

# Midnight Journal Club 3<sup>rd</sup> Oct 2022

大阪府済生会千里病院

千里救命救急センター

伊藤 裕介

## 本日のテーマ

- AMI
- といっても・・・Acute myocardial infarctionではありません。
- Acute Mesenteric ischemia

# Guidelines

Bala et al. *World Journal of Emergency Surgery* (2017) 12:38  
DOI 10.1186/s13017-017-0150-5

World Journal of  
Emergency Surgery

REVIEW

Open Access



## Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery

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## AMI

- Mesenteric arterial embolism ( 50% )
- Mesenteric arterial thrombosis ( 15-25% )
- Non-occlusive ( NOMI ) ( 20% )
- Mesenteric venous thrombosis ( 5-15% )

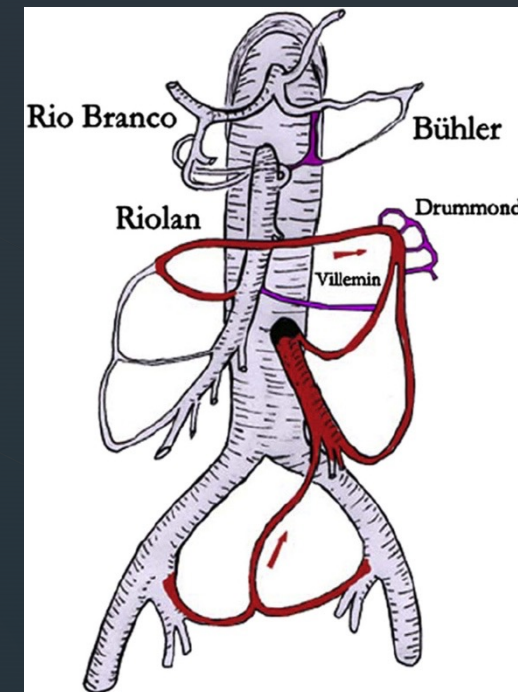
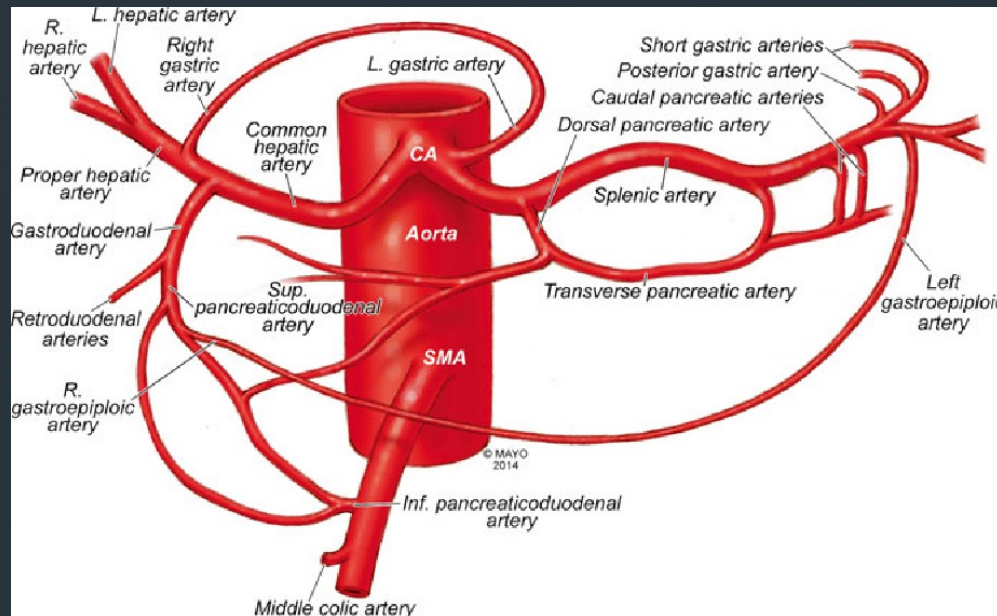
The overall incidence is low ( 0.09 ~ 0.2% ) of all acute admissions to ED

## ▶ Mortality

- Mortality rates are about 50– 80%.
- There are no level 1 evidence.
- The WSES World Congress, May 2017 in Campinas, Brazil

# Anatomy

- SMA is **primary** blood supply for the small bowel
- Collateral flow from **celiac arterial** system, via the **superior and inferior pancreaticoduodenal arteries** and **inferior mesenteric artery**



## Physiology

- **15-35% cardiac output**, depending on the feeding state
- Blood supply must be reduced **by more than 50%** before the small intestine becomes ischemic
- Mesenteric ischemia does not occur until the patient's mean arterial pressure is **< 45 mmHg**
- The small intestine is able to compensate **for a 75% reduction** in mesenteric blood flow for **up to 12h**

Surg Clin North Am. 1997; 77: 289-306  
Langenbeck's Arch Surg. 1999; 384:233-8  
J Vasc Surg 2014;60:111-9

## Acute mesenteric arterial embolism

- Roughly **50%** of all case of AMI
- Relatively **large diameter** and **low takeoff angle** from aorta
- The majority of emboli lodge **3 to 10 cm distal**
- More than 20% are associated with **the splenic, of kidney emboli.**



## ▶ Acute mesenteric arterial thrombosis

- Approximately **25%** of cases
- Associated with **pre-existing chronic atherosclerotic** disease leading to stenosis
- A history of **chronic** mesenteric ischemia
- Most often accompanies **celiac occlusion**
- Due to **vasculitis, mesenteric dissection, or a mycotic aneurysm**

## Non-occlusive mesenteric ischemia Mesenteric venous thrombosis

- NOMI occurs in **20%**, typically suffer from severe coexisting illness, hypovolemia and the use of vasoconstrictive agents.
- Mesenteric venous thrombosis accounts for less than **10%**. Portal hypertension, pancreatitis, inflammatory bowel disease, sepsis, and trauma.

▸ Recommendation 1A

- **Computed tomography angiography (CTA)** should be performed as soon as possible.
- **Prompt laparotomy** should be done for patients with overt peritonitis

## Recommendation 1B

- Sever abdominal pain **out of proportion** to physical examination findings should be assumed to be AMI.
- **Clinical scenario** differentiates AMI.
- There are **no laboratory studies** that are sufficiently accurate to identify the presence or absence of ischemic or necrotic bowel, although **elevated lactate, and D-dimer may assist.**

## Recommendation 1B

- NOMI **should be suspected** in critically ill patient with abdominal pain or distension requiring vasopressor support.
- When the diagnosis of AMI is made, **fluid resuscitation** should commence. **Nasogastric decompression**, correct **electrolyte abnormalities**.
- **Broad-spectrum antibiotics** should be administered. Anticoagulated with intravenous **unfractionated heparin**.
- **Damage control surgery**

## ▶ Recommendation 1B

- Mesenteric venous thrombosis can often be successfully treated with a continuous infusion of unfractionated heparin.
- When NOMI is suspected, correct the underlying cause.

▾ Treatment for AMI



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*MINIREVIEWS*

**Multidisciplinary management of acute mesenteric ischemia:  
Surgery and endovascular intervention**

Takashi Sakamoto, Tadao Kubota, Hiraku Funakoshi, Alan Kawarai Lefor

## AMI

- Mesenteric arterial embolism ( 50%→25% )
- Mesenteric arterial thrombosis ( 15-25%→40% )
- Non-occlusive ( NOMI ) (5~15%→25%)
- Mesenteric venous thrombosis ( 5-15% )



## Comparison of endovascular intervention and surgery observational study

- 42 endo vs 121 open: **28%** vs 42% (30d mortality) , **39%** vs 58% (1 year mortality)  
J Vasc Surg 2010;52:959-966
- 5237 patients ( 35.5% endo vs 64.5% open): mortality **15.6%** vs 38.6%
- 4665 patients ( 24% endo vs 76% open) : mortality **24.9%** vs 39.3%  
J Vasc Surg 2014;59:159-164
- 439 patients ( 6.2% endo vs 5.2% hybrid, 88.6% open ) : endovascular intervention was associated with decreased mortality ( **OR 0.4,95%CI 0.2-0.9** )  
Am Surg 2015;81:1170-1176

## Comparison of endovascular intervention and surgery a meta-analysis

- Endovascular intervention had **a lower prevalence of bowel resection ( OR 0.37,95%CI 0.23-0.59)**  
Eur J Vasc Endovasc Surg 2017;53:460-510
- Endovascular intervention was associated with **a lower prevalence of bowel resection ( OR 0.45,95%CI 0.34-0.59)**  
**30-d mortality ( OR 0.45,95%CI 0.34-0.59)**

## Hybrid

- **Retrograde open mesenteric stenting (ROMS)**  
shorter ROMS vs open: **189** vs 302 min  
patency ROMS **76~88%**

Vasc Surg 2020; 72:1260-1268  
Surg Pract Sci 2020  
J Vasc Surg 2018; 68:470-480

# Treatment strategy

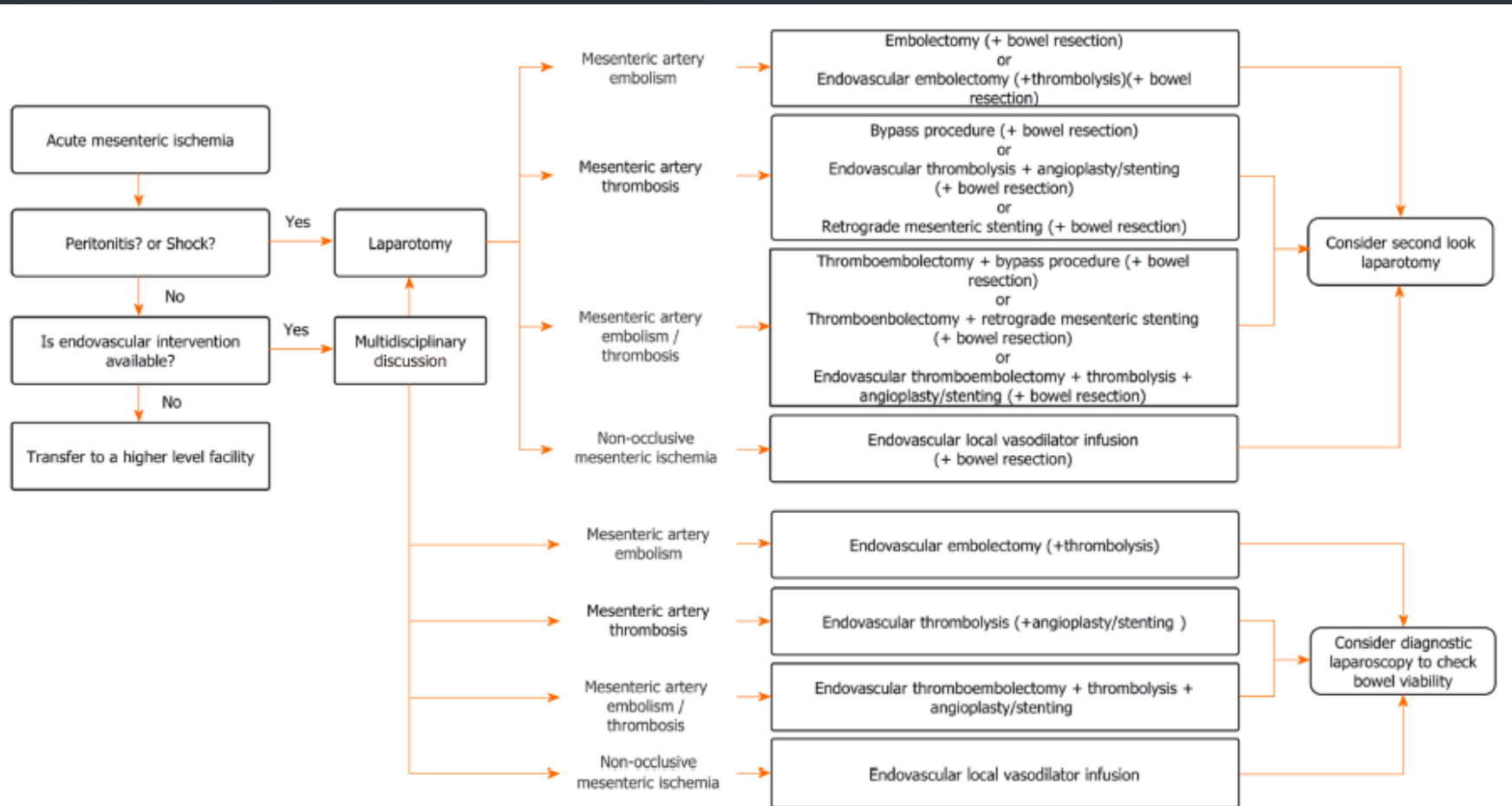




Figure 1 Algorithm for the management of patients with acute mesenteric ischemia.

# Prediction of need for bowel resection

ORIGINAL ARTICLE

 **AGSurg** Annals of Gastroenterological Surgery Open Access **WILEY**

## Prediction of need for bowel resection in acute superior mesenteric artery occlusion: A retrospective study of 48 Japanese patients

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Tatsuya Shimogawara<sup>6</sup> | Yuko Kitagawa<sup>2</sup>

## 茂木分類

- **A型(高位完全虚血型)**; MCA,RCA,J3レベルでの閉塞。側副血行路が期待できず、腸管壊死のゴールデンタイムは5時間以内。血栓溶解療法はこの時間を超えては危険
- **B型(中間位不完全虚血型)**: ICA,IA分岐レベルでの閉塞。ゴールデンタイム10~12時間を超えても血栓溶解療法が可能
- **C型(末梢血流不全型)**; 回腸末端の辺縁動脈の閉塞。症状があれば、切除術の適応

## ▶ The retrospective study

- Jun. 2009 – Aug 2018.
- Five general hospitals in Japan
- 48 patients diagnosed with acute SMA occlusion
- Proximal occlusion ( the main trunk-MCA )  
Distal occlusion ( MCA- )
- BRN group vs non-BRN group

TABLE 1 Demographics, clinical presentation, etiology, and preoperative laboratory results of 48 patients with superior mesenteric artery occlusion

	Overall	BRN group	Non-BRN group	P-value
N	48	28	20	
Age (y)	82.50 (10.22)	82.75 (10.09)	82.15 (10.65)	.844
Male sex	18 (37.5%)	9 (32.1%)	9 (45.0%)	.385
Atrial fibrillation	40 (83.3%)	21 (75.0%)	19 (95.0%)	.116
Peripheral arterial disease	10 (20.8%)	5 (17.9%)	5 (25.0%)	.721
Hypertension	39 (81.2%)	23 (82.1%)	16 (80.0%)	1
Diabetes mellitus	12 (25.0%)	7 (25.0%)	5 (25.0%)	1
Hyperlipidemia	13 (27.1%)	6 (21.4%)	7 (35.0%)	.339
Coronary artery disease	12 (25.0%)	9 (32.1%)	3 (15.0%)	.311
Cerebrovascular disease	15 (31.2%)	8 (28.6%)	7 (35.0%)	.755
History of smoking	26 (54.2%)	16 (57.1%)	10 (50.0%)	.77
Antiplatelet therapy	16 (33.3%)	10 (35.7%)	6 (30.0%)	.763
Anticoagulant therapy	14 (29.2%)	7 (25.0%)	7 (35.0%)	.528
Statin therapy	12 (25.0%)	5 (17.9%)	7 (35.0%)	.198
Abdominal pain	41 (85.4%)	23 (82.1%)	18 (90.0%)	.683
Vomiting	8 (16.7%)	7 (25.0%)	1 (5.0%)	.116
Diarrhea	7 (14.6%)	2 (7.1%)	5 (25.0%)	.111
Cause of occlusion = Embolism/Thrombus	37/7 (84.1%/15.9%)	19/6 (76.0%/24.0%)	18/1 (94.7%/5.3%)	.119
Site of occlusion = Proximal occlusion*	33 (68.8%)	22 (78.6%)	11 (55.0%)	.117
WBC (/ $\mu$ L)	13 629 (5150)	14 139 (4841)	12 914 (5601)	.422
CPK (g/dL)	235.6 (465.4)	280.6 (561.9)	172.6 (282.9)	.434
CRP (mg/dL)	6.54 (10.06)	9.50 (11.69)	2.55 (5.35)	.017
Lactate (mg/dL)	4.35 (2.53)	4.81 (2.78)	3.48 (1.73)	.126
pH	7.40 (0.09)	7.38 (0.06)	7.42 (0.12)	.119
D-dimer ( $\mu$ g/mL)	10.41 (10.65)	12.79 (11.07)	7.52 (9.61)	.111
Time from onset to diagnosis, hours (median [IQR])	13.00 [4.75-24.00]	16.50 [5.75-24.00]	12.50 [3.75-20.25]	.231
Time from diagnosis to intervention, hours (median [IQR]) <sup>b</sup>	3.50 [2.75, 4.00]	3.50 [3.00, 4.50]	3.50 [2.50, 4.00]	.417
Operation time, min (median [IQR])	130.50 [92.25-156.75]	139.50 [108.50-184.25]	113.00 [90.50-131.00]	.045
Estimated blood loss (g) (median [IQR])	100.00 [50.00-287.50]	149.00 [63.50-325.75]	73.00 [50.00-100.00]	.142
CHAD <sub>2</sub> score	3.04 (1.54)	3.04 (1.40)	3.05 (1.76)	.975
CHAD <sub>2</sub> DS <sub>2</sub> -VASc score	5.15 (1.94)	5.25 (1.71)	5.00 (2.25)	.664
In-hospital death	15 (31.2%)	11 (39.3%)	4 (20.0%) <sup>c</sup>	.212

# demographics



# Multivariable logistic regression model

TABLE 3 Multivariable logistic regression model for predicting whether bowel resection is required in patients with acute superior mesenteric artery occlusion

Variables		OR	95% CI	Beta coefficient	SE of Beta coefficient	P-value
Time from onset to diagnosis (hour)	Continuous	1.04	0.99-1.09	0.037	0.024	.115
Proximal occlusion	No	Ref	—	—	—	—
	Yes	4.46	1.08-18.34	1.494	0.722	.039
Intercept	—	—	—	-1.309	0.784	.095

Note: Logistic regression formula: Score (linear predictor) =  $0.037 \times$  Time from symptom onset to diagnosis (hour) +  $1.494 \times$  Proximal occlusion (Yes = 1, No = 0) - 1.309.

The threshold of the linear predictor was 0.315, with a sensitivity of 78.6% and specificity of 55.0%.

Example 1 Using this model, it can be determined with 78.6% probability that bowel resection is not necessary for cases of proximal occlusion within 3.5 h.

Example 2 It can be determined with 78.6% probability that bowel resection is not necessary for cases of distal occlusion within 43.6 h.

Abbreviations: CI, confidence interval; OR, odds ratio; SE, standard error.

## Predictive model for determining the needs for bowel resection in patients with SMA occlusion

Time from onset to diagnosis (hour)

Presence of Middle colic artery (MCA) occlusion

Yes

No

Predicted rate of need for bowel resection is 63.6 %

Judgement: Bowel resection is likely to be needed (sensitivity 78.6%, Specificity 55.0%)

[https://okui.shinyapps.io/sma\\_bowel\\_resection\\_predictor/](https://okui.shinyapps.io/sma_bowel_resection_predictor/)

## Summary

- AMIを疑ったら、CTA
- 明らかな腹膜炎は試験開腹または審査腹腔鏡
- 身体所見にそぐわない強い腹痛は要注意
- 病歴が大事
- あてになる採血はlactateとD-dimer
- AMIと診断したら、蘇生輸液、NG、抗生剤、ヘパリン
- 手術はDCS、方法はhybridがこれからの主流かな