Mesenteric Ischemia: Silent Killer

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Agenda

• Patient Presentation
• Differential Diagnosis
• Available Imaging Modalities
• Relevant Anatomy
• Radiologic Findings
• Pathophysiology
• Related Cases
• Patient Management & Disposition
• Take-Home Points
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Patient Presentation

**Hx:** 83yo F with 4d of nausea, vomiting, diarrhea. No abdominal pain or fever/chills. Found by EMS unable to get out of bed or take POs

**PMH:** HTN, CKD (baseline Cr 1.7-2), HLD, hypothyroidism, osteoporosis, non-Hodgkin lymphoma s/p radiation therapy in remission since 2001, Hx endometrial cancer

**Meds:** atenolol, levothyroxine, pravastatin

**SH:** Retired radiation researcher; lives with disabled relative for whom she is primary caretaker

**Exam:** Hypotensive to 70s, A&Ox3, conversant, lungs CTAB, RRR, abd soft, NT/ND, no CVA tenderness

**Labs:** WBC 14.1 with L shift, INR 1.5, BUN 26, Cr 2.0, ↑LFTs, Trop 0.08, nl CK-MB, TSH 6.2, Lactate 5.0, ABG 65/27/7.4
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Clinical DDx: N/V/D, Hypotension

“VITAMIN C D”

Vascular
Mesenteric ischemia
Hypovolemia
Embolism
MI

Infection/Inflammation
Sepsis
Gastritis
Gastroenteritis
Acute Hepatitis
Cholecystitis
Abscess
UTI
Perforated ulcer

Autoimmune
IBD
Allergy

Metabolic
DKA
Pancreatitis
Acute Renal Failure

Iatrogenic
Ventral hernia
Partial obstruction / Adhesions

Neoplastic
Recurrent lymphoma
Gastric cancer
Colon cancer
Pancreatic cancer
Hepatic cancer
Carcinoid

Congenital
Intestinal volvulus
Adrenocortical insufficiency

Drugs
B-blocker overdose
Thyroid storm
EtOH
TSS, Food poisoning (Staph Toxin A)

Trauma
Fall
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Imaging Modalities

For our patient with N/V/D, ↓BP

- **CT- abdomen & pelvis with contrast** to evaluate for bowel inflammation, perforation, looping, vascular supply (Rating 8)
- Ultrasound – RUQ U/S for biliary pathology (Rating 6)
- MRI – T1 to assess abnormal fat distribution; T2 to assess for edema, 1st line in pregnant patient (Rating 6)
- XR – KUB to evaluate for free air or dilated loops (Rating 5)
- Nuclear Medicine – Ga-67 scan to evaluate for sites of metabolic activity (Rating 4)
- Invasive – ultrasound-guided fluid drainage, ostomy placement via Seldinger technique

Imaging and Use of Contrast

- Use of IV Contrast in CT:
  - Contraindicated in chronic renal insufficiency
  - Contraindicated in acute kidney injury
  - Weigh risks and benefits

- Concern for renal damage:
  - Use Visipaque (iodixanol) rather than Optiray (ioversol)
  - Ensure adequate pre-hydration
Balance of Benefits & Burdens

- Renal Damage
- Radiation Risk
- Cost

- Speed
- Information

CT
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Anatomy Review

Celiac artery

From Gray’s Anatomy
http://commons.wikimedia.org/wiki/File:Gray532.png
Anatomy Review, continued

**Superior Mesenteric Artery**

Most tenuous blood supply – Marginal artery of Drummond

**Inferior Mesenteric Artery**

From Gray’s Anatomy
http://en.wikibooks.org/wiki/File:Gray537.png
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Axial CT (Portal Venous Phase)

- Posterior Right Portal Vein thrombosis
- Fat Stranding
- Fluid tracking along portal vein
- NG Tube
- Anterior Right Portal Vein obliteration
- Left hydronephrosis
- Note margin of liver hypoattenuation

Axial C+ CT; PACS, BIDMC
Mesenteric Ischemia on Axial CT

- Gallbladder wall edema
- Bowel wall edema & hyperenhancing mucosa
- Hydronephrosis
- * Fat Stranding

Axial C+ CT; PACS, BIDMC
Pelvic Free Fluid on Axial CT

Bowel wall edema

Free fluid in pelvis

Axial C+ CT; PACS, BIDMC
Arterial Extravasation on Axial CT

Extravasation from attempted femoral line insertion

Axial C+ CT; PACS, BIDMC
How can we link the patient’s presentation with disease processes?
Putting Together the Findings

Clinical Findings
- History of Nausea, Vomiting, Diarrhea
- Hypotension
- Coagulopathy
- Aggressive Resuscitation
- Elevated Cardiac Enzymes
- ? MI
- ? Sepsis
- ? MI
- Underlying Liver Disease
- ? UTI
- ? Acalculous Cholecystitis

Contributing Factors
- Hypotension
- Coagulopathy
- Aggressive Resuscitation
- Elevated Cardiac Enzymes
- ? MI
- ? Sepsis
- ? MI
- Underlying Liver Disease
- ? UTI
- ? Acalculous Cholecystitis
How do the disease processes manifest radiologically?
Putting Together the Findings (2)
Putting Together the Findings (3)

Contributing Factors
Radiologic Findings

- Periportal edema
- Aggressive Resuscitation
- Gallbladder Wall Edema
- ? Acute Calculous Cholecystitis
Putting Together the Findings (4)

Clinical Findings
Radiologic Findings
Contributing Factors
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What is Mesenteric Ischemia?

- **Development**
  - Lack of perfusion to bowel mesentery
  - **Causes:**
    - Infarction – arterial or venous
    - Embolism
    - Low-Flow State

- **Pathophysiology:**
  - Anoxia $\rightarrow$ Buildup of metabolites ($H^+$, $K^+$) $\rightarrow$ Cell death $\rightarrow$ Necrosis

Presentation of Mesenteric Ischemia

• **S/Sx:**
  - Abdominal pain
  - Vomiting
  - Abdominal distension
  - Fever
  - Melena

• **Hx:** May have Afib, hypercoagulability

• **DDx:** thromboembolic disease, digitalis toxicity, drug reaction, small bowel obstruction, cecal volvulus, gastroenteritis, compression from tumor, complicated diverticulitis, inflammatory bowel disease, cholecystitis, appendicitis, peptic ulcer disease
Why is Mesenteric Ischemia a Silent Killer?

Mortality Rates of Comparable Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mortality Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEMI</td>
<td>10</td>
</tr>
<tr>
<td>Ischemic Stroke</td>
<td>20</td>
</tr>
<tr>
<td>Hemorrhagic Stroke</td>
<td>30</td>
</tr>
<tr>
<td>Mesenteric Ischemia</td>
<td>80</td>
</tr>
</tbody>
</table>
Radiologic Diagnostic Signs

- Mucosal hyperenhancement
- Bowel wall hypoattenuation (edema)
- Bowel wall thickening >3mm

Radiologic Diagnostic Signs, Contd

- Mesenteric vessel occlusion (+/-)
- Mesenteric fat stranding
- Ascites


From meddean.luc.edu
From NYPEmergency.org
CT Hypotension Complex

• “Shock Bowel”
  – Mucosal enhancement
  – Submucosal edema
  – Luminal distension

• Other:
  – Collapsed vena cava
  – Adrenal hyperenhancement
  – Peripancreatic fat stranding
  – Hypoenhancing spleen
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Comparison Patient

- 41yo F with Hx IBS, colitis, HLD, atherosclerosis who presented with LUQ/LLQ pain and leukocytosis
- History notable for smoking, obesity, & family history of heart disease
- Intermittent flare-ups of acute, diffuse abdominal pain over preceding 3 yrs, associated with loose stools and 35 lb weight loss
Comparison Patient 1

1 month prior to presentation

Occluded Celiac Artery

Stenosed SMA

Axial C+ CT; PACS, BIDMC
Comparison Patient 1

Portal venous gas

Pneumatosis Coli

Axial C+ CT; PACS, BIDMC
Comparison Patient 2

- 78yo F transferred from OSH for 2 days of NB/NB emesis, nonbloody diarrhea, and bilateral lower abdominal pain
- WBC 6.9, 77% PMNs
- VS on arrival: HR 120 BP 90/52 T99 O2 95% on 1L
- Abdominal distention with palpable loop of bowel
Comparison Patient 2

Portal venous gas
Aortic calcification

Bowel wall thickening

Axial CT with PO Contrast; PACS, BIDMC
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Management of Mesenteric Ischemia

Options:

- Emergent Surgery
  - Bowel Resection
- Stenting
- Thrombolysis

Prognosis:

- 50-90% mortality rate
  - Lactate level correlates with mortality
Our Patient

- **~23:00** – Patient calls EMS; hypotensive to 70s; taken to ED
- **~23:30** – Patient arrives in ED; lactate of 5.0; central line placed; empiric antibiotics started
- **00:10** – Anterior T-wave inversions; Cards consult
- **00:30** – Bedside echo suggests decreased cardiac output and possible ischemia ➔ heparinized
Our Patient, Contd

• 01:30 – Patient complains of feeling “unwell”, then becomes unresponsive, HR 40s, BP 50s, resuscitated with 1 round of CPR, atropine & Ca, intubated
• 02:05 – CT chest/abdomen with contrast shows mesenteric ischemia
• ~03:00 – Transfer to MICU
• Immediately after transfer, patient develops PEA arrest; CPR resumed
• After 10 more minutes of CPR, futility is determined and patient expires.
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Pearls

• In patients such as ours, mesenteric ischemia may be a **marker of other life-threatening conditions** even if it is not the primary cause of death

• Mesenteric ischemia can be **acute** (from hypotension, hypovolemia, embolism) or **chronic** (from atherosclerosis)

• In patient with risk factors, always get **abdominal CT with contrast** to rule out mesenteric ischemia

• Weigh the **risks and benefits of IV contrast** in patients at risk for renal damage

• If mesenteric ischemia is on the differential → **must be excluded IMMEDIATELY** no matter how remote

• Use radiologic findings to guide both **prediction of outcome** and amenability to therapy

• Keep **VESSELS** on list of organs that could cause pain when examining films.
References

• Levy AD. “Mesenteric Ischemia.” Radiologic Clin N Am. 2007;593-599.
References, contd

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