Mesenteric ischemia

- Highly lethal complex of diseases resulting from a variety of underlying vascular conditions
- Notoriously difficult to diagnose, yet associated with much improved outcomes with early diagnosis and treatment

Definition: Impaired bowel perfusion causing progressing ischemia

Inadequate bowel perfusion
- Adynamic ileus
- Mucosal infarction
- Bacterial translocation
- Sepsis, systemic inflammatory response (SIRS)

Mortality rates: 50-90%
Mesenteric ischemia: complex of diseases

- **Etiology**
  - arterial emboli
  - non-occlusive
  - arterial thrombi
  - venous occlusion
  - “non-vascular”: hernias, closed loop obstructions

- **Chronicity**
  - acute
  - chronic

Mortality rates for acute mesenteric ischemia

<table>
<thead>
<tr>
<th>Study (year)</th>
<th>No patients</th>
<th>Mortality (%)</th>
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</thead>
<tbody>
<tr>
<td>Koveker (1985)</td>
<td>39</td>
<td>85</td>
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<tr>
<td>Braun (1985)</td>
<td>52</td>
<td>64</td>
</tr>
<tr>
<td>Clavien (1987)</td>
<td>81</td>
<td>67</td>
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<tr>
<td>Mishima (1988)</td>
<td>162</td>
<td>65</td>
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<td>Finucani (1989)</td>
<td>32</td>
<td>66</td>
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<tr>
<td>Georgiev (1989)</td>
<td>175</td>
<td>93</td>
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<td>Levy (1990)</td>
<td>92</td>
<td>59</td>
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<td>Inderbitzi (1992)</td>
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<td>Zan (1993)</td>
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<td>72</td>
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<td>Cohen Solal (1993)</td>
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<td>Voltolini (1996)</td>
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<td>Ritz (1997)</td>
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<td>71</td>
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<td>Foley (2000)</td>
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<td>24</td>
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<tr>
<td>Park (2002)</td>
<td>58</td>
<td>32</td>
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<tr>
<td>Kougias (2007)</td>
<td>72</td>
<td>31</td>
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</table>

Mesenteric ischemia: clinical findings

- Review of 72 patients with AMI requiring operations
  - Most patients had abdominal pain and leukocytosis

<table>
<thead>
<tr>
<th></th>
<th>No of Pts</th>
<th>%</th>
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<tbody>
<tr>
<td>Abdominal Pain</td>
<td>69</td>
<td>96%</td>
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<tr>
<td>Nausea</td>
<td>40</td>
<td>56%</td>
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<tr>
<td>Vomiting</td>
<td>27</td>
<td>38%</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>28</td>
<td>36%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>22</td>
<td>31%</td>
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</table>


Mesenteric ischemia: Diagnosis

- High index of suspicion
- No serum marker is sensitive or specific enough to reliably establish the diagnosis
- Plain films: normal does not exclude the diagnosis, late findings on plain films portend a worse prognosis
  - used to exclude other causes (perforated ulcer)
  - Ritz et al. 1997, patients tx’d for mesenteric ischemia: when plain films normal mortality was 29%, when abnormal, mortality was 78%
- Doppler/Duplex ultrasonography
  - highly specific (92-100%) for identification of severe stenosis, but of low sensitivity (70-89%)
  - multiple abnormalities can be asymptomatic
  - only useful in the proximal portion of the splanchnic vessels
Mesenteric ischemia: Diagnosis

- **Computed tomography (CT)**
  - widely used, non-invasive test used in patients with abdominal pain
  - most CT abnormalities are nonspecific and occur late in the course of the disease
  - in retrospective studies, specific diagnosis only made in 30-64% of patients
  - more valuable for diagnosis of mesenteric vein thrombosis (although may be asymptomatic finding)
  - 3-D reconstructions very helpful in providing more detailed vascular detail

  Alpern et al. Radiology 1988;166:149

Mesenteric ischemia: CT findings

- Severe bowel dilation
- Bowel wall thickening “target sign”
- Focal lack of bowel wall enhancement
- Pneumatosis
- Portal venous air

(Barajas et al, AJR 2009; 193:485-492)

Mesenteric ischemia: diagnosis

- **Magnetic resonance imaging**
- **Other techniques**
  - endoscopy, radioisotope studies
- **Mesenteric angiogram**
  - “gold standard”?
  - sensitivity 74-100%, specificity (100%)
  - can diagnose vascular abnormalities, prior to irreversible bowel compromise
  - “road-map” for revascularization, dx of non-occlusive mesenteric ischemia
  - some series report lower mortality rates when angiography used
  - difficult in critically ill patients
  - should not delay prompt surgical exploration in patients suspected of having infarcted bowel

Treatment of mesenteric ischemia

- High index of suspicion, early diagnosis
- dependent on etiology of the ischemia
- Supportive medical therapy
  - IV hydration, Abx, bowel rest, NGT, avoidance of pressors
- Aggressive anticoagulation, vasodilation
- Surgical exploration
  - Bowel resection, “2nd look” exploration
  - techniques to test bowel perfusion: doppler, fluresine
- Reperfusion techniques
  - embolectomy, bypass

(Sarkar R. Cardiovasc Surg 2001;10(4):395)
Superior mesenteric artery occlusion

- Embolism: (from the left ventricle, left atrium or aorta)
  - Arrhythmias, cardiomyopathy, valvular heart disease
- Acute thrombosis:
  - underlying atherosclerosis, FMD, arteritis, dissection
- Treatment depends on completeness of occlusion, location
  - embolectomy
  - bypass
  - thrombolytic tx
  - resection of non-viable bowel
- Consider papaverine to treat vasoconstriction

Superior mesenteric artery embolus

Classic consult:
65yo man with atrial fibrillation, presenting with a one-day history of severe acute abdominal pain

Non-occlusive mesenteric ischemia (NOMI)

- Develops as a result of hypoperfusion from sepsis, low cardiac output, vasospasm
- accounts for 10-20% of all cases of mesenteric ischemia
- associated with a mortality rate of 70-90%
- angiography the only way to diagnose NOMI before bowel infarction

Treatment:
- support splanchnic blood flow (increase MAP, avoid vasoconstrictors, pressors)
- If angiography done, consider papaverine infusion
- surgery for clinical deterioration/peritonitis


Non-occlusive mesenteric ischemia (NOMI)

Classic consult:
80 yo woman in the ICU on multiple vasopressors, hypotensive from sepsis of unknown etiology, with distended abdomen and elevated lactate. Too unstable for imaging

OR:
80 yo known vasculopathy, found down from cardiorespiratory arrest, regained rhythm after 20 mins of CPR, now with hypotension, distended abdomen, grimacing with palpation
Mesenteric venous thrombosis

- more common in patients with hypercoagulable states
  - Protein C, S deficiency
  - Anti-thrombin III deficiency
  - Activated protein C resistance
- often diagnosed by CT scan

Treatment:
- *Incidental finding: either no therapy or 3-6mos anticoagulation
- *symptomatic patient:
  - peritonitis --> immediate laparotomy, consider systemic heparin, “2nd look” laparotomy
  - no peritonitis --> immediate anticoagulation with heparin
  

Chronic mesenteric ischemia

- Characterized by transient episodes of inadequate intestinal perfusion, provoked by the increased metabolic demands of digestion --> chronic post-prandial pain, wt loss
- Diagnosis based on clinical symptoms, in combination with arteriographic evidence of occlusion of at least 2 of the 3 splanchnic vessels
  * Review by Moawad et al. SCNA 1997: 91% had occlusion of at least 2 vessels and 55% had occlusion of all 3

Treatment:
  * surgical revascularization (technical success 60-100%, recurrence 0-40%)
  * mesenteric angioplasty with/without stent

Non-occlusive mesenteric ischemia (NOMI)

Classic consult:
- 80 yo cachetic women with 6 month history of chronic post-prandial abdominal pain, “food fear”
Colonic ischemia

- broad spectrum of etiologies, usually from low-flow state or thrombosis in the inferior mesenteric artery or hypogastric
- "watershed areas" more susceptible (right colon, splenic flexure, sigmoid)
- disease severity ranges from self-limited (most cases) to gangrene and fulminant colitis
- elderly patients with aortic and cardiac surgery, colon cancer, coronary or peripheral vascular disease
- younger patients
  - endurance athletes, oral contraceptives, cocaine use, coagulopathies
- diagnosis
  - plain films "thumbprinting", colonoscopy, CT scan

Treatment:
- bowel rest, IV hydration, broad-spectrum antibiotics
- surgery for peritonitis, or failure to improve after 2-3 wks, chronic symptoms or stricture

Brandt et al. SCNA 1992;72:203

"non-vascular" AMI

- Mechanical obstruction of inflow/outflow
  - Hernias
  - Prior abdominal operations
- CT scan can often identify the underlying cause, areas of abnormal, non-enhancing bowel

Treatment:
- laparotomy, correction of the underlying problem
- resection of any non-viable bowel
- "second-look" exploration if questionable bowel

"non-vascular" causes of AMI

Classic consults:
- 45yo man without prior surgery presents with severe, diffuse abdominal pain
- 80yo woman POD #2 from repair of incarcerated femoral hernia, now with worsening abdominal pain and tachycardia
Conclusions

- Mesenteric ischemia is a highly lethal complex of diseases caused by inadequate bowel perfusion
- Mortality can be improved with early diagnosis and treatment, before bowel infarction and resection, sepsis
- CT angiography is a useful tool for diagnosis
- Many cases are self-limited, if diagnosed and appropriately treated medically
- Collaborative approach is increasingly important role in the treatment algorithm, and should be involved early in the care of these complex patients
  - Vascular
    - Interventional Radiology
    - Cardiology
    - General Surgery