Clinical spectrum and surgical management of acute mesenteric ischaemia in Singapore

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ABSTRACT

Introduction: Acute mesenteric ischaemia (AMI) is a surgical emergency with a dismal prognosis. Much of the literature concerning this condition is from the West. This study aims to present a single-centre Asian experience of management of patients with AMI and the immediate outcome following surgical treatment.

Methods: This is a retrospective study of patients managed for AMI in our department between 1990 and 2003. The data was obtained from a prospectively-collected surgical database as well as from clinical case records.

Results: 65 patients were managed by our department for AMI over 14 years. The median age of this patient group was 69 years, with a high prevalence of cardiovascular diseases. The majority of patients presented with abdominal pain, distension and vomiting. The commonest subtype of AMI was caused by mesenteric arterial occlusion; this subtype also had the highest in-hospital mortality. Our overall in-hospital mortality for all 65 patients was 55.4 percent.

Conclusion: Clinical suspicion, especially in a patient with the relevant risk factors, remains the mainstay of appropriate early management of AMI. Our patient demographics, coexistent diseases and commonest subtype of AMI were similar to that reported in the Western literature. In this paper, we also suggest a management algorithm for patients with suspected AMI.

Keywords: acute abdomen, acute mesenteric ischaemia, mesenteric arterial occlusion, surgical emergency

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INTRODUCTION

The clinical outcome of patients with acute mesenteric ischaemia (AMI) is dismal. 45 studies over 37 years reviewed by Schoots et al showed a consistent overall mortality of over 50%.[1] As it is an uncommon condition, even in large centres, there is often a delay in the diagnosis of AMI as a cause of acute abdomen. This narrows the window of opportunity for surgical revascularisation and salvage, resulting in poor treatment outcomes. The high mortality of this surgical emergency is also due in part to the fact that it occurs more frequently in the elderly population[1-5] and those with underlying cardiovascular diseases.[2,3,5] There is a paucity of data on AMI from an Asian perspective. Of the 45 studies that Schoots et al reviewed, only one was based in Asia.[6] The aim of this paper is to present a single-centre Asian experience of management of AMI and the immediate outcome following surgical salvage. This will be compared with Western literature, and lessons learnt from this experience will be highlighted.

METHODS

This is a retrospective study of patients managed in the Department of General Surgery, Singapore General Hospital, between 1990 and 2003 for AMI. The essential data was obtained from a prospectively-collected surgical database as well as from the clinical case records, and included patient demographics, comorbidities, pre-operative investigation results, treatment details and outcomes. Patients were excluded when the cause of bowel ischaemia was due to a mechanical obstruction of blood supply rather than an intrinsic vascular pathology. As such, patients with volvulus, strangulated hernia and adhesion bands causing bowel ischaemia were excluded. In total, 65 patients fulfilled our criteria and were included in this study.

The cause of bowel ischaemia was classified into mesenteric arterial occlusion, mesenteric venous occlusion, non-occlusive mesenteric ischaemia and an indeterminate group if findings were not conclusive. This was determined from radiological investigations, intraoperative assessment of mesenteric vascular supply and histological findings. The statistical analysis was carried out using the Statistical Package for Social

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Sciences version 13.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

65 patients were managed for AMI from 1990 to 2003 by our department. The median age was 69 (range 27–91) years. The demographical distribution of our patients and their comorbidities are shown in Tables I and II, respectively. Hypertension, ischaemic heart disease and diabetes mellitus were the three most commonly-associated medical conditions. A history of atrial fibrillation (AF) was present in 28.8% of the patients. All 65 patients were symptomatic at presentation, with abdominal pain (92.3%), abdominal distension (66.2%) and vomiting (43.1%), alone or in combination. The classical description of gastrointestinal bleeding was present in only 11 patients – nine had fresh per rectal bleeding while two had melaena. 26.2% of the patients presented with shock, with a systolic blood pressure below 100 mmHg. On examination, 69.2% showed signs of peritonism – 47.7% had local peritonism while 21.5% had generalised peritonism. The spectrum of clinical presentation is depicted in Table III.

Abnormalities in the preoperative blood test results are tabulated in Table IV. In 26 patients, laparotomy was performed without further investigations or interventions. The remaining 39 patients had additional investigations before definitive intervention – the results of these investigations are summarised in Table V. Colonoscopy was performed for three patients – two of them presented with fresh per rectal bleeding while the third had abdominal distension and diarrhoea. Of these three patients, only two had a colonoscopic diagnosis of bowel ischaemia. The underlying causes of AMI are summarised in Table VI. The majority of the patients had mesenteric arterial occlusion due to either thrombosis or embolism. In seven patients, the cause of AMI was not clearly identified.

Extensive bowel gangrene involving the distribution of the superior and inferior mesenteric arteries was considered unsalvageable, and these patients were treated conservatively. In those cases where there was limited bowel infarction or when the bowel was still viable, revascularisation and/or resection of gangrenous bowel was carried out. Dusky-looking bowel of questionable viability was left intact, and a second-look laparotomy was carried out within 24 hours for further assessment. Table VII shows the in-hospital mortality according to the various forms of treatment instituted. 42 of the 65 patients (64.6%) underwent bowel resection, either during the first or subsequent laparotomy. 45.2% of these patients died as inpatients. Eight of the 65 patients underwent a revascularisation procedure at laparotomy. Three of the five who underwent embolectomy and all three who underwent grafting were well at discharge.

15 patients had very extensive infarction of both the small and large intestines and no further surgical treatment was undertaken. All of them died within the same hospital admission. The overall in-hospital mortality for our 65 patients with AMI was 55.4%. Of the patients who were discharged alive, the median time spent in the intensive care unit was five (range 0–27) days. The median duration of hospital stay was 19 (range 6–85) days. Major complications occurred in 43.3% of the patients who were subsequently discharged. These comprised sepsis (8), bleeding of the gastrointestinal tract (2), acute myocardial infarction (2) and respiratory failure (1).

Table I. Demographics of patients managed for AMI.

Patients	No. (%) (n = 65)
Gender	
Male	36 (55.3)
Female	29 (44.6)
Race	
Chinese	46 (70.8)
Malay	11 (16.9)
Indian	7 (10.8)
Others	1 (1.5)

Table II. Comorbidities of patients managed for AMI.

Comorbidity	No. (%) (n = 65)
Hypertension	39 (60.0)
Ischaemic heart disease/congestive cardiac failure	38 (58.5)
Diabetes mellitus	23 (34.8)
Atrial fibrillation	19 (28.8)
Chronic renal impairment/end-stage renal disease	17 (25.8)
Peripheral vascular disease	12 (18.2)
Cirrhosis	5 (7.6)

Table III. Clinical presentation of patients managed for AMI.

Clinical presentation	No. (%) (n = 65)
Abdominal pain	60 (92.3)
Vomiting	28 (43.1)
Diarrhoea	19 (29.2)
Abdominal distension	43 (66.2)
Gastrointestinal bleeding	11 (16.9)
Fever	30 (46.2)
Tachycardia	38 (58.5)
Localised peritonism	31 (47.7)
Generalised peritonism	14 (21.5)
Preoperative documented hypotension	17 (26.2)

Table IV. Blood investigation results of patients managed for AMI.

Blood investigation	No. (%) (n = 65)
Neutrophilic leucocytosis	49/65 (75.3)
Hyperamylasaemia	22/55 (40.0)
Low serum bicarbonate	26/34 (76.5)
High serum lactate dehydrogenase	25/26 (96.2)

Table V. Further investigations done for the patients with AMI.

Type of investigation	No. of patients whose results suggested AMI (%)
Computed tomography	15/31 (48.4)
Angiography	4/5 (80.0)
Colonoscopy	2/3 (66.7)

Table VI. Subtypes of AMI among the patients.

AMI subtypes	No. (%) (n = 65)	In-hospital mortality (%)
Mesenteric arterial occlusion	43 (66.2)	60.5
Mesenteric venous occlusion	6 (9.2)	33.3
Non-occlusive mesenteric ischaemia	9 (13.8)	55.6
Indeterminate cause	7 (10.8)	42.9

Table VII. Types of surgery performed for the patients with AMI.

Surgery type	No. (n = 65)	In-hospital mortality (%)
Conservative	15	15 (100)
Bowel resection	42	19 (45.2)
Revascularisation	8	2 (25.0)

DISCUSSION

AMI has a poor survival outcome, if treatment is not rendered expeditiously. Diagnosis of this surgical emergency often requires a high index of clinical suspicion. Knowledge of risk factors for AMI helps in early diagnosis. Risk factors for AMI in our cohort are similar to those reported in Western literature.[1-3,7] These include a male preponderance, advanced age and concomitant cardiovascular disease. Our patients, on average, were in the seventh decade of life. 42 of our 65 patients (64.6%) had a history of cardiac and vascular diseases. Other risk factors for cardiovascular diseases, such as hypertension and diabetes mellitus, were also common underlying illnesses in these patients, which contributed to the poor outcome. The proportion of our patients with AF (28.8%), which is another known risk factor, was also similar to that reported in Western literature.[2]

Eight of our 65 patients were below 50 years of age. Of these, the possible predisposing causes were dehydration due to diabetic ketoacidosis (2), advanced malignancy on chemotherapy (1), myeloproliferative disorder (1) and homocystinuria (1). Three of them had no known predisposing factors. While mesenteric ischaemia has been associated with cocaine abuse in the Western literature,[8–10] no such association was noted in our patients. The likely reason is that cocaine abuse is very uncommon in Singapore and drug screening was not done for our young patients presenting with suspected mesenteric ischaemia. Other rarer predisposing factors such as use of oral contraceptives[11] and Buerger's disease [12] were also not noted in our patients.

In a similar study by Park et al,[2] all the studied patients presented with abdominal pain, while 35% had diarrhoea, 35% had vomiting and 16% had fresh blood per rectum. Five of our patients did not complain of abdominal pain at presentation; diarrhoea (2), vomiting (1), abdominal distension (1) and pyrexia (1) were their chief complaints. The proportion of our patients presenting with fresh bleeding per rectum was 13.8%, similar to the results obtained by Park et al. Although fresh bleeding per rectum is most often associated with large bowel ischaemia,[13] interestingly, only two of our nine patients with fresh per rectum bleeding had large bowel ischaemia. The reason for this discrepancy is that our unit manages far fewer patients presenting with fresh rectal bleeding than expected for acute general surgical units. This is because most of the patients with fresh per rectal bleeding at presentation are referred to the specialised colorectal department within our hospital.

The results of our blood investigations support the findings published in other studies. They should be used to guide the clinician towards the diagnosis, but are not by themselves diagnostic.[6,14–16] Based on our results, neutrophilic leucocytosis, raised serum lactate dehydrogenase level and low serum bicarbonate level make the diagnosis of AMI likely in patients with a classical clinical presentation. However, these blood results are dependent on the degree of bowel ischaemia. The blood results are likely to be suggestive of AMI only during late disease when gangrene is imminent. By then, the prognosis of the patient would have worsened too. This reinforces the greater importance of clinical suspicion of AMI over positive laboratory markers.

Currently, abdominal angiography is the investigation of choice in suspected AMI,[17,18] unless an emergency laparotomy is clinically warranted. Among the five patients for whom abdominal angiography was performed, one patient had a negative radiological result for AMI. However, a subsequent laparotomy revealed non-occlusive mesenteric ischaemia (NOMI) in this patient and he underwent resection of a segment of small bowel. A possible reason for this case

of NOMI not being picked up by angiogram is that the involved vessel may have undergone transient vasospasm, which caused bowel ischaemia that had resolved by the time the angiogram was performed.

Of the patients for whom computed tomography (CT) scan was done, 48% had radiological features suggestive of AMI – this value lies between other reported diagnostic accuracy values of 26%[19] and 75%.[20] CT features noted in our patients with AMI included visualisation of thrombosis or embolus, intramural gas, thickened bowel wall and focal/diffuse bowel dilatation. The diagnostic accuracy of CT for mesenteric venous thrombosis (MVT) is known to be high.[18] Of our patients with MVT, three of them had preoperative CT performed. In two of them, CT was confirmatory for MVT, based on visualisation of a thrombus in the mesenteric vein. The importance of this is that based on the CT finding of MVT, a laparotomy can be avoided as uncomplicated MVT can be treated by anticoagulation.[21] Despite the relatively low accuracy in using CT to diagnose AMI, CT still has an important preoperative role in ruling out other causes of abdominal pain.[19] However, in our department, the decision to perform an exploratory laparotomy for suspected AMI rests primarily on clinical features rather than results of investigations.

The commonest subtype of AMI in our pool of patients is that of mesenteric arterial occlusion, either thrombotic or embolic. This is followed by NOMI and mesenteric venous occlusion. This order of frequency is similar to that noted by other studies,[6,22] including Schoots et al's international review.[1] However, as our study population does not include patients who were treated by anticoagulation without surgery, the number of patients with mesenteric venous occlusion may be an underestimate. Our overall in-hospital mortality (55.4%) is lower than the overall mortality rate of 73.9% obtained by Schoots et al in his review.[1] As with Schoots et al's data, our in-hospital mortality is lowest for AMI caused by mesenteric venous occlusion. In this subset, the area of intestinal ischaemia is often less and hence the extent of bowel resection is limited,[23] even if the patient requires surgery. If anticoagulation is instituted early, irreversible bowel necrosis can be avoided. Furthermore, the proportion of arteriopaths in this subset is likely to be lower than in the other two subsets, as the predisposing pathology is impaired coagulation rather than a general arterial wall disorder. This explains the better outcome in these patients. As shown in Table VII, the in-hospital mortality was significantly lower for patients who met the criteria for revascularisation and underwent the procedure intraoperatively.

Our department's current approach to management of AMI is summarised in Fig. 1. The initial management of patients with suspected AMI of all types is similar, i.e. restoring haemodynamic stability, ensuring adequate replenishment of intravascular volume, correcting metabolic acidosis, controlling cardiac arrhythmias, and preventing or treating sepsis with broad-spectrum antibiotics.[24,25] A patient who is strongly suspected to have AMI clinically, with underlying AF, will be subjected to

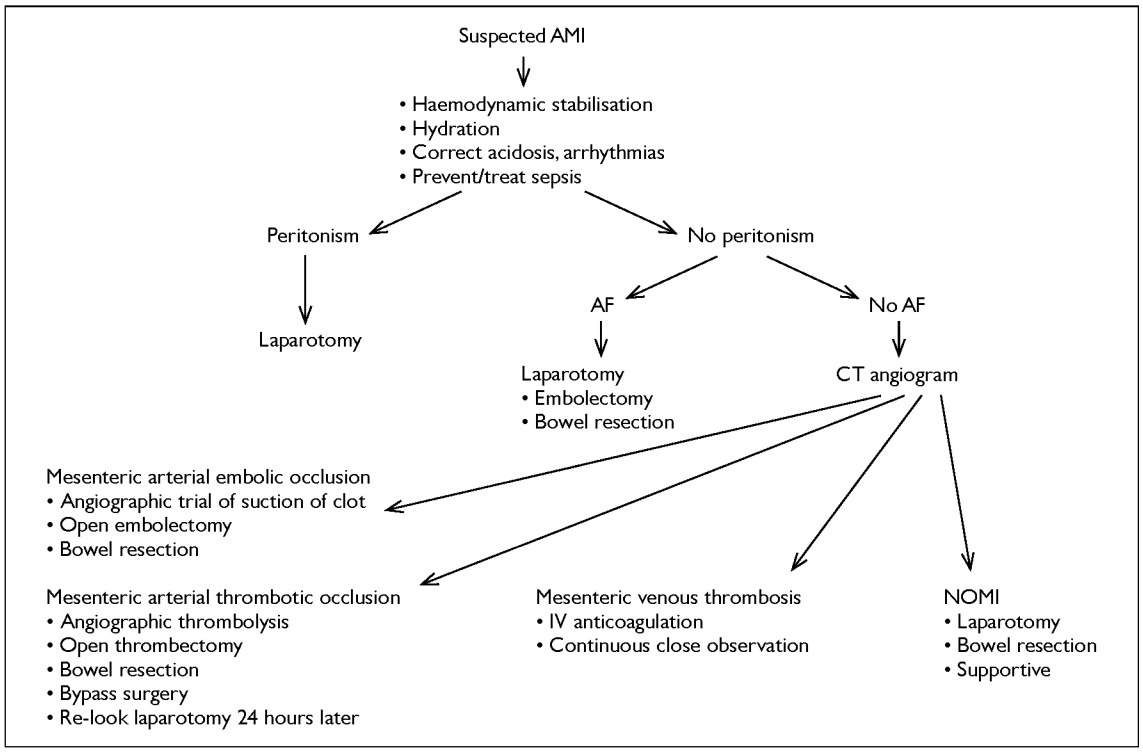

Fig. 1 Management algorithm for management of a patient with suspected AMI.

an exploratory laparotomy, as the most likely pathology is mesenteric arterial embolic occlusion.[18,24] CT may be used if clinical suspicion remains equivocal. Intraoperatively, embolectomy is performed, and the state of the bowel will determine the need for bowel resection. The aim of postoperative long-term management is prevention of further embolic events with the use of an anticoagulant like warfarin.[24]

If the patient has no AF, a CT angiogram should be performed. If the CT angiogram demonstrates mesenteric arterial thrombotic occlusion, the interventional radiologist may attempt thrombolysis and angioplasty to establish revascularisation. Failing this, laparotomy will be necessary for revascularisation and/or bowel resection.[24,25] If the CT angiogram shows the cause of occlusion to be mesenteric arterial embolic occlusion, the interventional radiologist may attempt a trial of suction of clot. Alternatively, an open embolectomy will be performed as mentioned above.[24] Should the patient demonstrate mesenteric venous occlusion without any signs of peritonism, anticoagulation therapy is commenced. The patient is then reviewed regularly to monitor for signs of peritonism. Long-term warfarin therapy should also be commenced.[24,25]

Management of NOMI is dependent on the following factors:

Predisposing disease: Often, the patient with NOMI is very ill. If the chance of recovery from the predisposing disease is deemed lower than that of recovery from a surgery to treat the NOMI, surgery may not be advised.

Fitness for surgery: Often, the patient with NOMI has medical comorbidities, which reduce his fitness for operation. This needs to be taken into account before undertaking any surgery.

Extent of disease: If the length of bowel that will remain after resection of non-viable segments is expected to be too short for acceptable bowel function, based on radiological evidence or intraoperative assessment, palliative measures may be advised rather than resection.

If NOMI was diagnosed during CT angiogram, the interventional radiologist can attempt trial of vasodilator infusion. Otherwise, surgery for NOMI consists mainly of resection of non-viable bowel. At any time during the clinical course, if clinical or radiological signs of peritonism appear, a laparotomy is to be performed to prevent the risk of intestinal perforation due to transmural infarction.

In summary, proper history-taking, including coexisting medical conditions, is essential for a clinical suspicion of AMI. AMI should always be considered as a differential diagnosis in a patient with the relevant risk factors presenting with a classical picture of "pain out of proportion to clinical signs". Blood results should be used to guide the diagnosis. Our results are similar to those reported in the Western literature. Our typical patient with AMI was in his seventh decade of life, had the risk factors of ischaemic heart disease, diabetes mellitus, AF and hypertension, and was most likely to have mesenteric arterial occlusion as the underlying pathology. Despite our department's emphasis on the high index of clinical suspicion needed for diagnosing AMI early, our in-hospital mortality is still more than 50%, similar to most other results from various overseas institutions. A departmental protocol, using our management algorithm, for all patients suspected of AMI would be useful in the management of such patients.

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