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Superior Mesenteric Artery Syndrome with Duodenal Obstruction in a Chronic Drug User

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Background	A 27-year-old male presented with complete duodenal obstruction after weight loss of 30 pounds with concomitant methamphetamine use.
Summary	A 27-year-old male with a prolonged history of intravenous drug abuse presented to the hospital with inability to tolerate oral intake after a 30-pound weight loss over the past three months. The patient underwent CT imaging of the abdomen and pelvis, which revealed a duodenal obstruction at the anatomic site of the duodenum traversing between the branching of the superior mesenteric artery off of the aorta. The patient failed several days of conservative management with total parenteral nutrition, nasogastric tube to suction, NPO status, and intravenous fluids. The patient subsequently underwent surgery to bypass the obstruction via a laparoscopic-assisted gastrojejunostomy with Roux-en-Y limb. Superior mesenteric artery (SMA) syndrome classically occurs in cases of malnutrition and extensive weight loss similar to our patient. Typically, a duodenojejunostomy is undertaken to bypass the obstruction, however a gastrojejunostomy with Roux-en-Y limb was applied to improve overall outcomes given ease of procedure and prevention of bile reflux. The varying surgical approach is highlighted in this case review of a classic presentation of SMA syndrome.
Conclusion	SMA syndrome occurs in rapid and prolonged cases of weight loss due to mesenteric fat pad wasting leading to obstruction of the duodenum. We present a case of a young male with daily drug abuse, malnutrition, and cachexia who responded rapidly to bypass of the obstruction via laparoscopic-assisted gastrojejunostomy with Roux-en-Y limb. The addition of a Roux-en-Y limb may improve overall outcomes and postoperative success.
Keywords	Superior mesenteric artery syndrome, duodenojejunostomy, gastrojejuonstomy, Roux-en-Y limb, drug abuse, malnutrition

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Case Description

A 27-year-old male with a history of methamphetamine use was admitted to the hospital due to acute onset of progressively worsening abdominal pain, distension, and vomiting, which occurred the day prior to arrival. Since the onset of symptoms, the patient had been unable to tolerate anything by mouth. Of note, the patient began using methamphetamines intravenously six months prior to presentation with a concomitant 30-pound weight loss throughout this period. The patient endorsed that over the past several months that he had been only able to eat small meals, as he would get full easily and develop abdominal distension. The patient's history was otherwise unremarkable.

Physical examination revealed significantly distended abdomen with absent bowel sounds and epigastric tenderness. Upon arrival, his labs revealed WBC 13.4 with otherwise unremarkable findings including normal electrolytes, normal renal function, an albumin of 4.1, and negative HIV.

Given severe abdominal distension, anorexia, and vomiting a CT scan of the abdomen and pelvis was attained using oral and intravenous contrast. The study revealed severe dilatation of the distal esophagus, stomach, and proximal duodenum with abrupt duodenal caliber change at the anatomic site of the duodenum passing between the superior mesenteric artery (SMA) and the abdominal aorta (Figure 1 and Figure 2). Of note, the angle of the SMA as it branches off of the abdominal aorta was nine degrees (notice in Figure 1); a normal angle is between 38 to 65 degrees.[1,2]

The patient's diagnosis of SMA syndrome was confirmed on CT scan with PO and IV contrast revealing profound obstruction at the site passing through aortomesenteric branching, along with an aortomesenteric angle of nine degrees. Initially, conservative methods were employed with placement of a nasogastric tube to intermittent low wall suction, NPO status, and provision of total parenteral nutrition (TPN) via a PICC line for a total of seven days. Despite these efforts, the patient continued to have upwards of four liters of bilious output daily with no resolution of the obstruction. The patient was provided the option of continuing conservative measures versus transitioning to surgical management. The patient elected for immediate surgical management to improve his symptoms of abdominal pain, nausea, and vomiting. He therefore was taken to the operating room for surgical management.

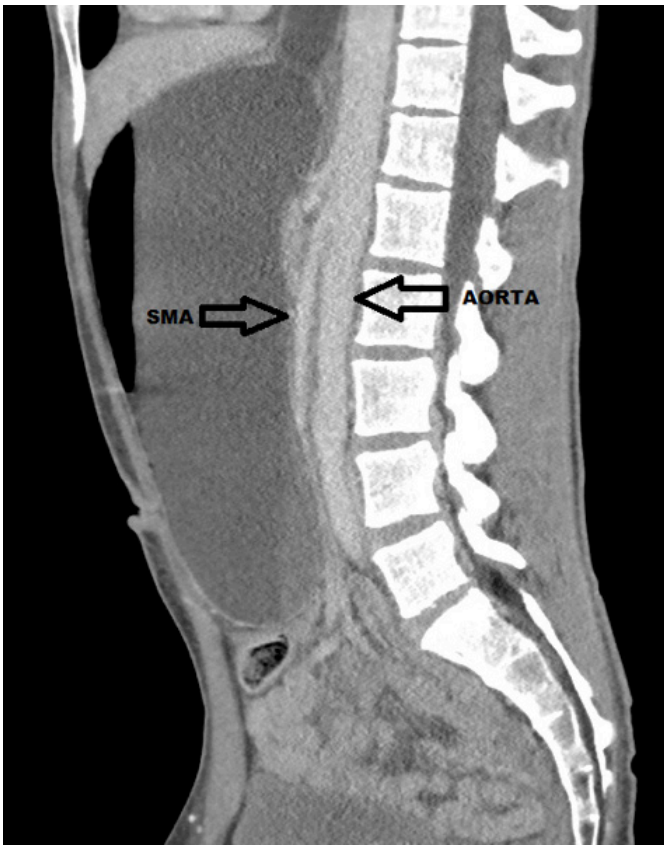

Figure 1. Sagittal section of SMA branching off aorta. Sagittal section of severe proximal duodenal and gastric distension with narrowing at the SMA/Aorta branching. Take note of the sharp angle of the SMA branching off of the aorta, calculated to be only 9 degrees. This narrowing is the cause of the duodenal obstruction due to the loss of the fat pad which allows the angle to widen thereby supporting intestinal flow. In addition, one can appreciate the extensive dilatation of the stomach spanning across the intraabdominal cavity.

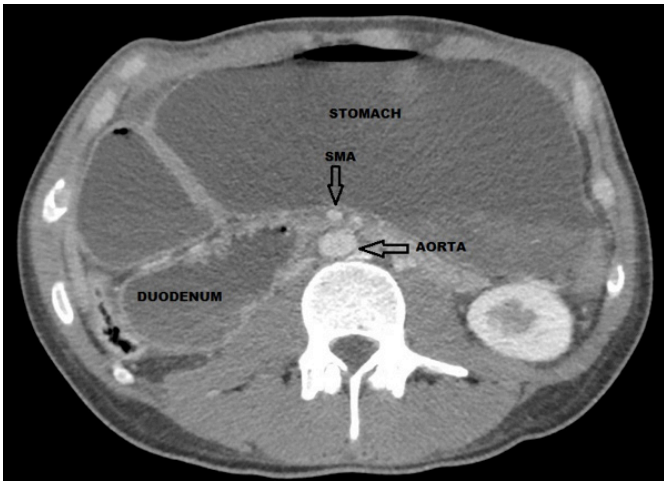

Figure 2. Transverse section of severe proximal duodenal and gastric distension with narrowing at the SMA/aorta branch point. In this image, the marked obstruction and dilatation of the stomach and proximal duodenum is evident and clearly visualized.

A laparoscopic-assisted gastrojejunostomy with Roux-en-Y limb allowed for bypass of the obstruction, with placement of a gastrojejunostomy feeding tube for gastric decompression and jejunal feeds distal to the anastomosis. The patient experienced immediate resolution of symptoms postoperatively. An upper gastrointestinal film series on postop day three revealed a patent gastrojejunal anastomosis with no evidence of leak. The patient tolerated jejunal feeds distal to the anastomosis with minimal gastric port output. He was tolerating a regular diet by postop day five and was stable for discharge home. At time of discharge, the patient had gained 4 kg (8.8 pounds) of body weight. Remarkably, upon repeat follow up in the outpatient setting, the patient had gained 20.2 kg (~45lbs) from his day of discharge six weeks earlier without the use of the feeding tube. He was completely asymptomatic overall with no abdominal pain, vomiting, or abdominal distension. The gastrojejunostomy feeding tube was removed in clinic.

Discussion

Superior mesenteric artery (SMA) syndrome (Wilkie syndrome, cast syndrome) is characterized by the compression of the distal third of the duodenum as it traverses between the branching of the SMA off of the abdominal aorta.[3] The SMA originates at the level of L1, surrounded by lymphatic and fatty tissue. The space and the angle between the branching of the SMA off of the aorta are narrowed by the deterioration of this mesenteric fat pad. Hence, the patients that are at particularly higher risk of SMA syndrome today are those plagued by debilitating medical illnesses such as AIDS, malignancy, severe trauma, drug abuse, and psychiatric illness including anorexia nervosa.

SMA syndrome was initially identified by von Rokitansky in 1861 as he identified multiple presentations of gastric obstruction.[4] His theories were later confirmed in the early 1900s by Conner, who agreed the obstruction occurred at the SMA branch point.[5] In the early 1950s, patients in full body casts treated for major orthopedic injuries began developing similar symptoms of gastric and proximal duodenal dilatation. It was proposed by several authors that the natural wasting of patients in full body casts led to loss of the mesenteric fat pad, leading to duodenal obstruction.[6] Hence, cast syndrome became the pseudonym for SMA syndrome, as it was rather common for these patients to develop such obstructions.

Diagnosis can be confirmed with upper gastrointestinal swallow series, which reveals a classic "double-bubble" sign on imaging representing a distended, contrast-filled stomach, functional pyloric sphincter, and distended duodenum proximal to obstruction. A CT scan of the abdomen and pelvis with PO and IV contrast can also be utilized, which reveals a proximal duodenal obstruction and an aortomesenteric artery angle of less than 25 degrees.[7] Conservative management is initially attempted by decompressing the stomach with nasogastric tube to intermittent low wall suction. Nutritional support is key, and often, a nasojejunal feeding tube can be placed distal to the obstruction to provide girth to the mesenteric fat pad and increase the aortomesenteric angle, thus relieving the obstruction. Electrolyte replacement and close monitoring to avoid refeeding syndrome is critical in these patients. TPN is also a conservative option in cases that are not amenable to jejunal feeds.[8]

If conservative measures fail, surgical management is required. The literature describes three procedures capable of resolving the obstruction: Strong's procedure, gastrojejunostomy, and duodenojejunostomy. Strong's procedure focuses on taking down the ligament of Treitz, which allows for the mobilization of the duodenum out of the obstructing region between the SMA and aorta.[9] Failure rate is upwards of 25 percent due to adhesions reattaching the duodenum to posterior abdominal wall leading to recurrent obstruction; this will often require a second operation. The more common approach, currently, is the laparoscopic versus open gastrojejunostomy or duodenojejunostomy, which bypasses the obstruction.

Duodenojejunostomy is the current operation of choice as it is less likely to cause blind loop syndrome or dumping syndrome, which can be seen in gastrojejunostomies.[10] Additional benefits of the duodenojejunostomy include the ability to maintain a physiologic construct, thereby allowing food to reach the duodenum, as well as the ability to preserve the integrity of the stomach. Allowing chyme to reach the duodenum creates duodenal stretching, vagal nerve stimulation, and the initiation of the enterogastric reflex, stimulating gastrin release from G cells in the stomach. Specialized endocrine cells within the duodenum are stimulated, as well, which promote pancreatic enzyme release to stabilize pH and promote delay in gastric emptying to allow for complete absorption of nutrients.[11] This technique, however, is a technically challenging procedure laparoscopically. The typical approach is a laparoscopic duodenojejunostomy performed through the transverse mesocolon allowing for access and visualization of the duodenum.

Given the technically difficult procedure, a gastrojejunostomy was undertaken. The addition of a Roux-en-Y limb was applied, which is novel to the typical management described in current literature. This approach was employed given the technical ease of the gastrojejunostomy in contrast to the duodenojejunostomy. The addition of the Roux-en-Y limb can be beneficial in its ability to limit bile reflux, which is common following a loop gastrojejunostomy. This may improve overall outcomes and limit complications classic of gastrojejunostomy. Blind loop syndrome should be preventable by the ensuing rapid weight gain, enlargement of the mesenteric fat pad, and subsequent relief of the duodenal obstruction, thereby allowing for flow through the duodenum and eliminating the blind loop. A common complication specific to the gastrojejunostomy in contrast to the duodenojejunostomy, is a marginal ulcer at the jejunal aspect of the gastrojejunal anastomosis. Prolonged ulceration can lead to hematemesis and perforation.[12] The disruption of the integrity of the stomach has potential adverse effects, as well, including delayed gastric emptying and limitation of the enterogastric reflex described above.

The patient of this case review tolerated the procedure exceptionally well, responded rapidly, and gained significant weight postoperatively without any complications and without any symptoms of bile reflux.

Conclusions

SMA syndrome occurs in rapid and prolonged cases of weight loss due to mesenteric fat pad wasting leading to obstruction of the duodenum. We present a case of a young male with daily drug abuse, malnutrition, and cachexia who responded rapidly to bypass of the obstruction via laparoscopic gastrojejunostomy with Roux-en-Y limb. When conservative measures fail utilizing decompression of the stomach and proximal jejunum, along with total parenteral nutrition, a surgical approach is recommended. Duodenojejunostomy, while more technically challenging, maintains the integrity of the stomach and physiologic reflexes. A gastrojejunostomy is an acceptable alternative, though does have multiple adverse effects comparative to the more physiologic duodenojejunostomy. The addition of a Roux-en-Y limb may provide added benefit by preventing bile reflux.

Lessons Learned

SMA syndrome occurs in chronically malnourished patients and presents with complete obstruction. Duodenojejunostomy is currently the recommended approach to limit blind loop syndrome and maintain physiologic function. A gastrojejunostomy with Roux-en-Y limb is technically less challenging, though does cause additional potential adverse effects including the loss of a physiologic conduit. Surgeons comfortable with the technical approach should employ a duodenojejunostomy, which is consistent with the current literature. This may improve overall outcomes by reducing postoperative complications and maintaining a physiologic conduit.

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