

# Popcorn Bezoar Mimicking Superior Mesenteric Artery Syndrome

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<b>Background</b>	Superior mesenteric artery syndrome (SMAS) is a rare presentation of proximal intestinal obstruction caused by compression of the duodenum between the SMA and the aorta and spine. The symptoms and presentation are usually nonspecific; therefore, a high degree of clinical suspicion is needed for the diagnosis.
<b>Summary</b>	We describe the case of a 16-year-old male who presented with five days of worsening abdominal pain, emesis, and no passage of stool or flatus. His CT scan demonstrated severe dilation of the proximal duodenum, which was filled with popcorn kernels. There was an acute transition point at the third portion of the duodenum associated with a severely acute angle between the superior mesenteric artery and the aorta, which was concerning for superior mesenteric artery syndrome (SMAS). The patient was successfully treated with surgical extraction of the bezoar only.
<b>Conclusion</b>	In children and other populations at risk for obstruction by foreign bodies or bezoars, consideration of this presentation in the differential diagnosis could spare the need for more extensive surgical intervention.
<b>Keywords</b>	superior mesenteric artery syndrome, bezoar, phytobezoar, duodenal obstruction, small bowel obstruction

**DISCLOSURE STATEMENT:**

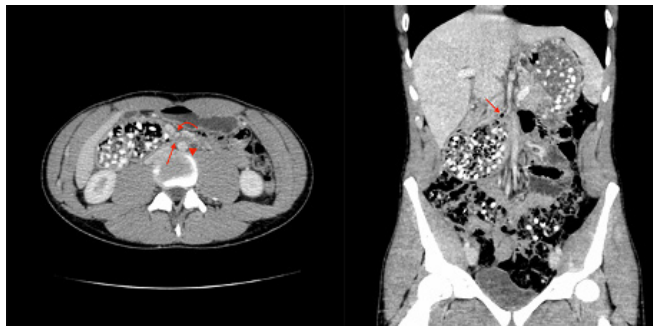
The authors have no conflicts of interest to disclose.

**To Cite:** Gologorsky RC, Ely S, Rothenberg KA, Wolman DN, Stehr W. Popcorn Bezoar Mimicking Superior Mesenteric Artery Syndrome. *ACS Case Reviews in Surgery*. 2020;2(6):58-61.

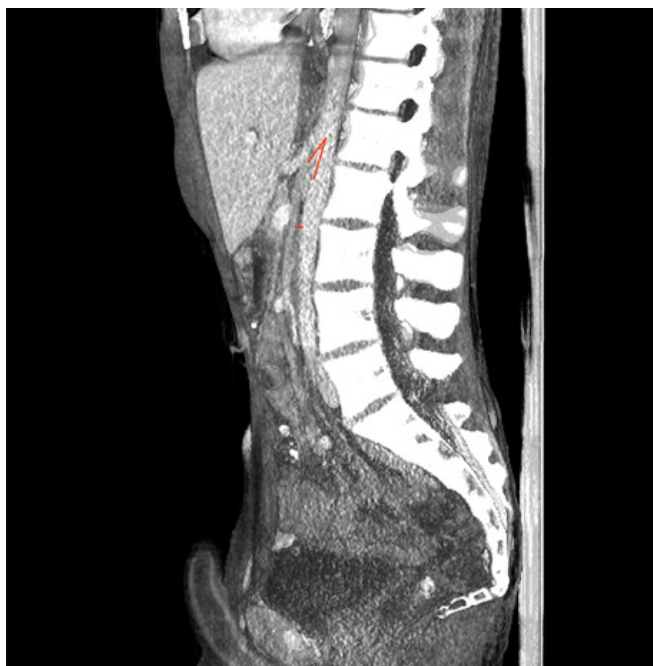
## Case Description

Superior mesenteric artery (SMAS) is a rare cause of small bowel obstruction characterized by a reduced aortomesenteric angle that compresses the third or fourth portion of the duodenum.<sup>1</sup> SMAS is more common in women and children,<sup>2,3</sup> and risk factors include any condition resulting in decreased retroperitoneal fat. Diagnosis is made by cross sectional imaging demonstrating a  $<38^\circ$  angle between the superior mesenteric artery and the aorta.<sup>1,4,5</sup> If conservative measures of bowel rest with nasogastric tube decompression or weight gain with or without a distal feeding tube fail, surgery such as duodenojejunostomy with or without duodenal resection, gastrojejunostomy, or division of the ligament of Treitz with mobilization of the duodenum away from the aortomesenteric angle (Strong's procedure) are indicated.<sup>3,4,6</sup> We describe the case of teenage male who presented with symptoms and imaging consistent with SMAS after eating a large amount of raw popcorn kernels.

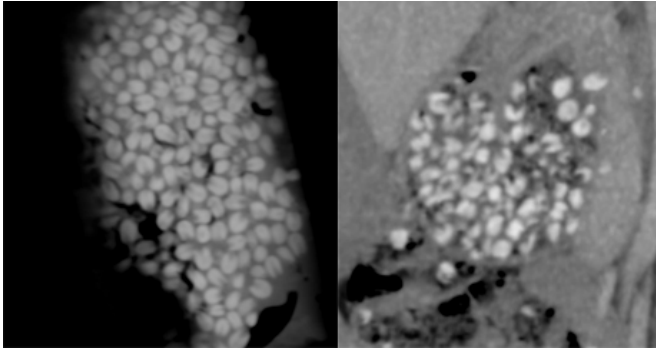
A healthy 16-year-old male with no prior surgical or psychiatric history presented with five days of worsening abdominal pain, emesis, and absence of bowel function after ingesting approximately 12 ounces of popcorn kernels. The patient reported that he had been given a large serving of popcorn at a movie theater had eaten the kernels because he did not want to be wasteful and was hungry; the event was witnessed and corroborated by his parents. On exam, the patient was hemodynamically normal with a non-distended abdomen and diffuse tenderness without peritonitis. His body mass index was 18.84 kg/m<sup>2</sup>. Laboratory evaluation including complete blood count, comprehensive metabolic panel, and urinalysis were unremarkable. A CT scan with intravenous contrast demonstrated severe dilation of the proximal duodenum with an acute transition point associated with a  $20.5^\circ$  angle between the superior mesenteric artery and the aorta and aortomesenteric distance of 3.3 mm, indicative of superior mesenteric artery syndrome (Figure 1 and Figure 2). Multiple small radiopaque objects filled the duodenum and distal stomach, which were confirmed to be popcorn kernels in a separate CT scan (Figure 3).



**Figure 1.** CT with intravenous contrast of the abdomen and pelvis. A: An axial image shows dilated duodenum with narrowing at the aortomesenteric angle. Arrows indicate the superior mesenteric artery anteriorly, sharp narrowing of the third portion of the duodenum, and the aorta posteriorly. B: A coronal reconstruction shows the dilated duodenum which exerts mass effect and inferiorly displaces the transverse colon. Narrowing of the third portion of the duodenum as it courses superiorly with the superior most visualized focus of gas corresponding to that seen on the axial images at the site of marked narrowing.

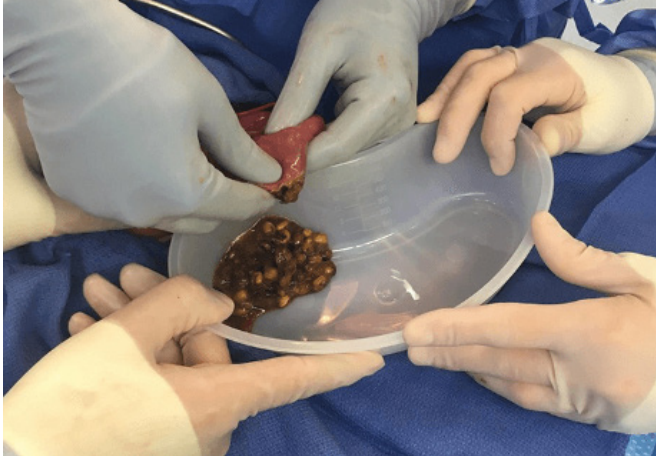


**Figure 2.** CT with intravenous contrast of the abdomen and pelvis. A sagittal reconstruction demonstrates a narrowed aortomesenteric angle measuring  $20.5^\circ$  and reduced aortomesenteric distance measuring 3.3mm, both marked.



**Figure 3.** Detailed view of popcorn kernels within the duodenum. Note the clefted appearance of the kernel (left image) also seen within the dilated duodenum on detail view of the coronal image (right image).

The patient continued to have abdominal pain without bowel function after nasogastric tube placement. Eighteen hours after admission, he was taken to the operating room for exploratory laparotomy. Loose, mobile popcorn kernels were palpated within the duodenum and were easily milked into the jejunum, where they were extracted through a jejunotomy. Gross evaluation of the extracted foreign body revealed innumerable, loose popcorn kernels measuring 5cm x 4cm x 4cm in aggregate (Figure 4).



**Figure 4.** Intraoperative image revealing the gross appearance of the extracted popcorn kernels, which measured 5cm by 4cm by 4cm in aggregate. The enterotomy through which the kernels were extracted is also shown.

The patient tolerated oral nutrition on postoperative day one and was discharged home on postoperative day two. At six months follow-up, the patient has had no symptom recurrence or complications. The patient demonstrated appropriate behavior during hospitalization, and insight and embarrassment regarding the etiology of the obstruction; a psychiatric consult was therefore not obtained, and the patient was determined to have low risk of a repeated event.

## Discussion

SMAS is a rare disease with an estimated prevalence of 0.0023-0.30%, though variable terminology for the same condition has made accurate estimations more difficult.<sup>2,4</sup> Since its initial description,<sup>7</sup> debate has raged over its existence and clinical relevance, stemming from reports of discordant symptomatology and anatomy as well as poor responses to surgical decompression or bypass.<sup>6,8</sup> Some speculate that these inconsistencies are caused by misdiagnosis of the syndrome<sup>9</sup> making accurate diagnosis paramount.

In this case, the patient's symptoms and the classic anatomic findings of a severely reduced aortomesenteric angle with proximal dilation of the duodenum were clearly present. However, consideration of the relatively acute presentation after ingestion of raw popcorn kernels and the additional unusual finding of innumerable kernels within the distended duodenum instead suggest a diagnosis of obstructing bezoar. It must be noted, though, that this patient's presentation did not perfectly match that of a bezoar. Phytobezoars, which are formed when masses of indigestible plant fiber interact with gastric acid, are formed in the stomach over weeks to months and are typified by a concrete-like mass adherent to intestinal mucosa.<sup>10</sup> This description contrasts with the loose popcorn kernels filling the duodenum.

A less common subtype of bezoar forms within the small bowel, rather than upon exposure to gastric acid, in the setting of a mechanical disruption, i.e. at a diverticulum, stricture, or site of dysmotility.<sup>11</sup> This explanation may be the most appropriate to our patient, who appears to have had a primary small intestinal bezoar precipitated by luminal narrowing secondary to narrow aortomesenteric angle. This patient was ultimately treated surgically, but some cases of bezoar may be treated with endoscopic fragmentation.<sup>12</sup> Foreign body removal via esophagogastroduodenoscopy was considered in this patient but deferred for safety given the degree of duodenal and stomach distention and difficulty associated with fragmentation and removal of an impacted mass of kernels. Case reports have suggested benefit to chemical dissolution in combination with endoscopy, using agents such as papain and carbonated liquids though the value of this strategy is neither proven, nor recommended as monotherapy.<sup>12-14</sup>

Given imaging findings suggestive of bezoar and failure to improve with conservative management, our patient underwent surgical removal of the bezoar rather than a more extensive bypass procedure, as would be standard

for a refractory case of SMAS.<sup>6,8,15</sup> His rapid postoperative recovery supported the diagnosis of bezoar precipitated by a narrowed aorto-mesenteric angle.

As SMAS occurs most commonly in children and young adult women, clinical suspicion for a pseudo-SMAS in children with foreign body or other unusual ingestions may be warranted in similar presentations.

## Conclusion

SMAS is characterized by duodenal obstruction secondary to reduced aortomesenteric angle and requires cross-sectional imaging for definitive diagnosis. Weight loss is associated with development of this syndrome, though it is not necessary for its diagnosis. Misdiagnosis may be a common reason for treatment failure.

## Lesson Learned

A broad spectrum of diagnoses should be considered in the setting of duodenal obstruction, including motility disorders and anatomic abnormalities. Two concurrent conditions contributing to obstruction, as in this case, increase the difficulty of clinical decision making. Interestingly, the obstructing mass in this patient was loose in texture, in contrast to what is typically described of a bezoar. However, in the context of duodenal narrowing, this was sufficient to cause obstruction. Ultimately, a conservative surgical approach with enterotomy and evacuation without addressing SMAS produced an excellent outcome.

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