Le ischemie gastrointestinali

La Radiologia Interventistica nell’Emergenza-Urgenza

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Introduction

• Overall incidence 0.63/100,000 person years
• Autopsy rate incidence more than twenty times higher 12.9/100,000 person years
• M=F
• Mean age 70 y.o.
• Mortality rates 50-70%
Pathophysiology

Acute Mesenteric Ischaemia

- Arterial occlusion
  - Embolism 20-30%
  - Thrombosis 50%
- Venous occlusion
  - Mesenteric venous thrombosis 15%
- Non-occlusive
  - Non-occlusive mesenteric ischaemia 15%

Mortality rates:

- Embolism: 54%
- Thrombosis: 77%
- Mesenteric venous thrombosis: 32%
- Non-occlusive mesenteric ischaemia: 73%

Clinical suspicion

Most symptoms and signs are non-specific and need to exclude other non-vascular emergencies
Past history of atherosclerotic diseases, hypertension and FA are the principal risk factor

- **Symptoms and signs**
  - Abdominal pain  95%
  - Pain out of proportion of signs
  - Nausea  44%
  - Vomiting  35%
  - Bloody Diarrhea  35%
  - PR bleeding  16%
  - Fever  46%
  - Tachycardia  58%
  - Abd distension  66%

- **Laboratory tests**
  - Leukocytosis
  - Elevated urea
  - Elevated creatinine
  - Elevated lactate
  - Metabolic acidosis
  - DIC

15 mins
Structural changes to intestinal villi

3 hours
- Mucosal sloughing
- Still reversible

6 hours
- Transmural necrosis
- Gangrene
- Perforation

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
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<tbody>
<tr>
<td>Spastic Phase</td>
<td>Widespread cramping pain, diarrhea nausea and vomiting. No signs of acute abdomen</td>
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<tr>
<td>Paralytic Phase</td>
<td>Severe ischemic pain, stopping diarrhea and cramping. Initial signs of acute abdomen</td>
</tr>
<tr>
<td>Peritonitis Phase</td>
<td>Acute abdomen associated to rapid worsening of general condition and shock</td>
</tr>
</tbody>
</table>

Gasparini et al. CIRSE 2010 Workshop: acute mesenteric ischemia, all you need to know
CT scan

- SMA thrombus
- Bowel wall thickening
- Non-enhanced bowel wall
- Pneumatosis intestinalis
- Portal venous gas
- Fluid collection

Injury Severity

Persisting ischemia

Life threatening transmural bowel wall necrosis

Wall thicknes $\geq 2-3$ mm

Gasparini et al. CIRSE 2010 Workshop: acute mesenteric ischemia, all you need to know
Acute SMA occlusion

**SMA Embolism**

- Aortic ostium
  - ~15%
- Around Middle colic artery
  - ~40%
- Distal branches
  - ~45%

**SMA Thrombosis**

- Aortic ostium
  - ~60-80%
- Around Middle colic artery
  - ~15%
- Distal branches
  - ~5%

Vascular anastomosis

RIOLANO’S ARCH
DUODENAL PANCREATIC ARCHES
HEMORRHOID ARTERY
DRUMMOND’S ARCH (Marginal artery)

Gasparini et al. CIRSE 2010 Workshop: acute mesenteric ischemia, all you need to know
Weak points

The splenic flexure (Griffith’s Point)

The rectosigmoid junction (Sudek’s point)
The point of Reiner is a segment of the superior mesenteric artery between the point before the origin of the second intestinal artery and middle colic and a point downstream dell'ileocolic artery. The occlusion is frequent in case of emboli ischemia and this event undermine the Drumond arch.
Reiner’s Critical Segment

Injury extension in case of obstruction of the Reiner segment. The ischemia is extended from the Traiz legament to the splenic colon flexure.
Treatment

Traditional management of AMI was open surgery especially for acute abdomen.

- Embolectomy
- Thrombo-endarterectomy
- Aorto-mesenteric bypass
  +/- Bowel resection of necrotic parts

Mortality and intestinal resection rate remains high (37%-59%)

Alternative treatment: Endovascular
Endovascular treatment

- PTA and stenting
- Primary stenting
- Mechanical aspiration (manual or automated systems)
- Pharmacological therapy (urokinasis, rTPA, 2b–3a antagonists...)
- Combined technique
ET: SMA stenting

- Brachial vs femoral
- Occlusions stump
- Lateral view
- Heparin 2500 U.I.
- Vasodilators
- Long sheath
- Occasionally, a .014” and low-profile balloons are needed to cross and predilate the lesion
- Balloon-expandable stents should be preferred for proximal lesions and self-expandable to compliance better to SMA angulations for distal ones
  - dual anti-platelets (aspirin for life/clopidogrel 3-6 months)
  - restenosis/occlusion 16-20%/1 year

Raupach et al. CIRSE 2016 Workshop: acute mesenteric ischemia
Aspiration embolectomy

- 7F angled guiding catheter, *(Destinaton, RDC, Terumo)* removable haemostatic valve
- 5-7F aspiration catheter manual aspiration 20 ml/60 ml syringe
- Automatic thromboaspiration Penumbra Indigo System (CAT5-CAT6)

Raupach et al. CIRSE 2016 Workshop: acute mesenteric ischemia
Tromboembolectomy

- **Thrombectomy by AngioJet** (Boston Scientific)
- **Thrombectomy by Rotarex** (*Straub Medical AG*)
- Thrombectomy with carotid filter
- Thrombectomy with stent retriever

7-8F guiding cath for treat by mechanical fragmentation (e.g. Aspirex, Straub) or aspiration by several passes

Raupach et al. CIRSE 2016 Workshop: acute mesenteric ischemia
Thrombolysis infusion

Femoral access with a 6-8F introducer.

Heparin up to ACT 250-300’.

The SMA must be deeply engaged and a 7F 60cm introducer with removable hub (Destination, Terumo).

Local thrombolysis should be performed with rtPA at a rate of 0.25 to 1 mg/h or 0.02 – 0.1 mg/kg/h.

Angiographic control of cath position and thrombolytic effect should carried out every 12 hours.
Evidence

- No randomized controlled trials to guide treatment
- High ratio of case reports and small retrospective series
## Morbidity

<table>
<thead>
<tr>
<th></th>
<th>ET (n = 234)</th>
<th></th>
<th>OS (n = 856)</th>
<th></th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Data Available (n)</td>
<td>Number of Events, n (%)</td>
<td>Data Available (n)</td>
<td>Number of Events, n (%)</td>
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<tr>
<td>Overall complications</td>
<td>209</td>
<td>100 (47.9% ± 6.8%)</td>
<td>644</td>
<td>400 (62.1% ± 3.8%)</td>
<td>.0001</td>
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<tr>
<td>Wound infection</td>
<td>209</td>
<td>0</td>
<td>284</td>
<td>11 (3.9% ± 2.2%)</td>
<td>.003</td>
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<tr>
<td>MODS</td>
<td>188</td>
<td>3 (1.6% ± 1.8%)</td>
<td>323</td>
<td>56 (17.3% ± 4.1%)</td>
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<tr>
<td>Reocclusion of SMA</td>
<td>188</td>
<td>1 (0.5% ± 1.0%)</td>
<td>284</td>
<td>8 (2.8% ± 1.9%)</td>
<td>.15</td>
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<tr>
<td>SMA dissection</td>
<td>209</td>
<td>4 (1.9% ± 1.9%)</td>
<td>405</td>
<td>0</td>
<td>.013</td>
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<tr>
<td>SMA perforation/bleeding</td>
<td>188</td>
<td>2 (1.1% ± 1.5%)</td>
<td>405</td>
<td>0</td>
<td>.1</td>
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<tr>
<td>Emboli in distal branches</td>
<td>199</td>
<td>2 (1.0% ± 1.4%)</td>
<td>405</td>
<td>0</td>
<td>.11</td>
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<tr>
<td>Short bowel syndrome</td>
<td>209</td>
<td>11 (5.3% ± 3.0%)</td>
<td>405</td>
<td>37 (9.1% ± 2.8%)</td>
<td>.09</td>
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<tr>
<td>Septicemia</td>
<td>188</td>
<td>7 (3.7% ± 2.7%)</td>
<td>405</td>
<td>25 (6.2% ± 2.3%)</td>
<td>.22</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>188</td>
<td>16 (8.5% ± 3.9%)</td>
<td>284</td>
<td>18 (6.3% ± 2.8%)</td>
<td>.371</td>
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<tr>
<td>Pulmonary infection</td>
<td>188</td>
<td>16 (8.5% ± 3.9%)</td>
<td>323</td>
<td>49 (15.2% ± 3.9%)</td>
<td>.029</td>
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<tr>
<td>Myocardial infarction</td>
<td>188</td>
<td>1 (0.5% ± 1.0%)</td>
<td>284</td>
<td>19 (6.7% ± 2.9%)</td>
<td>.003</td>
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<td>Anastomotic leakage</td>
<td>188</td>
<td>0</td>
<td>284</td>
<td>10 (3.5% ± 2.1%)</td>
<td>.007</td>
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<tr>
<td>Urinary infection</td>
<td>188</td>
<td>0</td>
<td>284</td>
<td>7 (2.5% ± 1.8%)</td>
<td>.045</td>
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<tr>
<td>Access site bleeding</td>
<td>199</td>
<td>11 (5.5% ± 3.2%)</td>
<td>405</td>
<td>0</td>
<td>.001</td>
</tr>
<tr>
<td>Bowel ischemia/infarction</td>
<td>188</td>
<td>19 (10.1% ± 4.3%)</td>
<td>337</td>
<td>36 (10.7% ± 3.3%)</td>
<td>.84</td>
</tr>
<tr>
<td>Stroke</td>
<td>188</td>
<td>2 (1.1% ± 1.5%)</td>
<td>284</td>
<td>3 (1.1% ± 1.2%)</td>
<td>I</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>234</td>
<td>63 (26.9% ± 5.7%)</td>
<td>859</td>
<td>346 (40.3% ± 3.3%)</td>
<td>.0001</td>
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<td>Primary patency</td>
<td>89</td>
<td>84 (94.4% ± 4.8%)</td>
<td>181</td>
<td>95 (52.5% ± 7.3%)</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Zhao Y, Management of acute mesenteric ischemia, Vascular and Endovascular Surgery, 2016
**Figure 3.** Secondary operation for patients treated with OS versus ET. CI indicates confidence interval; ET, endovascular therapy; OS, opening
Mortality

In hospital mortality
ET 27% vs OS 40%

5-year Mortality
1 year ET 90% vs OS 65%
2 years ET 56% vs OS 50 e 55%

But selection bias...

Zhao Y, Management of acute mesenteric ischemia,
Vascular and Endovascular Surgery, 2016
SPASTIC PHASE
Widespread cramping pain, diarrhea nausea and vomiting. No signs of acute abdomen

PARALYTIC PHASE
Severe ischemic pain, stopping diarrhea and cramping. Initial signs of acute abdomen

PERITONITIS PHASE
Acute abdomen associated to rapid worsening of general condition and shock

Time critical
No presence of peritonitis or suspicions of intestinal necrosis!

Gasparini et al. CIRSE 2010 Workshop: acute mesenteric ischemia, all you need to know
Time critical

Injury Severity

Wall thickness ≥ 2-3 mm

Life threatening transmural bowel wall necrosis

Persisting ischemia

Gasparini et al. CIRSE 2010 Workshop: acute mesenteric ischemia, all you need to know
Anatomical suitability

Anatomic suitability is one of the most important factors for determining choice of endovascular intervention

- Main trunk of SMA is not angular or tortuous
- Proximal and distal landing zones are ≥ 10 mm
- No main branches located within the section of proximal or distal landing zone

Zhao Y, Management of acute mesenteric ischemia, Vascular and Endovascular Surgery, 2016
What is the specific treatment for AMI?

Arterial thrombosis (TAMI)

Answer: Endovascular treatment should be the first choice for TAMI whenever possible.

Recommendations: When bowel integrity has not been compromised, endovascular techniques should be performed as first line treatment for TAMI (LOE: III).

When a laparotomy has been performed for TAMI the choice of vascular intervention will depend on available resources and expertise (LOE: IV).

When vascular expertise is not available it may be reasonable to resect the necrotic bowel first and transfer the patient for urgent interventional angiography or vascular surgery (LOE: III).
What is the specific treatment for AMI?

Arterial embolism (EAMI)

Answer: Open embolectomy is widely used in this scenario. However, if expertise and appropriate resources are available, and there is no evidence of bowel necrosis, endovascular techniques should be attempted.

Recommendation: In cases where immediate surgical intervention is not required the decision to perform endovascular or open vascular surgery for EAMI should be determined by the personal experience and technical capabilities of the surgeon and the available resources (LOE: IV).

When EAMI is identified during a laparotomy an open embolectomy should be performed (LOE: IV).
Treatment algorithm

Peritoneal irritation

Emergency OS

Suitable anatomy

OS

Life expectancy >5y

ET

Good Nutrition status

ET/ET to OS

OS/HT

Zhao Y, Management of acute mesenteric ischemia, Vascular and Endovascular Surgery, 2016
Mesenteric Venous Thrombosis

Younger patients

Primary MVT (40%)
• any hypercoagulable states

Secondary MVT (60%)
• Portal hypertension
• Intraabdominal sepsis
• Intraabdominal neoplasia
• Pancreatitis
• Trauma

Symptoms
• Less severe
• Slower onset [weeks]

Mainstay therapy
• Anti-coagulation
• Surgical resection

Endovascular treatment

SMA thrombolytic infusion
Portal vein or SMV:
  • Percutaneous hepatic/splenic
  • Trans-jugular trans-hepatic
  • Thrombolysis
  • Mechanical

When?
  • Anti-coagulation failure
  • Severe pain without infarction
  • Infarction/surgery excludes thrombolysis
  • Options discussion

Raupach et al. CIRSE 2016 Workshop: acute mesenteric ischemia
What is the specific treatment for AMI?

Venous ischaemia (VAMI)

Answer: The first line treatment for mesenteric venous thrombosis is anticoagulation.

Recommendations: Systemic anticoagulation should be started as soon as possible in VAMI (LOE: III).

Endovascular intervention should be offered to patients with VAMI who deteriorate during medical therapy (LOE: IV).
Non-occlusive Mesenteric Ischaemia

Conditions resulting in splanchnic vasoconstriction

ICU – elderly

- Septic or cardiogenic shock
- Vasoconstrictive drugs/poisoning
- Infarction established
- Exclude SMV thrombosis

Management

- Treat shock
- Spasm-local vasodilators [poisoning]
- Laparotomy/laparoscopy
What is the specific treatment for AMI?

*Non-occlusive mesenteric ischaemia (NOMI)*

**Answer:** The first line treatment for NOMI is medical therapy with direct infusion of vasodilators into the SMA.

**Recommendation:** NOMI should be managed by correcting the underlying cause wherever possible and improving mesenteric perfusion by **direct infusion of vasodilators.** Infarcted bowel should be excised (LOE: III).
“Occlusion of the mesenteric vessels is apt to be regarded as one of those condition of which
...the diagnosis is impossible,
...the prognosis hopeless,
...and the treatment almost useless”

A.J. Cokkinis 1926