Colon Ischemia (CI): New Developments and Guidelines for Management

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Spectrum of CI

Reversible
- Colopathy: intramural hemorrhage, edema
- Transient segmental colitis
- Transient (reversible) stricture

Irreversible
- Gangrenous infarction
- Stricture
- Persistent segmental colitis
- Fulminating universal colitis

Other
- Colitis simulating carcinoma
- Colitis associated with distal obstruction
- Protein-losing colopathy
- Recurrent sepsis
## Incidence of CI

<table>
<thead>
<tr>
<th>Study</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suh et al. <em>Alim Pharm Ther. 2007</em></td>
<td>17.7 cases/100,000 admissions</td>
</tr>
<tr>
<td>Longstreth and Yao <em>Clin Gastroenterol Hepatol 2009</em></td>
<td>15.6 patients/100,000 admissions</td>
</tr>
<tr>
<td>Yadav et al. <em>Clin Gastroenterol Hepatol 2014</em></td>
<td>16.3 cases/100,000 patient-years</td>
</tr>
</tbody>
</table>

### Incidence of CI

#### Age-specific incidence

![Age-specific incidence graph](image)

*Yadav et al. Clin Gastro Hep. 2014*

#### Age-adjusted incidence

![Age-adjusted incidence graph](image)
Clinical Presentations of CI

- **Usual:** sudden cramping, mild, abdominal pain; urgent desire to defecate; passage within 24 h BRBPR or bloody diarrhea. Symptoms usually resolve within 10-14 days
  - bleeding > pain
  - pain > bleeding (with IRCI)

- **Unusual:** stricture, gangrene, fulminant, colitis, toxic universal colitis, and recurrent sepsis
What is the Role of Colonoscopy in CI?

- **Diagnosis**
  - **non-specific findings**: *segmental* subepithelial hemorrhage and edema, ulceration, ps. membr, ps. polyps, stenosis
  - **more specific findings**: CSSS, gangrene
  - **associated findings**: neoplasm, stricture

- **Prognosis**
  - segment of colon involved (IRCI worse)
  - gangrene (worst), ulcers (worse); CSSS (better)
Colonoscopic Findings in CI: 297 cases

- Erythema (83.7%)
- Edema (69.9%)
- Superficial ulcerations (57.4%)
- Friability (42.6%)
- Deep ulcerations (21.7%)
- Luminal narrowing (8.4%)
- Intraluminal blood (8.4%)
- Blue-black nodules (5.5%)

_all the above findings are time-related_

_Montoro, Brandt et al. Scand J Gastro, 2011_
Colon Single Stripe Sign (CSSS)

Histopathology of CI: 297 cases

<table>
<thead>
<tr>
<th>Finding</th>
<th>Total (%)</th>
<th>&lt;48 h (%)</th>
<th>3-5 d (%)</th>
<th>&gt;5 d (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghost cells</td>
<td>5.7</td>
<td>13.0</td>
<td>5.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Mucosal infarction</td>
<td>7.7</td>
<td>16.9</td>
<td>5.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Hemosiderin-laden macrophage</td>
<td>10.8</td>
<td>7.8</td>
<td>8.5</td>
<td>15.7</td>
</tr>
<tr>
<td>Crypt abscess, cryptitis</td>
<td>11.4</td>
<td>10.4</td>
<td>9.3</td>
<td>14.7</td>
</tr>
<tr>
<td>Ulcers/pseudomembranes</td>
<td>13.1</td>
<td>23.4</td>
<td>8.5</td>
<td>10.8</td>
</tr>
<tr>
<td>Intravascular thrombi</td>
<td>17.2</td>
<td>29.9</td>
<td>15.3</td>
<td>9.8</td>
</tr>
<tr>
<td>Neutrophilic infiltration</td>
<td>17.8</td>
<td>24.7</td>
<td>10.2</td>
<td>21.6</td>
</tr>
<tr>
<td>Fibrin exudation</td>
<td>26.9</td>
<td>40.3</td>
<td>19.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Loss of glands</td>
<td>28.6</td>
<td>42.9</td>
<td>20.3</td>
<td>27.5</td>
</tr>
<tr>
<td>Mucosal ulceration</td>
<td>36.4</td>
<td>39.0</td>
<td>28.8</td>
<td>43.1</td>
</tr>
<tr>
<td>Granulation tissue, fibrosis</td>
<td>41.4</td>
<td>35.1</td>
<td>38.1</td>
<td>50.0</td>
</tr>
<tr>
<td>Chronic inflammatory cells</td>
<td>45.5</td>
<td>42.9</td>
<td>40.7</td>
<td>52.9</td>
</tr>
<tr>
<td>Subepithelial hemorrhage</td>
<td>47.8</td>
<td>55.8</td>
<td>48.3</td>
<td>41.2</td>
</tr>
</tbody>
</table>

All the above findings are time-related

Montoro, Brandt et al. Scan J Gastro 2011
Infarction

Ghost-cells

Colon Ischemia (CI)
Associated with Carcinoma (CA)
CI Mimicking CA

Post-colonoscopy CI
CI and Diverticulitis

Colonoscopy and CI

- Colonoscopy with biopsy is the best test to dx CI
- In suspected CI, the colon should be insufflated minimally and with CO₂, rather than RA, if possible

**Expert Opinion**

- In severe CI, CT should be used to evaluate disease distribution with a limited colonoscopy to confirm the nature of the CT abnormality
- No need to reach the cecum; passage should be halted at the distal most extent of disease
- Biopsies should be taken in most cases except gangrene
CT and MRI in CI

- CT with IV and oral contrast is the \textit{imaging modality of choice} to assess the distribution and phase of colitis.
- CT or MRI findings (e.g., bowel wall thickening, edema, thumbprinting, pericolonic fat-stranding) are \textit{suggestive} of CI, but \textit{not specific} for diagnosis.
- CT (MRI) findings of colonic pneumatosis and porto-mesenteric venous gas are \textit{highly suggestive} of transmural colonic infarction, but \textit{not diagnostic}.

\textit{Common findings (good prognosis) are non-specific and the more specific findings (bad prognosis) are uncommon}

\textbf{Expert Opinion}

- Multi-phasic CTA should be performed for any patient with suspected IRCI or when AMI cannot be excluded.

CT Staging of CI

\textbf{Phase 1 (Early stage with reperfusion injury)}
- Wall thickening
- Submucosal edema
- Peri-colic fluid
- Mucosal hyperdensity from submucosal hemorrhage (e.g., “little rose” sign)

\textbf{Phase 2 (Late stage with lack of reperfusion)}
- Concentric symmetric homogenous colon wall attenuation
- Minimal peri-colic streakiness
- Small amount of peritoneal fluid

\textbf{Phase 3 (End stage with lack of reperfusion; Infarction)}
- Intramural, portal or mesenteric pneumatosis
- Absence of peritoneal fluid
- Pneumoperitoneum
- Absence of parietal enhancement

\textit{Romano et al. Eur J Rad. 2006}
Non-specific CT

More Specific but Ominous CT Findings

Pneumatosis linearis

Portal venous gas
Is There a Role for Angiography in the Management of CI?

- By the time of presentation, colon blood flow has already returned to normal
- Angiography will show age-related changes in the vasculature, but not reveal a causative lesion
- Angiography plays no role in CI except
  A) patients with IRCI
  B) combined colon and AMI
  C) recurrent disease?

At presentation: 1) blood flow has returned to normal
2) angiography is usually normal (age appropriate)
## Outcomes of Anatomic Patterns of CI

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Pan Colon</th>
<th>Right Colon</th>
<th>Trans Colon</th>
<th>Left Colon</th>
<th>Distal Colon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOS</strong></td>
<td>7 (1-115)</td>
<td>9 (1-54)</td>
<td>10 (1-89)</td>
<td>6 (1-113)</td>
<td>5 (1-75)</td>
<td>6 (1-55)</td>
</tr>
<tr>
<td><strong>Surgery</strong></td>
<td>19.8%</td>
<td>30.4%</td>
<td>44.3%</td>
<td>18.8%</td>
<td>5.9%</td>
<td>10.4%</td>
</tr>
<tr>
<td><strong>Mortality</strong></td>
<td>11.8%</td>
<td>21.7%</td>
<td>20.3%</td>
<td>12.5%</td>
<td>6.9%</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

*Brandt, Feuerstadt, Blaszka. Am J Gastro, 2010*
Outcomes of IRCI ± AMI


IRCI

- IRCI has a worse prognosis than CI involving any other segment of colon
Risk Factors For Poor Outcome
(30-day mortality &/or colectomy)

Clinical Presentation
- Abdominal pain without rectal bleeding
- Non-bloody diarrhea
- Peritoneal signs
- Symptom onset after hospital admission

Vital Signs
- HR > 100bpm
- SBP < 90 mmHg

SeroLogic Values
- Hgb < 12 mg/dL
- Na < 136 meq/L
- LDH > 450 U/L
- BUN > 28 mg/dL
- HCO3 < 24 mmol/L
- Albumin < 2.8g/L
- WBC > 15x10^3/L

Disease Distribution
- IRCI
- Pancolonic

Classification of Disease Severity and Risk Factors for Prognosis in CI

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<thead>
<tr>
<th>Disease Severity</th>
<th>Criteria</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Typical symptoms of CI with a segmental colitis not isolated to the right colon and with none of the commonly associated risk factors for poorer-outcome that are seen in moderate disease</td>
<td>Observation, Supportive care</td>
</tr>
<tr>
<td>Moderate</td>
<td>Any patient with CI and up to three of the following factors: Male gender, Abdominal pain without rectal bleeding, Hypotension (systolic BP &lt; 90 mm Hg), Tachycardia (heart rate &gt; 100 beats/minute), White blood cell count &gt; 15 x 10^9/L, Hemoglobin &lt; 12 g/dL, Blood Urea Nitrogen &gt; 20 mg/dL, Serum sodium &lt; 136 mEq/L, Lactate dehydrogenase &gt; 350 U/L, Colonic mucosal ulceration identified colonoscopically</td>
<td>Correction of cardiovascular abnormalities (e.g., volume replacement), Broad spectrum antibiotic therapy, Surgical consultation</td>
</tr>
<tr>
<td>Severe</td>
<td>Any patient with CI and more than three of the criteria for moderate disease or any of the following: Peritoneal signs on physical examination, Pneumatosis or portal venous gas on radiologic imaging, Gangrene on colonoscopic examination, Pan-colonic distribution or IRCI on imaging or colonoscopy</td>
<td>Emergent surgical consultation, Transfer to intensive care unit, Correction of cardiovascular abnormalities (e.g., volume replacement), Broad spectrum antibiotic therapy</td>
</tr>
</tbody>
</table>
Overall Treatment of CI

- Most cases of CI do not require specific Rx and resolve spontaneously
- Rx is conservative and supportive
  - Correction of precipitating condition
  - NPO
  - IV fluids, electrolyte repletion
  - Correction of CV abnormalities
  - Optimize forward cardiac flow
- Broad spectrum antibiotics for moderate-to-severe CI
- Surgical Rx should remove only the area of ischemic bowel

**Expert Opinion**

- Consider antimicrobial Rx for moderate or severe disease

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Why are Antibiotics Indicated for CI?

**In the past:** Uncontrolled canine studies using antibiotics no longer used and administered at the time of CI showed
- less severe injury
- better survival

**Today:** Controlled murine studies of SMA ligation and reperfusion showed that with antibiotics (ampicillin, vancomycin, neomycin and metronidazole)
- less bacterial translocation*
- less inflammation#
- fewer toll-like receptors#
- decreased complement#

Indications for Surgical Intervention

Acute
- Peritoneal signs
- Medically uncontrollable bleeding
- Fulminant colitis
- Portal venous gas and/or pneumatosis linearis
- Deteriorating clinical condition

Sub-acute
- Failure of acute segmental CI to respond to treatment within 2-3 weeks with continued symptoms or protein-losing colopathy
- Recurrent sepsis

Chronic
- Symptomatic colon stricture
- Symptomatic segmental CI

“Take-home” Points for CI

- Site of involvement determines presentation and prognosis
  - **Non-IRCI**: BRBPR or bloody diarrhea > abd pain
    - Good outcome
  - **IRCI**: Abd pain > BRBPR or bloody diarrhea;
    - Poorer outcome:
      - more frequent need for surgery
      - higher 30-day mortality rate
“Take-home” Points for CI

- Evaluation is by CT and colonoscopy not angiography (except possibly IRCI)
  - CT scan is the initial screening test; may help determine prognosis
  - Colonoscopy is the test of choice for confirming diagnosis
- Antibiotics for moderate-to-severe CI

The End