INTRODUCTION

• Superior mesenteric artery (SMA) syndrome is a rare cause of small bowel obstruction affecting 0.1-0.3% of the U.S population
  • Occurs in higher frequency in adolescents and young adults, F>M 3:2.
• Hypothesized etiology involves the acute angulation of superior mesenteric artery compressing the third segment of the duodenum against the abdominal aorta.
• Signs and symptoms are non-specific (nausea, vomiting, abdominal pain and distention, early satiety, food aversion, weight loss)
  • Delay in diagnosis can result in severe complications: electrolyte imbalances, gastric rupture, and intestinal perforation

Early diagnosis and treatment are important to achieve more favorable outcomes and prevent further complications
CASE PRESENTATION

19 year old male presents to ED with sudden onset, diffuse abdominal pain x 6 hours while hiking with family.

+: sweats, chills, nausea, numbness, hand paresthesia
- : fever, weakness, rash, sore throat, chest pain, syncope, vomiting, diarrhea, dysuria, hematuria, back pain, headache, sick contact, recent foreign travels, or consumption of spoiled food

Pt has been living a more active lifestyle lately, losing significant amount of weight from 320 to 170 lbs in the past year by working with a personal trainer.

HISTORY

Past Medical History: GERD

Past Surgical History: Nissl fundoplication (2015) Cholecystectomy

Social History: Denies tobacco, alcohol, or illicit drug use

Medications: No prescriptions, over the counter medications, or supplements

Allergies: NKDA
PHYSICAL EXAM

- **Vitals:** T35.6°C (tympanic), HR 112, BP 126/62, RR 22, SPO2 100%
- **General:** Patient lying in bed, appears in mild acute distress and mild discomfort, Alert and oriented.
- **Skin:** Warm, dry, no rash, + abdominal striae
- **Head:** normocephalic, atraumatic
- **Eye:** PERRLA, extraocular movements are intact, normal conjunctiva
- **CV:** Regular rate and rhythm, normal S1 and S2, no murmur, no edema
- **Resp:** lungs clear to auscultation bilaterally, respirations non-labored, breath sounds equal, symmetrical chest wall expansion
- **Chest wall:** no tenderness, no deformity
- **MSK:** normal ROM, normal strength, no tenderness, no deformity
- **GI:** soft, non distended. Normal bowel sounds, present in all 4 quadrants.. No organomegaly. + Diffuse tenderness to palpation. No guarding, rebound tenderness, or McBurney’s sign.
- **Neuro:** A&O x4. no focal neurological deficit observed, normal motor and speech observed.

LABS

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Result</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (thousand/uL)</td>
<td>19.5</td>
<td>High 4.5-11.0</td>
</tr>
<tr>
<td>RBC (million/uL)</td>
<td>5.25</td>
<td>4.3-5.9</td>
</tr>
<tr>
<td>Hgb (gm/dL)</td>
<td>15.4</td>
<td>14-18</td>
</tr>
<tr>
<td>Hct (%)</td>
<td>45.1</td>
<td>42-50</td>
</tr>
<tr>
<td>MCV (fL)</td>
<td>86.0</td>
<td>80-100</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>29.4</td>
<td>26-34</td>
</tr>
<tr>
<td>MCHC (gm/dL)</td>
<td>34.2</td>
<td>33-37</td>
</tr>
<tr>
<td>RDW (%)</td>
<td>13.3</td>
<td>11.5-14.5</td>
</tr>
<tr>
<td>Plt (thousand/uL)</td>
<td>294</td>
<td>150-350</td>
</tr>
<tr>
<td>Neut (%)</td>
<td>87.8</td>
<td>High 54-62</td>
</tr>
<tr>
<td>Lymph (%)</td>
<td>5.8</td>
<td>Low 25-30</td>
</tr>
<tr>
<td>Mono (%)</td>
<td>6.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Eos (%)</td>
<td>0.0</td>
<td>0.1-3</td>
</tr>
<tr>
<td>Baso (%)</td>
<td>0.2</td>
<td>0.0-0.75</td>
</tr>
<tr>
<td>ABS Neut (thousand/uL)</td>
<td>17.1</td>
<td>High 1.5-7.8</td>
</tr>
<tr>
<td>ABS Lymph (thousand/uL)</td>
<td>1.1</td>
<td>0.85-3.9</td>
</tr>
<tr>
<td>ABS Mono (thousand/uL)</td>
<td>1.2</td>
<td>0.2-0.95</td>
</tr>
<tr>
<td>ABS Eos (thousand/uL)</td>
<td>0.0</td>
<td>0.015-0.5</td>
</tr>
<tr>
<td>ABS Baso (thousand/uL)</td>
<td>0.0</td>
<td>0.0-0.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Result</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (mmol/L)</td>
<td>141</td>
<td>135-145</td>
</tr>
<tr>
<td>Potassium (mmol/L)</td>
<td>3.5</td>
<td>3.5-5</td>
</tr>
<tr>
<td>Chloride (mmol/L)</td>
<td>105</td>
<td>98-110</td>
</tr>
<tr>
<td>CO2 (mmol/L)</td>
<td>17</td>
<td>18-29</td>
</tr>
<tr>
<td>Anion Gap</td>
<td>22</td>
<td>High 18-29</td>
</tr>
<tr>
<td>Glucose Level (mg/dL)</td>
<td>204</td>
<td>High 65-110</td>
</tr>
<tr>
<td>BUN (mg/dL)</td>
<td>19</td>
<td>7-20</td>
</tr>
<tr>
<td>Cr (mg/dL)</td>
<td>1.28</td>
<td>High 1.2-1.5</td>
</tr>
<tr>
<td>eGFR Non-African Am (mL/min/1.73m2)</td>
<td>&gt;60</td>
<td>&lt;60</td>
</tr>
<tr>
<td>Calcium (mg/dL)</td>
<td>10</td>
<td>8.4-10.4</td>
</tr>
<tr>
<td>Total Protein (gm/dL)</td>
<td>7.9</td>
<td>6-8</td>
</tr>
<tr>
<td>Albumin (gm/dL)</td>
<td>5.1</td>
<td>High 3.5-5.0</td>
</tr>
<tr>
<td>Globulin (gm/dL)</td>
<td>2.8</td>
<td>2.3-3.5</td>
</tr>
<tr>
<td>Total Bk (mg/dL)</td>
<td>1.3</td>
<td>0.1-1.3</td>
</tr>
<tr>
<td>ALT (Units/L)</td>
<td>25</td>
<td>5-30</td>
</tr>
<tr>
<td>AST (Units/L)</td>
<td>25</td>
<td>5-30</td>
</tr>
<tr>
<td>Alkaline (Units/L)</td>
<td>92</td>
<td>50-100</td>
</tr>
<tr>
<td>Lipase (Units/L)</td>
<td>440</td>
<td>High 0-160</td>
</tr>
</tbody>
</table>
IMAGING
NON-CONTRAST CT ABDOMEN/PELVIS

CORONAL SECTION
CORONAL SECTION

AXIAL SECTION

SAGITTAL SECTION

Pink = aortomesenteric angle
### ASSESSMENT AND PLAN

**# Duodenal Obstruction secondary to SMA syndrome**
- CT A/P results reviewed and discussed with patient
- SMA syndrome likely secondary to patient's history of rapid and extreme 150 pound weight loss (47% of his body weight) over the past year.
- Given gastric distention, nasogastric tube placed for decompression, draining more than 500mL with symptomatic relief.
- General surgery consulted and admitted to hospital service.

**# Acute Pancreatitis**
- Acute persistent epigastric pain and elevated lipase 440 (3 times greater than upper limit of normal)
- Leukocytosis (WBC 19,500), neutrophilia (ANC 17,100), hyperglycemia (BS 204) supportive of this diagnosis
- Pain control, IV fluid hydration, correction of electrolyte and metabolic abnormalities

**# Metabolic Acidosis**
- Raised anion gap 22
- No patient history of DM or alcohol usage
- Most likely due to prolonged starvation and physiologic stress

### CLINICAL COURSE

- During the 3 day hospitalization, the medical team decided to take a more conservative approach:
  - continue the NG tube decompression
  - monitor patient's gastric distention and lipase levels
  - maintain fluid and electrolyte balance
  - treat symptomatically
- Considering symptomatic improvement, emergent surgical intervention was deemed not necessary at the time
- Patient's symptoms and lab abnormalities improved over course of few days and patient was discharged home
- Patient has not returned to hospital since day of discharge
DISCUSSION

SMA syndrome is a rare etiology of upper gastrointestinal obstruction in which the third transverse portion of the duodenum is pinched between the abdominal aorta (AA) and the overlying SMA.

- **ACQUIRED** – significant weight loss, scoliosis correction surgery
- **CONGENITAL** – short or hypertrophic ligament of treitz, low anatomical origin of SMA, intestinal malabsorption, lumbar hyperlordosis
- **IDIOPATHIC**

Lack of retroperitoneal and mesenteric fat causes acute angulation between the AA and SMA, narrowing the angle from normal ranges of 38°–56° to 6°–25° and decreasing the aortomesenteric distance from normal ranges of 10–28 mm to less than 10 mm.

- Nonspecific symptoms (nausea, vomiting, abd pain, post-prandial abd distention, early satiety) → SMA syndrome considered diagnosis of exclusion

- Differential Diagnosis: mesenteric ischemia, biliary colic, GERD, peptic ulcer disease.

**OSTEOPATHIC FINDINGS**

- Viscerosomatic reflex → somatic clues of the dysfunction
- Stomach, pancreas, small intestine → palpatory tissue texture changes in T5-T11

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**Chart of Viscerosomatic Reflexes and Summary of Chapman’s Reflexes**

[Diagram showing various reflexes and their corresponding areas]

**Sympathetic Origins**

<table>
<thead>
<tr>
<th>System / Organ</th>
<th>FON</th>
<th>Level</th>
<th>Chapman’s Anterior</th>
<th>Chapman’s Posterior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head and Neck</td>
<td>1–4</td>
<td>T1–3</td>
<td>T1 and T2 vertebrae</td>
<td></td>
</tr>
<tr>
<td>Heart</td>
<td>3–5</td>
<td>T3</td>
<td>T3 and T4 vertebrae</td>
<td></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>5–9</td>
<td>T3–4</td>
<td>T3 and T4 vertebrae</td>
<td></td>
</tr>
<tr>
<td>Pancreas</td>
<td>5–8</td>
<td>T3</td>
<td>T3 and T4 vertebrae</td>
<td></td>
</tr>
<tr>
<td>Kidney</td>
<td>5–10</td>
<td>T3–4</td>
<td>T3 and T4 vertebrae</td>
<td></td>
</tr>
</tbody>
</table>

**Parasympathetic Origins**

- Heart, lungs, tongue, larynx, salivary gland, stomach, pancreas, spleen, kidneys, small intestine, ascending and transverse colon
- Reproductive organs, genitae, bladder, uterus, perineum (ascending and sigmoid)
WORKUP

Imaging:
- Plain abdominal films, upper GI studies with oral contrast
- Transabdominal ultrasound
- CT scan of abdomen/pelvis

TREATMENT

- Treat symptomatically
- Initial attempt- posture therapy (prone, left lateral decubitus, knee-chest position)
- Nasogastric tube for duodenal decompression
- Electrolyte and fluid replacement
- Hypercaloric diet or enteral/parenteral nutrition
  - AVOID refeeding syndrome!
- Refractory cases → surgical approach
  - Laparoscopic duodenojejunostomy > division of ligament of Treitz (Strong’s procedure) and gastrojejunostomy

CAUTION!

- Individuals with low BMI and children can have narrow aorto-mesenteric angle WITHOUT SMA syndrome.
- Important to keep in differential! Delay in diagnosis --> severe complications (electrolyte imbalance, gastric rupture, gastric pneumatosis, portal venous gas)

CASE DISCUSSION

- Patient states his 150 lbs weight loss journey consist of solely exercising with a personal trainer once a week and denies making any dietary changes.
- Elevated lipase, leukocytosis, neutrophilia, mild hyperglycemia → Pancreatitis
  - Possible pancreatic ketoacidosis
- Pancreatitis + SMA syndrome is uncommon, making this ED case an interesting and unique one!
  - Suggested mechanism: duodenal obstruction causes retrograde bile reflux into the pancreatic duct and triggers an inflammatory response by the pancreas.
CONCLUSION

- In a young adult patient presenting with acute onset of diffuse abdominal pain in the setting of extreme weight loss → consider SMA syndrome

- Important to have multidisciplinary discussion to investigate further possible roots of such rapid weight loss
  - Intended
  - Desired
  - Secondary to medical/psychosocial reasonings

- Importance for health professionals to educate patients on healthy, gradual weight loss and bring to attention the hidden dangers of fast weight loss

REFERENCES


- Badal MC. Viscerosomatic reflexes, a review. JAMA 1986;255(8):800.


ACKNOWLEDGEMENTS

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