS) is a rare entity that need high suspicious for diagnosis especially in females with low BMI with upper gastrointestinal symptoms. Surgical management is the treatment of choice to improve symptoms and quality of life.

Key words: Laparoscopic duodenojejunostomy, superior mesenteric artery syndrome, chronic duodenal obstruction.

Introduction

Superior mesenteric artery syndrome (SMAS) is a rare disease, it accounts 0.0024–0.3%, it occurs due to compression of the third part of duodenum between Superior mesenteric artery and aorta, it also known as Wilkie's syndrome, "cast syndrome", arteriomesenteric duodenal compression or chronic duodenal ileus.¹⁻³

According to Akin et al., reporting that 40.4% of cases had no apparent cause, but it may be due to congenital abnormalities (intestinal malrotation, high insertion of the ligament of Treitz, low origin of the superior mesenteric artery), loss of weight (After bariatric surgeries), psychiatric disorders (Anorexia nervosa, bulimia), abdominal surgery (Proctocolectomy) or spinal surgery (Spinal elongation for scoliosis).⁴⁻⁹

Most authors considered diagnosis established when aortomesenteric angle less than 22 (Normal value 25 – 60) and decrease in aortomesenteric distance less than 8 (Normal value 10 – 28).¹⁶

SMAS may be presented with nausea, vomiting, epigastric pain, abdominal bloating, dyspepsia and weight loss due to decreased oral intake. Differential diagnosis of SMAS include biliary colic, peptic ulcer, pancreatitis, and mesenteric ischemia.^{3,10}

Barium study and UGIT endoscopy help in diagnosis of SMAS, but CT mesenteric angiography is considered the golden standard in diagnosis of SMAS.

Management of SMAS range from conservative medical treatment to surgical procedures after failed medical treatment or in severe cases.

Duodenojejunostomy, gastrojejunostomy or Strong's procedure (Division of ligament of Treitz and mobilization of duodenum) has been used as surgical procedures in management of SMAS.

Latero-lateral duodenojejunostomy is the treatment of choice that described by Bloodgood in 1907 till the laparoscopic approach in 1995 by Massoud.^{11,12}

Duodenojejunostomy is considered superior to gastrojejunostomy and Strong's procedure by most of surgeons.¹

Pathients and methods

Twelve patients (3 males and 9 females) underwent laparoscopic duodenojejunostomy for SMAS from NOV 2020 to FEB 2023 at Ain Shams University hospitals with mean age 23.3 years.

Preoperative evaluation as regard weight loss, comorbidities, dysphagia, vomiting and epigastric pain pre-operative assessment by Multidisciplinary team (MDT) of nutritional, anesthesia, endocrinal, psychiatric, and behavioral.

Multi-slice CT with mesenteric angiography (**Fig. 1**) and Upper GI endoscopy were performed to evaluate angle between SMA and Aorta, gastric or duodenal ulcer and hiatus hernia. All patients were informed about the operation and the possibility of conversion to open surgery, informed about benefits of surgery and other alternatives, informed consent

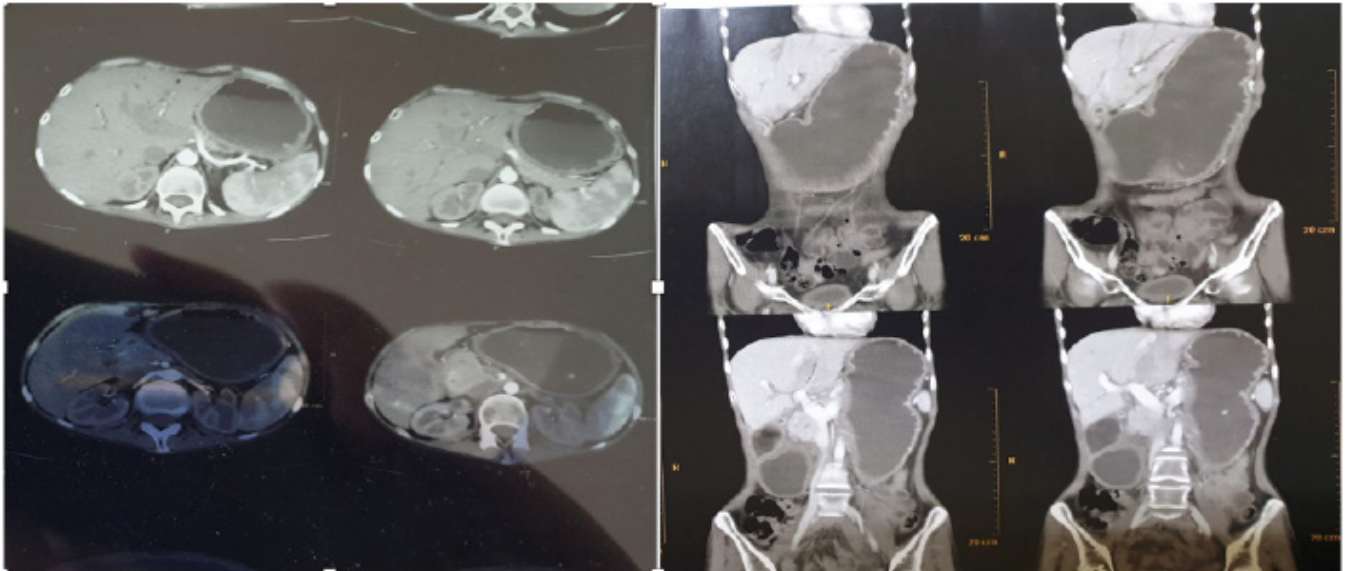


Fig 1: C.T mesenteric angiography.

was obtained from all patients in the study.

Data collected and reviewed for age, gender, electrolytes, operative time, hospital stay, complications, weight, BMI.

Surgical Technique

All patients were admitted two to three days before operation to correct electrolytes imbalance. Patients received a third-generation cephalosporin one hour before operation. Subcutaneous low molecular weight heparin was administrated 12 hr. preoperatively as a prophylaxis for DVT. The patient

placed in the table in supine reverse Trendelenburg position. Four port technique used optical trocar, two working ports and assistant port. Greater omentum and transverse mesocolon were identified with cranial traction followed by identification of SMA then dissection of visceral peritoneum from the duodenum before obstruction (With or without dissection of the duodenum from retroperitoneum). Side to side duodenojejunosomy was created with 45-mm Endo GIA Universal Stapler (3.5-mm white cartridge), the stapling defect was closed by continuous V-loc sutures (Autosuture Division of Covidien) (**Fig. 2**).

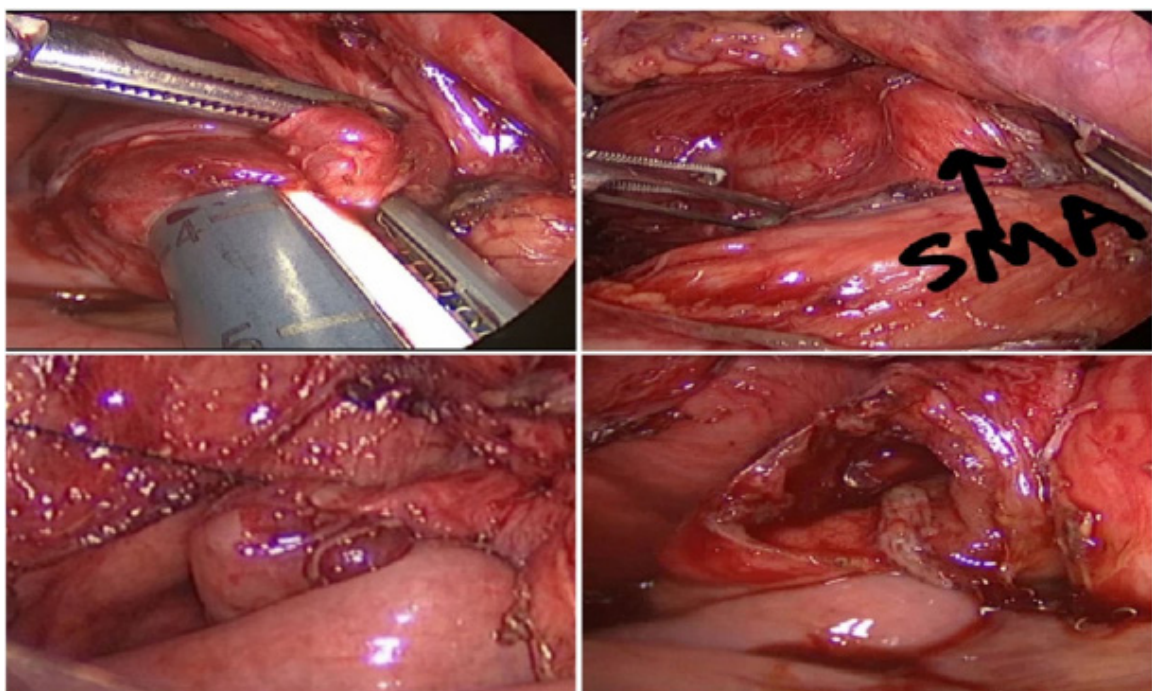


Fig 2: Laparoscopic duodenojejunosomy.

Results

The age of our patients was ranging from 16 to 58 years with mean age 23.3 years. Most of our patients were females; eight patients (66.66% of cases) (**Table 1**).

The most common cause was idiopathic (Seven cases were of idiopathic cause 58.3% and three cases had psychiatric disorder and two cases after orthopedic spine operation) shown in Table 1. The most frequent symptoms at time of presentation were abdominal pain (91.66%), nausea and vomiting (83.33%) and loss of weight (66.6%). The mean preoperative weight was 38.58 ± 5.7 and the mean preoperative BMI was 16.06 ± 2.3 . the mean aortomesenteric angle at C.T angiography was 15.8 ± 4.6 .

All patients underwent laparoscopic duodenojejunostomy except one patient who underwent laparoscopic antrectomy with Roux-en-Y

gastrojejunostomy due to hugely dilated atonic stomach. No conversion to open surgery.

The mean operative time was 74 ± 18 min. the mean hospital stay was 5 ± 2.5 days.

No intraoperative complications, one case postoperative developed melena that was managed conservatively (packed RBCs and fresh frozen plasma), no postoperative leakage detected. Case No 4 developed delayed gastric emptying that managed conservatively with prokinetics and discharged after 7 days. One patient case No 9 developed refeeding syndrome (Hypophosphatemia, vitamin B deficiency and hypokalemia) one week after discharge, the patient readmitted to ICU and managed by nutritionist and the patient improved after 3 days.

All patients follow up was done everyone week in the first month by surgeon and nutritionist then monthly follow up by nutritionist for one year.

Table 1: Distribution and causes of SMAS

Age	Mean±SD	23.3±10.3
	Range	16-58
Sex	Female	8
	Male	4
Cause	Idiopathic	7
	Post spine operation	2
	Psychiatric disorder	3
Weight	Mean±SD	38.58±5.7
	Range	30.5-50
BMI	Mean±SD	16.06±2.3
	Range	13-18.4
Aortomesenteric angle	Mean±SD	15.8±4.6
Operative time	Mean±SD	74±18 min
Hospital stay	Mean±SD	5±2.5

Discussion

Carl von Rokitansky,¹³ in 1842 was first described SMAS, and then, Bloodgood,¹¹ in 1907 reported that surgical treatment by latero-lateral duodenojejunostomy. However, Wilkie,¹⁴ published the first surgical series in 1921, so SMAS known as Wilkie's syndrome.¹⁵

Superior mesenteric artery syndrome (SMAS) is a rare disease, it accounts 0.0024–0.3%, it occurs due to compression of the third part of duodenum

between Superior mesenteric artery and aorta.¹⁻³

Most authors considered diagnosis established when aortomesenteric angle less than 22 (Normal value 25 – 60) and decrease in aortomesenteric distance less than 8 (Normal value 10 – 28).¹⁶

SMAS should be differentiated from other disorders as GERD, functional dyspepsia, cyclic vomiting syndrome, gastroparesis and eating disorder (Anorexia and bulimia).¹⁷⁻¹⁹

SMAS need high suspicious index for diagnosis as it

is a rare disease, so it is misdiagnosed and treated improbably with PPIs, antacids, prokinetics, H2-receptor blockers or neuroleptics.

Diagnosis of SMAS depend on clinical presentations, Multi-slice CT or MRI with mesenteric angiography and Upper GI endoscopy were performed to evaluate angle between SMA and Aorta, gastric or duodenal ulcer and hiatus hernia.

SMAS prevalence more common in young females, children, and adolescents,²⁰ that is like our study (Mean age 23.3 years and 66.66% of cases were females).

Weight loss and low BMI are clinical features of SMAS,²¹ in our study the mean preoperative BMI was 16.06±2.3.

Korea authors,²² observed the most common presenting symptoms are vomiting (70%), abdominal pain (65%), post-prandial fullness (33.8%), anorexia (33.8%) and early satiety (12.5%), in our study abdominal pain (91.66%), nausea and vomiting (83.33%) and weight loss (66.6%).

Some authors support conservative medical treatment as first-line,²³ Merrett et al.²⁴ reported that medical treatment in patients with chronic symptoms required prolonged hospital stay with poor success rates, Welsch et al.¹⁵ support surgical management after failed medical treatment in symptomatic patients.

Sun et al.,²³ recommended that when SMAS diagnosed clinically and radiologically, surgical management is the first choice as it has high success rate with low recurrence rate.

Many surgical procedures to bypass obstruction as gastrojejunostomy, Strong's procedure (Division of ligament of Treitz and mobilization of duodenum) and duodenojejunostomy, these surgical procedures can be done either open surgery or laparoscopic.^{25,26}

Strong's procedure (Division of ligament of Treitz and mobilization of duodenum) is less invasive but associated with high failure rate.²⁷

Gastrojejunostomy has been associated with blind loop syndrome and complications of duodeno-gastric reflux with risk of anastomotic ulcer and bleeding.¹⁵

Duodenojejunostomy is the treatment of choice by most of surgeon than gastrojejunostomy and Strong's procedure as it has good postoperative results and less risk of adhesions.¹⁻²²

Barner's series, Lee and Mangla and Lee's series reported that good results and improvement of symptoms after Duodenojejunostomy that is like

our study.^{28,29}

Chang et al. reported that laparoscopic Duodenojejunostomy is more feasible, safe, less postoperative pain, less hospital stay and immediate improvement of symptoms after surgery.³⁰

Conclusion

SMAS is a rare entity that needs high suspicious for diagnosis to be differentiated from other functional GIT disorders, laparoscopic Duodenojejunostomy is the treatment of choice with good postoperative results.

SMAS should be treated by multidisciplinary team of surgeons, gastroenterologists, radiologists and nutritionist for diagnosis, treatment and postoperative follow up.

References

1. Ylinen P, Kinnunen J, Hockerstedt K: Superior mesenteric artery syndrome. *J Clin Gastroenterol.* 1989; 11: 386–391.
2. Merrett ND, Wilson RB, Cosman P, Biankin AV: Superior mesenteric artery syndrome: Diagnosis and treatment strategies. *J Gastrointest Surg.* 2009; 13: 287–292.
3. Jain R: Superior mesenteric artery syndrome. *Curr Treat Options Gastroenterol.* 2007; 10: 24–27.
4. Adson DE, Mitchell JE, Trenkner SW: The superior mesenteric artery syndrome and acute gastric dilatation in eating disorders: A report of two cases and a review of the literature. *Int J Eat Disord.* 1997; 21: 103–114.
5. Lescher TJ, Sirinek KR, Pruitt BA: Superior mesenteric artery syndrome in thermally injured patients. *J Trauma.* 1979; 19: 567–571.
6. Goitein D, Gagne DJ, Pappasavvas PK, Dallal R, Quebbemann B, Eichinger JK, Johnston D, Caushaj PF: Superior mesenteric artery syndrome after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Obes Surg.* 2004; 14: 1008–1011.
7. Roy A, Gisel JJ, Roy V, Bouras EP: Superior mesenteric artery (Wilkie's) syndrome as a result of cardiac cachexia. *J Gen Intern Med.* 2005; 20: C3–4.
8. Matheus Cde O, Waisberg J, Zewer MH, Godoy AC: Syndrome of duodenal compression by the superior mesenteric artery following restorative proctocolectomy: a case report and review of literature. *Sao Paulo Med J.* 2005; 123: 151–153.

9. Akin JT, Gray SW, Skandalakis JE: Vascular compression of the duodenum: Presentation of ten cases and review of the literature. *Surgery*. 1976; 79: 515–522.
10. Derrick JR, Fadhli HA: Surgical anatomy of the superior mesenteric artery. *Am Surg*. 1965; 31: 545–547.
11. Bloodgood JC: Acute dilatation of the stomach-gastro- mesenteric Ileus. *Ann Surg*. 1907; 46: 736–762.
12. Massoud WZ: Laparoscopic management of superior mesenteric artery syndrome. *Int Surg*. 1995; 80: 322–327.
13. Rokitsansky C (ed): Handbuch der pathologischen Anatomie. *Wien, Braunmuller & Seidel*. 1842; 1(3): 187–191.
14. Wilkie DPD: Chronic duodenal ileus. *Br J Surg*. 1921; 9: 204–214.
15. Welsch T, Buchler MW, Kienle P: Recalling superior mesenteric artery syndrome. *Dig Surg*. 2007; 24: 149–156.
16. Konen E, Amitai M, Apter S, Garniek A, Gayer G, Nass S, Itzhak Y: CT angiography of superior mesenteric artery syndrome. *AJR Am J Roentgenol*. 1998; 171: 1279–1281.
17. Lacy BE, Parkman HP, Camilleri M: Chronic nausea and vomiting: Evaluation and treatment. *Am J Gastroenterol*. 2018; 113: 647–659.
18. Camilleri M, Chedid V, Ford AC et al: Gastroparesis. *Nat Rev Dis Primers*. 2018; 4: 41.
19. Stanghellini V, Chan FKL, Hasler WL et al: Gastroduodenal disorders. *Gastroenterology*. 2016; 150: 1380–1392.
20. Ozbulbul NI, Yurdakul M, Dedeoglu H, Tola M, Olcer T: Evaluation of the effect of visceral fat area on the distance and angle between the superior mesenteric artery and the aorta. *Surg Radiol Anat*. 2009; 31: 545–549.
21. Goitein D, Gagne DJ, Papasavas PK, Dallal R, Quebbemann B, Eichinger JK, Johnston D, Caushaj PF: Superior mesenteric artery syndrome after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Obes Surg*. 2004; 14: 1008–1011.
22. Lee TH, Lee JS, Jo Y, Park KS, Cheon JH, Kim YS, Jang JY, Kang YW: Superior mesenteric artery syndrome: Where do we stand today? *J Gastrointest Surg*. 2012; 16(12): 2203–2211.
23. Sihuay-Diburga DJ, Accarino-Garaventa A, Vilaseca-Montplet J, Azpiroz-Vidaur F: Acute pancreatitis and superior mesenteric artery syndrome. *Rev Esp Enferm Dig*. 2013; 105: 626–628.
24. Merrett ND, Wilson RB, Cosman P, Biankin AV: Superior mesenteric artery syndrome: Diagnosis and treatment strategies. *J Gastrointest Surg*. 2009; 13: 287–292.
25. Strong EK: Mechanics of arteriomesenteric duodenal obstruction and direct surgical attack upon etiology. *Ann Surg*. 1958; 148: 725–730.
26. Gersin KS, Heniford BT: Laparoscopic duodenojejunostomy for treatment of superior mesenteric artery syndrome. *JSLA*. 1998; 2: 281–284.
27. Ahmed AR, Taylor I: Superior mesenteric artery syndrome. *Postgrad Med J*. 1997; 73: 776–778.
28. Ha CD, Alvear DT, Leber DC: Duodenal derotation as an effective treatment of superior mesenteric artery syndrome: A thirty-three-year experience. *Am Surg*. 2008; 74: 644–653.
29. Lee CS, Mangla JC: Superior mesenteric artery compression syndrome. *Am J Gastroenterol*. 1978; 70: 141–150.
30. Chang J, Boules M, Rodriguez J, Walsh M, Rosenthal R, Kroh M: Laparoscopic duodenojejunostomy for superior mesenteric artery syndrome: Intermediate follow-up results and a review of the literature. *Surg Endosc*. 2017; 31: 1180–1185.