



A RETROSPECTIVE CASE SERIES ON MESENTERIC ISCHEMIA- AN OVERLOOKED SURGICAL EMERGENCY

General Surgery

Dr. Akshay Nagwani

Resident, Dept. of General Surgery, MGM Medical College and Hospital, Navi Mumbai

Dr. Vasvi Sharma*

Resident, Dept. of General Surgery, MGM Medical College and Hospital, Navi Mumbai
*Corresponding Author

Dr. Mukesh Soni

Assistant Professor, Dept. of General Surgery, MGM Medical College and Hospital, Navi Mumbai

Dr. Preeti Deshpande

Assistant Professor, Dept. of General Surgery, MGM Medical College and Hospital, Navi Mumbai

KEYWORDS

Acute mesenteric ischemia (AMI) is caused by sudden obliteration of the blood supply to the intestine, ultimately leading to intestinal necrosis, and death if left untreated⁽¹⁾. AMI may be occlusive or non-occlusive (NOMI), with the incidence rate of **mesenteric ischemia** secondary to **superior mesenteric artery** occlusion being **8.6/100 000/year**. Embolism is a cause of SMA occlusion in 70% of cases and thrombosis in 30% of cases.⁽²⁾ The annual **incidence** of mesenteric ischemia is approximately 5.5% per 100,000 individuals. The **incidence** due to non-occlusive mesenteric ischemia is 2/100,000 persons and 1.8/100,000 per person due to **mesenteric venous thrombosis**. The overall incidence of patients diagnosed as mesenteric ischemia, of all acute admissions to emergency departments is about 0.09–0.2%^(3,4,5). Lastly, it is essential to have a focused multidisciplinary approach based on early diagnosis and individualized treatment.

In earlier days, open surgery was considered as the option for the treatment of AMI, but recently with the advancement in endovascular therapy, the treatment modalities have changed and have been shown to reduce the rates of mortality and bowel resection as compared to the open approach.^(6,7,8)

In addition, with the improvement in post-operative care, the outcomes have become better for patients with short bowel syndrome.^(9,10) There are four types of AMI, acute mesenteric arterial embolism, acute mesenteric arterial thrombosis, non-occlusive mesenteric ischemia, and mesenteric venous thrombosis.

Acute Mesenteric Arterial Embolism:

Mesenteric emboli can originate from the left ventricle, left atrium, or cardiac valves. Occasionally, an embolus can get dislodged from an atherosclerotic plaque. SMA is commonly affected because of the large take-off angle and a large diameter from the aorta. In majority of the cases emboli lodge 3-10cm distal to the origin of SMA, thus sparing the proximal jejunum and colon.⁽¹¹⁾

Acute Mesenteric Arterial Thrombosis

A pre-existing chronic atherosclerotic disease usually forms a thrombus in the SMA which may lead to stenosis. Patients with chronic mesenteric ischemia, present with weight loss, food fear and post-prandial pain. The underlying plaques in the SMA progress eventually to critical stenosis that results into collateral beds. The causes of SMA thrombosis include vasculitis, mesenteric dissection, mycotic aneurysm.⁽¹²⁾

Acute Non-occlusive Mesenteric Ischemia

SMA vasoconstriction associated with low splanchnic blood flow leads to acute non-occlusive mesenteric ischemia.⁽¹³⁾ Involvement of ileocecal artery usually affects the proximal part of the colon. The condition worsens with hypovolemia and the use of vasoconstrictive agents.

Mesenteric Venous Thrombosis

Accounts for less than 10% of the cases of mesenteric infarction. An

inflammatory process around the SMV due to causes such as acute pancreatitis or an inflammatory bowel disease may lead to thrombosis. Other causes include surgical trauma such as bariatric surgeries, splenectomy can lead to SMV thrombosis. Hypercoagulable conditions like Factor V Leiden, deficiency of Protein C & S, Antithrombin deficiency, and antiphospholipid syndrome also cause SMV thrombosis.

Recent studies suggest that TPA (tissue plasminogen activator) fibrinolysis shutdown, is a significant risk factor for hypercoagulability.⁽¹⁴⁾

The incidence of AMI increases exponentially with age.⁽¹⁾ Covid 19 shows association with the causation of AMI probably due to large vessel thrombo-embolic events as well as to small vessel thrombosis. This leads to hypercoagulability and fibrinolysis shutdown.⁽¹⁵⁾ Severe covid 19 infections and AMI have a poor prognosis, delay in diagnosis and intervention.^(16,17,18) In Covid 19 patients presenting with nausea, vomiting, diarrhea, abdominal pain and abdominal distension, AMI should be suspected because of hypercoagulability and hypoperfusion in these cases.

This case paper discusses about the clinical presentation and outcome of the patients presenting with abdominal complaints and diagnosed as mesenteric ischemia. The diagnosis of acute mesenteric ischemia remains difficult due to nonspecific symptoms of this condition. Early diagnosis is therefore important to decrease the rate of morbidity and mortality and for successful management.

Case Presentation 1 :-

A 36 years old gentleman came to our casualty with complaints of severe abdominal pain with distension since 4 days, 5-6 episodes of coffee coloured vomiting since 4 days and recent onset constipation. Patient was a chronic smoker and alcoholic, consuming around 12-15 cigarettes per day for around 10 years. He also gave a history of right lower limb DVT 5 years back for which he was started on anticoagulants but stopped his medication midway without consulting a doctor. On arrival, patient was tachycardiac and normotensive with per abdominal findings being a tense, gauged abdomen, with absent bowel sounds. Per rectal examination was normal. Patient was initially resuscitated and was planned for CECT of the abdomen which showed filling defect in the superior mesenteric vein extending into the portal vein, prior to bifurcation small bowel walls appear thickened and edematous and shows mild enhancement findings suggestive of mesenteric ischemia secondary to venous thrombosis. The patient was immediately given a bolus of unfractionated low molecular weight heparin.

The decision to explore the patient surgically by a laparotomy was taken and intraoperatively around 1500ml of serous reactionary fluid was drained after opening abdomen. Multiple adhesion with gangrenous changes were seen in the jejunal loops. Around 100 cm of bowel was gangrenous and a resection was attempted 50cm distal to DJ flexure up to the distal ileum leaving behind 20 cm of distal ileum

which appeared healthy. After resection a jejunostomy and an ileostomy was done and the abdomen was closed. Patient tolerated the procedure well and was kept in intensive care unit for observation.

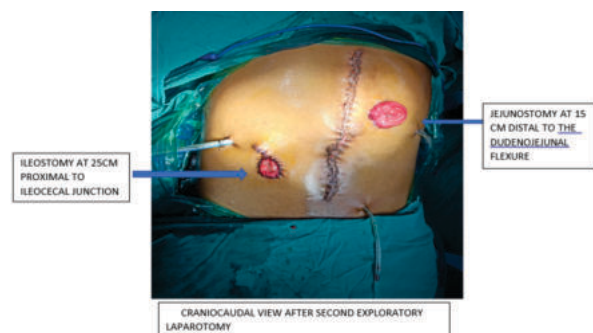
Patients clinical condition deteriorated on the second postoperative day and was tachycardiac with hypotension. The stoma was non-functional and had dusky gangrenous changes. Patient was planned for a re-exploration under high risk and on exploring, 40cm of jejunal loop was found to be gangrenous. Resection of gangrenous segment was done with around 10cm of a jejunal loop left behind from DJ flexure and was brought out as a stoma. The patient tolerated the procedure well and was shifted to the intensive care unit postoperatively. Heparinization of the patient was continued. There was an improvement in patient's clinical condition and the stomas were functional. The patient was started on total parenteral nutrition on day two to supplement nutrition and was discharged on the postoperative day 8 on apixaban.



Gangrenous Jejunal Loops With Adhesions On Initial Exploration



Gangrenous Jejunal Loops On Reexploration



Case Presentation 2 :

A 28 years old, young gentleman was brought to the MGM hospital casualty on 9th of June, 2022 with the complaints of constipation since 5 days, severe pain in abdomen and vomiting since 1 day. Patient was a chronic smoker, consuming 10 cigarettes per day for 10 years and also an alcoholic, consuming alcohol from the past 10 years. Surgical history of the patient revealed an appendectomy done 5 years back. On arrival, patient was tachycardiac with hypotension. On per abdominal examination:- abdomen was distended, generalised tenderness with guarding was present, bowel sounds were absent. Per rectal examination had ballooning present with no blood stains on glove or palpable mass. Patient was initially resuscitated in the casualty. X-ray abdomen in a standing position was done which was suggestive of multiple air-fluid levels, USG of the abdomen was suggestive of intestinal obstruction with moderate free fluid in the abdomen. CECT abdomen was suggestive of acute small bowel obstruction involving the distal jejunum and the ileal loops, thrombus in the SMA distally at the level of the isthmus of the horseshoe kidney, and gross ascites. The patient was taken up for emergency exploratory

laparotomy. Intra-operatively, around 800ml of haemorrhagic fluid was drained, the bowel was inspected and there were multiple adhesions with dusky pre-gangrenous changes distal to the DJ flexure up to the IC junction with 10cm of a gangrenous segment of the jejunum which was around 30cm distal to the DJ flexure. A stricture was present around 10cm from the IC junction. Pre- gangrenous changes were present throughout the bowel from the DJ flexure to the IC junction. Initially, warm saline mops were kept over the intestinal loops and high-flow oxygen was given to the patient. The viability of the bowel was restored except for the gangrenous segment which was resected and jejunostomy was done. The patient was then shifted to ICU on inotropic supports in an intubated state and started on higher antibiotics. Overnight the patient could not maintain the blood pressure and so the inotropic supports were increased to the maximum dosage. The patient collapsed the next day and could not be revived.



Gangrenous jejunal loop with pre-gangrenous changes of the bowel

Case Presentation 3 :

A 38 years old gentleman came to the MGM Hospital casualty with a complaint of severe lower abdominal pain lasting since one day, constipation since one day and multiple episodes of vomiting since one day. Patient had a past history of femur fracture of both the lower limbs following which he developed deep vein thrombosis for which he was started on anticoagulants, but stopped taking the prescribed medicines without any consultation. On arrival the patient was tachycardiac and hypotensive. Per abdominal examination revealed generalized tenderness with absent bowel sounds. Initial resuscitation was done in the casualty and the patient was taken up for CECT of the abdomen after stabilization which was suggestive of a filling defect in the superior mesenteric vein and a thickened, oedematous small bowel. Anticoagulation therapy with heparin was started.

Patient was shifted to the operation theatre for exploration. Intra-operatively, a 15cm gangrenous segment of ileum, 40cm proximal to the IC junction was seen for which resection of the segment with ileostomy was done. Patient tolerated the operation well and was discharged with the stoma on anticoagulants.

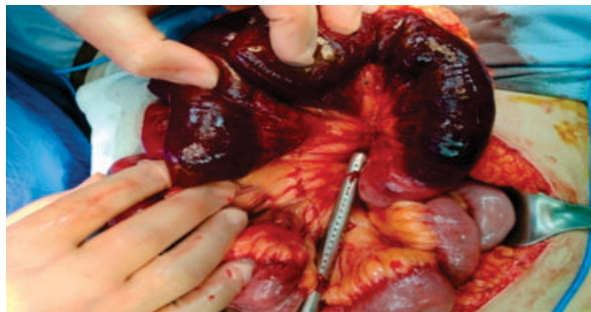


Gangrenous Segment Of The Ileum

Case Presentation 4:

A 56 years old gentleman presented to the casualty with a complaint of pain in the abdomen, obstipation, persistent vomiting and bleeding per rectum while passing stools since 2 days. On examination, patient was tachycardiac and hypotensive. Abdominal examination revealed a generalised tense and a guarded abdomen. On per rectal examination,

there was blood stain on gloves with soft stools, no ballooning, anal fissure, hemorrhoids. Patient was resuscitated and a CECT abdomen was done which was suggestive of filling defect in branches of superior mesenteric artery with thinning of the small bowel wall and mesenteric stranding. Injection heparin 5000U bolus was given to the patient. The patient and relatives were counseled about the guarded prognosis and the patient was taken up for an emergency laparotomy with the intra-operative findings being a gangrenous jejunal segment of approximately 15cm which was 20cm distal to the DJ flexure. A jejunostomy was done and the patient was shifted to the ICU post-operatively. The patient went into septic shock and later collapsed.



Gangrenous jejunal segment of the small bowel

Case Presentation 5 :-

A 67 years old gentleman was brought to the casualty with complaints of severe abdominal pain and coffee colored vomiting since 2days. Patient was a chronic smoker and had a past history of myocardial infarction 10years back. The patient was also a known case of diabetes mellitus and hypertension. The patient was uncompliant as he did not take the prescribed medication. On arrival, patient was tachycardiac and hypotensive. Per abdominal examination showed generalized tenderness and guarding with a silent abdomen. Per rectal examination was normal. CECT of the abdomen was suggestive of filling defects in the mesenteric artery, absence of wall enhancement, and mesenteric stranding. Heparinization was initiated with a bolus injection of heparin in the casualty pre-operatively. The patient was taken up for an exploratory laparotomy with intraoperative findings being approximately 300ml of serous fluid drained and a gangrenous segment involving the distal jejunum and ileum, approximately 30cm distal to the DJ flexure and 10cm proximal to the IC junction for which resection was done and a proximal jejunostomy with ileostomy was created. The patient was shifted to the ICU post-operatively. The clinical condition of the patient deteriorated on the second postoperative day when he became tachycardiac and hypotensive. The stoma was non-functional and had to be started on inotropic supports. The patient collapsed on the same night and could not be revived.



Gangrenous segment of the ileum

DISCUSSION

Acute mesenteric ischemia is a life-threatening surgical emergency. Early diagnosis and intervention is therefore needed to adequately restore mesenteric blood flow and to prevent bowel necrosis and patient death. Improvements in the imaging technologies in the recent years has led to timely and accurate diagnosis of acute mesenteric ischemia. The prevalence of acute mesenteric ischemia among the patients with acute abdomen may vary from 17.7% in emergency laparotomy and 31% in laparotomy for elderly non-trauma patients.⁽¹⁹⁾

Mesenteric arterial embolism is the most common cause of mesenteric

ischemia with thrombosis being the second most common cause which historically accounts for 20-35% and recently increased to 40%.⁽²⁰⁾ NOMI accounts for 25% of cases.⁽²¹⁾

Patients with mesenteric arterial thrombosis, often present with history of progressive weight loss, postprandial pain. Patients with NOMI have pain which is generally more diffuse and episodic, associated with poor cardiac performance. Patients with Mesenteric venous thrombosis present with nausea, vomiting, diarrhoea, abdominal cramps and gastro-intestinal bleeding occurs in 10% cases.⁽²²⁾ About 50% of the patients presenting with embolic Acute mesenteric ischemia have atrial fibrillation and about one-third of the patients present with a prior history of arterial embolus with pre-existing peripheral vascular diseases.⁽²³⁾

Plain x-ray is not recommended in evaluating patients with intestinal ischemia. (*Strong recommendation based on moderate-quality evidence 1-b*). There are no specific laboratory parameters that accurately help us in the diagnosis of acute mesenteric ischemia. Although D-DIMER, elevated lactates, leucocytosis may be present. (*Weak recommendation based on moderate quality evidence 2-b*)

The second most abnormal finding that is commonly encountered is metabolic acidosis and elevated lactates, occurring in 88% of the cases.⁽²⁴⁾ Lactic acidosis may be due to dehydration and decreased oral intake. Elevated serum lactate levels of more than 2mmol/L is associated with irreversible intestinal ischemia, hazard ratio of 4:1.⁽²⁵⁾ Patients presenting with lactic acidosis in combination with abdominal pain who may not be otherwise appearing clinically ill should be considered for early CT angiography, which is the best modality for diagnosing intestinal ischemia.

Early assessment of d-dimer is recommended as it has been reported to be an independent risk factor for intestinal ischemia⁽²⁶⁾ which reflects the ongoing hypercoagulability and fibrinolysis. Roughly around half of patients diagnosed with acute mesenteric ischemia also have high amylase levels,⁽²⁷⁾ which misleads with the diagnosis and can be confused with acute pancreatitis. Other biomarkers used in the diagnosis of Acute mesenteric ischemia include intestinal fatty acid binding protein, serum alpha glutathione s- transferase, and cobalt albumin binding assay.^(28,29)

CT angiography should be done without delay in patients suspicious of Acute Mesenteric Ischemia (*strong recommendation based on high quality evidence 1-A*). Multi-detector CT Angiography has now replaced formal angiography as a diagnostic study of choice. In advanced Acute Mesenteric Ischemia the CT findings that reflect to irreversible ischemia are - intestinal dilatation and thickness, reduction or absence of visceral enhancement, pneumatosis intestinalis and portal venous gas and free intra-peritoneal air.⁽³⁰⁾

Oral contrast is not indicated and is even harmful in patients with acute mesenteric ischemia. CT Angiography should be performed despite of an acute kidney injury.⁽³¹⁾ In mesenteric venous thrombosis, the most common positive radiological findings and venous phase CT Angiography is thrombus in the SMV which is described as "target sign".⁽³²⁾

Occlusive embolic and thrombotic forms can be differentiated from non- occlusive forms with the help of Diagnostic angiography. In patients with suspected Acute mesenteric ischemia MR angiography is an established technique for evaluation of mesenteric arterial and venous vasculature. It has been widely accepted for chronic mesenteric ischemia cases and for functional assessment of bowel insufficiency as a result of superior mesenteric artery pathology.⁽³³⁾ But its use is limited in emergency setting.

Clinical examination and routine laboratory investigations have a limited value in reaching to the diagnosis of Non occlusive mesenteric ischemia. After the diagnosis of Acute Mesenteric Ischemia is made, fluid resuscitation with crystalloid and blood products is essential for the management. Preoperative resuscitation is important to prevent cardiovascular collapse on anaesthetic induction. A proper haemodynamic monitoring should be implemented.⁽³⁴⁾ A proper assessment of the acid-base status is important, especially in the patients with metabolic acidosis and hyperkalaemia resulting from an underlying bowel infarction and reperfusion.⁽³⁵⁾ The goal of the therapy is to check the physiologic levels of oxygen delivery with monitoring

of the lactate levels which indicates the perfusion improvement. Broad spectrum antibiotics should be immediately administered since intestinal ischemia leads to an early loss of mucosal barrier which facilitates bacterial translocation and increases the risk of septic complications.⁽³⁶⁾

Emergency laparoscopy or a laparotomy should be done in patients who present with an overt peritonitis which helps in re-establishing the blood supply of the ischemic bowel, resection of the non-viable regions and preservation of the viable segments of the bowel. Laparoscopy is feasible as a bedside procedure in the ICU, avoiding the delay for awaiting operating room availability and preventing adverse events during transfer of patients to the operation theatre.^(37,38)

A multidisciplinary approach to Acute mesenteric ischemia involves the revascularisation of the ischemic bowel which can be achieved by embolectomy and angioplasty, which have been proved to be the definitive treatment for SMA emboli. Whereas thrombosis arising from the aorta into the SMA will require a bypass procedure which could be an antegrade approach from the supra-celiac aorta or a retrograde approach from the infrarenal aorta or common iliac arteries. Single vessel revascularisation is usually sufficient in acute setting. Endovascular revascularization procedures are the primary option in cases for arterial occlusion when sufficient expertise is available.⁽³⁹⁾

In NOMI and MVT, full dose anticoagulation therapy should be started in all patients prior to the operation. LMWH bridged to vitamin K antagonists is the preferred method of anticoagulation in conservative management and even in postoperative management of patients with venous thrombosis. Anticoagulants are usually given for 6 months but most of the patients with hypercoagulability should be given lifelong.⁽⁴⁰⁾ The use of systemic intravenous tissue plasminogen activator has been successfully reported⁽⁴¹⁾. Thrombolysis via the SMA is ineffective and associated with high risk of bleeding.⁽⁴²⁾ The role of open surgical thrombectomy in modern practice is uncertain.⁽⁴³⁾

Intraoperative bowel assessment is done to check for the viability of the bowel. If the bowel appears dusky or threatened, temporary closure is done with negative pressure wound therapy device or temporary dressing for a second-look surgery. A clear documentation of bowel length is crucial in every operation. Doppler ultrasonography is a safe, non-invasive technique to measure the blood flow.⁽⁴⁴⁾ Flowmetry with fluorescein dye is currently the accepted standard of clinical care for intraoperative assessment of bowel viability.^(45,46)

A hybrid approach by the retrograde open mesenteric stenting (ROMS) which includes laparotomy and retrograde endovascular revascularization of the superior mesenteric artery is an emerging technique for treatment of AMI with an advantage being shorter operative time and also may avoid the need for a second-look surgery.⁽⁴⁷⁾

Damage control surgery with temporary abdominal closure is an important adjuvant for patients who require intestinal resection allowing the reassessment of bowel viability and in situations of severe abdominal sepsis. (*Strong recommendation based on low-quality evidence 1-b*) DCS is a surgical modality of choice in critically ill patients for physiological and technical reasons. Advanced age is not a contraindication for DCS as good outcomes have been observed.⁽⁴⁸⁾

Most often re-exploration should be done within 24-48 hours and decisions regarding anastomosis, stoma, or additional resection can be made with plans for sequential abdominal closure. Patients with short bowel syndrome following extensive bowel resection should have restoration of digestive continuity in association with hormonal therapy to optimize absorptive function and achieve nutritional autonomy. (*Weak recommendation low-quality evidence 1-c*)

In patients following endovascular stent placement clopidogrel should be given for six months and acetyl-salicylic acid as lifelong maintenance. Patients undergoing revascularisation should undergo surveillance imaging obtained via CTA or duplex USG within 6 months with frequent follow-ups to enable early intervention for recurrent diseases.⁽⁴⁹⁾ Current studies of vascular surgery recommend duplex USG at 1st, 6th, and 12th month after intervention and then annually.⁽⁵⁰⁾

CONCLUSION

Acute Mesenteric Ischemia is a serious surgical emergency. Under higher index of suspicion for diagnosis, is based on the combination of history of a sudden onset abdominal pain, acidosis and organ failure. Such clinical scenarios should prompt for CT Angiography in order to establish diagnosis.

A rapid resuscitation is essential after careful assessment of the CT Angiography. Based on CT Angiography, patient should be explored to check for the bowel viability and for establishment of a vascular flow and resection of a non-viable bowel. A focus should be made more on revascularisation. Recent developments with improvement of early diagnosis have allowed endovascular techniques to be implemented but requires expertise to carry it out. Evidence suggests that the treatment of AMI in dedicated centres using a multidisciplinary approach improves the outcomes.

Abbreviations :

- 1) AMI - ACUTE MESENTERIC ISCHEMIA
- 2) NOMI - NON-OCCLUSIVE MESENTERIC ISCHEMIA
- 3) MVT - MESENTERIC VENOUS THROMBOSIS
- 4) SMA - SUPERIOR MESENTERIC ARTERY
- 5) SMV - SUPERIOR MESENTERIC VEIN
- 6) TPA - TISSUE PLASMINOGEN ACTIVATOR
- 7) CECT - CONTRAST-ENHANCED COMPUTED TOMOGRAPHY
- 8) DJ flexure - DUODENO-JEJUNAL FLEXURE
- 9) USG - ULTRASONOGRAPHY
- 10) IC JUNCTION - ILEO-CAECAL JUNCTION
- 11) CTA - COMPUTED TOMOGRAPHY ANGIOGRAPHY
- 12) MRA - MAGNETIC RESONANCE ANGIOGRAPHY
- 13) LMWH - LOW MOLECULAR WEIGHT HEPARIN
- 14) DCS - DAMAGE CONTROL SURGERY

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