ACTA SCIENTIFIC MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 4 Issue 2 February 2020

Clinical Case Report

# Acute Surgical Abdomen and Acute Mesenteric Ischemia Management

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**DOI:** 10.31080/ASMS.2020.04.0534

**Received:** January 04, 2020

**Published:** January 20, 2020



## Abstract

This lecture consists of a detailed explanation of the abdominal pain and the correct surgical method for its treatment. The acute intestinal ischemic disease has been mentioned in detail in, as it is one of the most dangerous diseases that accompanies a high mortality rate, and in most cases it is not diagnosed except in advanced stages. Re-perfusion, and the subject of performing two-stage surgical work as a new way to treat this disease. Also, D-dimer analysis was mentioned as a diagnostic analysis in the early stages of the disease, and I wish the benefit to everyone who reads this lecture.

**Keywords:** Acute Surgical Abdomen; Abdominal Pain; Visceral Pain

## Introduction

The acute surgical abdomen is an important cause of morbidity and mortality in emergency departments. Therefore, in this lecture, i explained the clinical form in which patients with abdominal pain can review emergency department, Thin i provided a detailed explanation of acute intestinal ischemia with the aim of improving the clinical approach and reducing mortality.

## Physiology of abdominal pain

### Visceral pain

This pain arising from the abdominal, pelvic, and thoracic viscera.

The visceral peritoneum is sensitive to stretch and is innervated by autonomic nerves. Afferent fibers from these sensory receptors travel with sympathetic and parasympathetic fibers to reach CNS.

Visceral pain is generally vague and poorly localized and is generated by stretching of the viscera.

Due to activation of the autonomic nerves system, visceral pain may be associated with warmth, flushing, pallor, and dizziness, visceral pain is poorly localized.

### Somatic pain

This is pain arising from surface structures. The neuro receptors in skin skeletal muscle detect the type and location of the pain very accurately. Abdominal pain arising from the parietal peritoneum is of the somatic type and can be precisely located to the site of the origin.

### Referred pain

In this phenomenon visceral pain is not perceived in the affected viscus but at somatic site some distance from the viscus. Eg testicular pain is felt in the periumbilical area rather than the scrotum.

### Radiation pain

In this phenomenon pain is felt diffusely in and around the region of the affected viscus, in addition to being perceived remotely.

E.g. Ureteric colic radiating to the ipsilateral.

### Peritonism

This pain arising from peritonitis. It can be detected by clinical signs of tenderness, rebound, and guarding. It can be localized or generalized. It is eased by lying still and exacerbated by movement.

## To approach abdominal pain you need

Full history

Clinical abdominal examination

Investigations

Vital signs pulse-bp-temperature

Inflammatory markers cbc crp esr blood group

Urine analysis

Biochemistry urea cr at least amylase tb db alp clotting

Radiology x ray us ct mri endoscopy

Others like ECG abg virology Vidal blood culture immunology

Laparoscopy

Please note in the acute scenario, urgent laparotomy should not be delayed for time consuming tests if the clinical indications for surgery are clear.

Clinical classification of abdominal pain related to time of management.

1. Abdominal pain need immediate intervention.
2. Abdominal pain need intervention within 24 hours.
3. Abdominal need admission and thin surgical management.
4. Abdominal pain need follow up in op to exclude malignancy
5. Abdominal need medical treatment.

## In details

Acute abdominal pain plus shock: In pallor patient oar tic aneurysm tear, or tear of ectopic pregnancy. If the patient is not pallor that mean mostly sepsis, the causes are intestinal obstruction, mesenteric ischemia, necrotic pancreatitis.

Generalized peritonitis, mean perforation: The causes ulcer, diverticulitis, appendicitis, this patients need CT abdomen to exclude acute pancreatitis.

Local peritonitis this include the cases: You can admit the case, investigate the patient and treat according to the cause.

Chronic abdominal pain need us, ct, endoscope to exclude malignancy.

Medical treatment in Keto acidosis, pneumonia, MI.

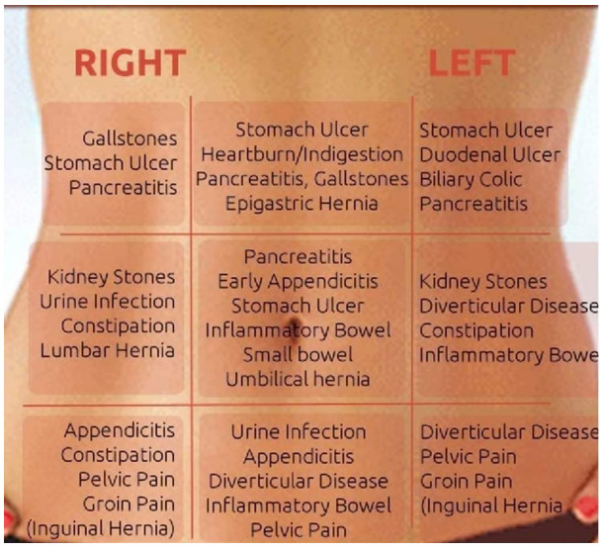



**Figure** a

## Cases of acute abdominal pain

- 50 years DM, HTN patient presented with acute surgical abdomen, diagnosis was delayed, as a result patient got renal failure and died
- Old patient 90 years presented with acute abdominal pain and bile vomiting, diagnosis was acute mesenteric ischemia but patient died because of comorbidity.

So as we saw above acute mesenteric ischemia has bad prognosis and some times need intestinal transplantation so i discussed it in detailed.

## Mesenteric Anatomy

Superior mesenteric artery and its branches.

Collateral from celiac artery via superior and inferior pancreaticoduodenal arteries, as well as from the inferior mesenteric artery.

## Mesenteric physiology

The small intestine is able to compensate 75% reduction in mesenteric blood flow for up 12 hours. Because the blood supply must reduced by more than 50% before the small intestine becomes ischemic.

## Pathology and causes

Acute mesenteric arterial embolism.

This forms 50% of all causes, the sources are atrial fibrillation or aortic atherosclerosis, the majority of emboli lodge to 3to10 cm distal to the SMA thus classically sparing the proximal jejunum and colon.

## Acute mesenteric artery thrombosis

Pathology is stenosis of the artery because of atherosclerotic disease, accordingly, symptomatic SMA thrombosis most often accompanies celiac occlusion. Other causes are: vasculitis, mesenteric dissection, mycotic aneurysm.

## Acute non occlusive mesenteric ischemia

It forms 20%, because of SMA vasoconstriction associated with low blood flow, commonly patient has comorbidity like cardiac failure, and the use of constructive agents.

## Mesenteric venous thrombosis

It forms less than 10%.Thrombosis often happen as a combination of Virchow, striad. Hypercoagulability, reduced blood flow, vascular injury, Causes malignancies, bowel edema in sepsis, portal hypertension, pancreatitis.

## Others like band, volvulus

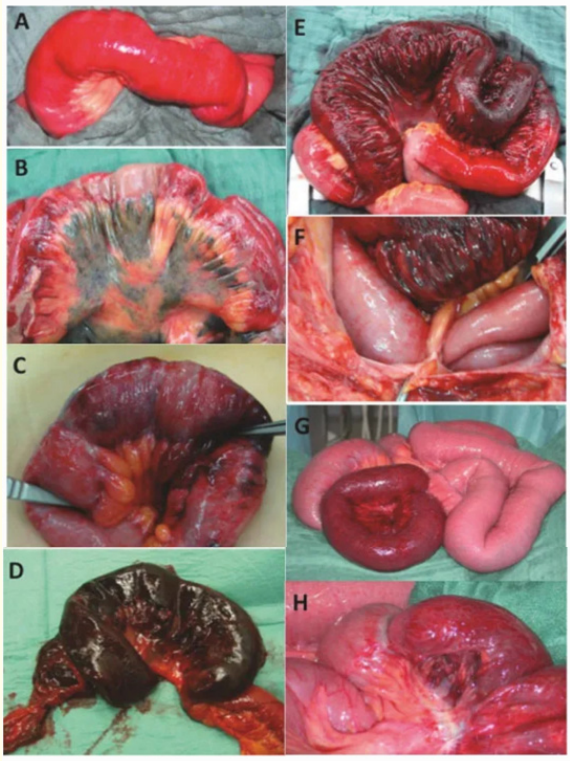
## Clinical picture in early mesenteric ischemia

Sever abdominal pain out of proportion to physical examination findings, plus the symptoms of comorbidity disease like DM, HTN, AF.

## Clinical picture in advanced ischemia

- Acute surgical abdomen plus shock plus comorbidity disease
- And this means irreversible ischemia.
- Also some patient presented with abdominal pain, fever, bloody diarrhea.

A careful history is important because distinct clinical scenarios are associated with the pathophysiological form of AMI. Patients with mesenteric arterial thrombosis often have a history of chronic postprandial abdominal pain, progressive weight loss, and previous revascularization procedures for mesenteric arterial occlusion. Patients with NOMI have pain that is generally more diffuse and episodic associated with poor cardiac performance. Patients with MVT present with a mixture of nausea, vomiting, diarrhea, and abdominal cramping. Gastrointestinal bleeding occurs in 10%.




**Intraoperative causes of pneumatosis intestinalis related to the small bowel.** Limited early small bowel ischemia (A), extended hemorrhagic small bowel infarction (B), small bowel ischemia with partial necrosis (C), gangrenous ileum segment small bowel caused by ischemia (D), necrotic ileum segment (E) due to a bridle stricture (F), ischemic ileum segment (G) and detailed view of G showing a constriction mark as its cause (H).

**Figure** b

Nearly 50% of patients presenting with embolic AMI have atrial fibrillation and approximately one-third of patients have a prior history of arterial embolus.

## Diagnosis and treatment

The gold diagnostic investigation is CTA and D-dimer in early setting.

A radiograph is usually the initial test ordered in patients with acute abdominal pain but has a limited role in the diagnosis of mesenteric ischemia, especially in the early setting. A negative radiograph does not exclude mesenteric ischemia. Plain radiography only becomes positive when bowel infarction has developed and intestinal perforation manifests as free intraperitoneal air.

Although laboratory results are not definitive, they may help to corroborate clinical suspicion. More than 90% of patients will have an abnormally elevated leukocyte count. The second most commonly encountered abnormal finding is metabolic acidosis with elevated lactate level, which occurred in 88%.

Patients may present with lactic acidosis due to dehydration and decreased oral intake. Thus, differentiation of early ischemia versus irreversible bowel injury based upon the lactate level alone is not reliable unless accompanied by other clinical evidence. Elevated serum lactate levels >2 mmol/l was associated in irreversible intestinal ischemia (Hazard Ratio: 4.1 (95% CI: 1.4–11.5; $p < 0.01$) in established diagnosis of AMI.

It should be emphasized that the presence of lactic acidosis in combination of abdominal pain when the patient may not otherwise appear clinically ill should lead to consideration for early CTA.

Based on the current literature, no accurate biomarkers have been identified to date. D-dimer has been reported to be an independent risk factor of intestinal ischemia, reflecting ongoing clot formation and endogenous degradation via fibrinolysis. No patient presenting with a normal D-dimer had intestinal ischemia and D-dimer >0.9 mg/L had a specificity, sensitivity, and accuracy of 82, 60, and 79%, respectively. Thus, D-dimer may well be useful in the early assessment. Elevated amylase has been reported in roughly a half of patients. Other biomarkers reported to assist in the diagnosis of AMI include intestinal fatty acid binding protein (I-FABP), serum alpha-glutathione S-transferase (alpha–GST), and cobalt-albumin binding assay (CABA). These biomarkers may offer improved diagnostic accuracy of acute mesenteric ischemia, however, further research is required to specify its accuracy and values.

Delay in diagnosis is the dominant factor that accounts for continued mortality rates as high as 30–70% despite vast clinical experience and recognition of this entity. The multi-detector CTA has supplanted formal angiography as the diagnostic study of choice. Multi-detector computed tomography (MDCT) scanners are essential for the early diagnosis of AMI, but often require specialized personnel to perform and interpret the findings. 3D reconstruction is frequently helpful. Volume rendering as in this image is now a semi-automatic workflow component of many CT machines. These can aide remote communities with less experienced staff.

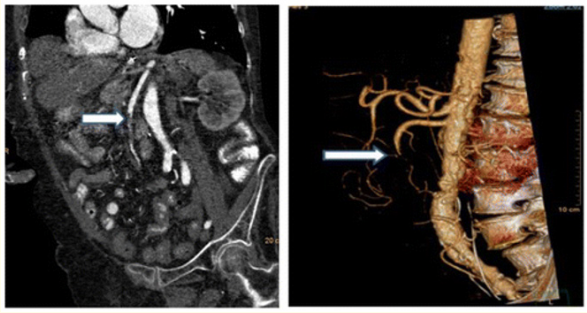


**Figure 1:** Selected image from a CTA scan of a patient with acute mesenteric ischemia secondary to occluded SMA from an embolic source (arrow). 3D reconstruction is demonstrates mid occlusion of SMA (arrow).

In the presence of advanced AMI, the CTA findings reflect irreversible ischemia (intestinal dilatation and thickness, reduction or absence of visceral enhancement, pneumatosis intestinalis, and portal venous gas) and free intraperitoneal air.

Comprehensive biphasic CTA includes the following important steps:

- Pre-contrast scans to detect vascular calcification, hyperattenuating intravascular thrombus and intramural hemorrhage.
- Arterial and venous phases to demonstrate thrombus in the mesenteric arteries and veins, abnormal enhancement of the bowel wall, and the presence of embolism or infarction of other organs.
- Multi-planar reconstructions (MPR) to assess the origin of the mesenteric arteries.

CTA should be performed despite the presence of renal failure, as the consequences of delayed diagnosis, missed diagnosis, or mismanagement are far more detrimental to the kidneys and the patient then exposure to the iodinated contrast agent. A recent study found that in 27 of 28 patients (96.4%) MDCT correctly diag-

nosed AMI (specificity of 97.9%). A sensitivity of 93%, specificity of 100%, and positive and negative predictive values of 100 and 94%, respectively, were achieved.

In NOMI CTA may demonstrate bowel ischemia and free fluid in the face of patent mesenteric vessels. In MVT, the most common positive radiological finding on venous phase CTA is thrombus in the superior mesenteric vein on venous phase CTA. This has been described as the target sign.

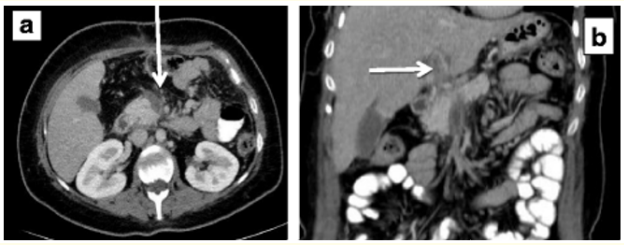



**Figure 2:** 30-year-old patient with acute superior mesenteric vein a. and portal vein thrombosis b. due to hypercoagulable state. No signs of bowel ischemia were noted, and the patient was treated successfully with long-term anticoagulation.

### Treatment should be started up to crisp protocol

- Airway must be patent abd oxygen must supplied
- Breathing air entry must be acceptable with sao2 more than 94%
- Circulation fluid must be given and cvp in shock patient must insert
- Disability determine Glasgow coma scale and correct electrolyte
- Others ngt, foly cathter, antibiotic, dopamine, heparin, insulin.

### In patient with peritonitis laparotomy and revascularisation must be done immediate

When physical findings suggestive of an acute intraabdominal catastrophe are present, bowel infarction already occurred, and the chance of survival in this patient population with significant associated comorbidity is dramatically reduced. There is overwhelming evidence in literature that peritonitis secondary to bowel necrosis mandates surgery without delay.

The goal of surgical intervention for AMI includes:

- Re-establishment blood supply to the ischemic bowel.
- Resection of all non-viable regions.
- Preservation of all viable bowel.

Intestinal viability is the most important factor influencing outcome in patients with AMI. Non-viable intestine, if unrecognized, results in multi-system organ dysfunction and ultimately death. Prompt laparotomy allows for direct assessment of bowel viability.

After initial resuscitation, midline laparotomy should be performed followed by assessment of all areas of the intestine with decisions for resection of all clearly necrotic areas. In cases of uncertainty, intraoperative Doppler may be helpful, as the presence of Doppler signals over distal branches of SMA facilitates bowel conservation, avoiding long-term disability. The SMA is easily palpated by placing fingers behind the root of the mesentery. The SMA is identified as a firm tubular structure, which may or may not have a palpable pulse. Otherwise, the SMA can also be reached by following the middle colic artery where it enters the SMA at the mesentery. Direct sharp dissection, exposing the artery from its surrounding mesenteric tissue, is required for proper exposure to perform revascularization. In cases of diagnostic uncertainties, arteriogram is the study of choice. It can be done intraoperatively especially in hybrid suites.

Different techniques of blood flow restoration are used depending on the pathophysiology of the AMI. Embolectomy and either primary or patch angioplasty is a well-established definitive treatment for SMA emboli. On the other hand, thrombosis of the SMA at the origin of aorta (a common pathology in diffuse atherosclerosis) will require a bypass procedure. However, it increases the magnitude of the procedure and may require prosthetics in the presence of contaminated field. One option is a retrograde bypass from the iliac artery to the distal SMA using the femoral vein or a synthetic graft (Figure 3).

Neither NOMI nor MVT typically require vascular repair. Full dose anticoagulation should be initiated on all patients prior to the surgical procedure. Unfractionated heparin is effective and easy to manage, especially in patients with acute kidney failure.

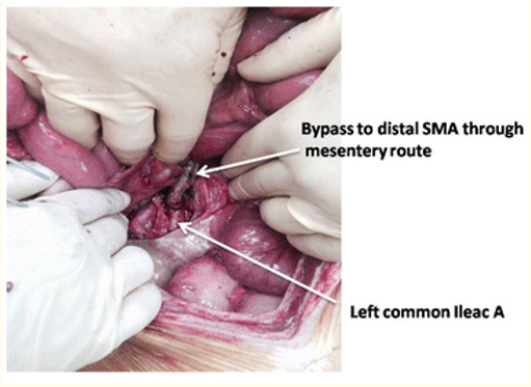



**Figure 3:** Patient with acute thrombosis of SMA underwent left ileo–SMA bypass with a common femoral vein graft.

## In early settings patient without peritonitis endovascular and laparoscopic diagnosis has a role

Several case series using endovascular techniques in combination with pharmacologic therapy have been reported recently. It should be emphasized, however, that any evidence of bowel ischemia or infarction precludes the use of thrombolytic therapy. At this time, these techniques have been attempted in very early, cases of AMI, and the role of such procedures remains to be determined. Other contraindications to thrombolytic therapy include recent surgery, trauma, cerebrovascular or gastrointestinal bleeding, and uncontrolled hypertension.

In recent retrospective series of 679 patients with AMI and vascular intervention (both open and endovascular) endovascular treatment performed in 24% (165 patients). The technique was successful in 87% of the patients, and in-hospital mortality was lower than among those who underwent open procedure (25 vs. 40%). Again, this report emphasized that only patients who did not require open emergent intervention are suitable for this technical approach to revascularization.

Endovascular embolectomy may be achieved by percutaneous mechanical aspiration or thrombolysis and permits percutaneous transluminal angioplasty, with or without stenting in case series of patients with CTA evidence of acute partial or complete occlusion of the SMA (either the main trunk or branch) and without no clinical or imaging evidence of advanced bowel ischemia. Complete technical success was achieved in 28% of cases; all of these had occlusion of the main SMA trunk.

There are no randomized controlled trials comparing laparotomy versus endovascular treatment as a first line strategy for the management AMI. The most important argument in favour of the early laparotomy approach is the ability to assess bowel viability directly and thereby, minimizing delays in restoring mesenteric blood flow. In one retrospective series, the authors documented that 1/3 of patients managed with endovascular therapy avoided laparotomy. In cases of endovascular approach, the use of laparoscopy to assess bowel function may be a reasonable addition.

Centers of excellence equipped with hybrid operating rooms may provide further data supporting the use of an endovascular strategy.

## To decrease short bowel syndrome incidence damage control, stoma, temporary closure has a role

Damage control laparotomy strategy (abbreviated laparotomy) was accepted for trauma over 30 years ago and was found to be an important option in the patient with AMI. Damage control is the surgical modality of choice in the critically ill patient with AMI for physiological and technical reasons. The decision to implement the DCS mode should be made early based upon the response to resuscitation and ongoing physiology, as this has been associated with improved mortality. Advanced age is not a contraindication to DCS as good outcomes have been observed in the elderly.

Planned second look techniques are required after restoration of SMA flow, with or without resection of ischemic bowel (and no anastomosis or stoma) following resuscitation in intensive care unit. Given frequent uncertainty with regard to bowel viability, the stapled off bowel ends should be left in discontinuity and re-inspected after a period of continued ICU resuscitation to restore physiological balance. Often, bowel which is borderline ischemic at the initial exploration will improve after restoration of blood supply and physiologic stabilization. Of note, however, multiple adjuncts have been suggested to assess intestinal viability, but none have proven to be uniformly reliable.

Most often, re-exploration should be accomplished within 48 h and decisions regarding anastomosis, stoma, or additional resection can be made with plans for sequential abdominal closure.

In a review of 43 patients undergoing open mesenteric revascularization, the authors noted that 11 of the 23 patients undergoing a second-look operation required bowel resection. The bowel in these patients is often very swollen and at high risk for anastomotic leak. Recent studies suggest that careful hand sewn techniques are preferable to the use of staples in this group.

These patients often suffer from acidosis, hypothermia, and coagulation abnormalities, which require prompt and ongoing correction. Physiologic restoration is multi-factorial and includes careful and limited crystalloid infusion to avoid abdominal compartment syndrome, frequent monitoring of lactate clearance and central venous oxygen saturation as an indication of satisfactory cardiac output, and the use of viscoelastic techniques (TEG, ROTEM) to assess coagulation status and guide ongoing blood product administration. Recent evidence suggests that peritoneal resuscitation techniques may aid in this process.

**Figure c**

Various techniques of open abdomen have been described. The author's preferred mechanism is a simple plastic drape over the bowel, covered with a sterile towel and the use of Ioban over the abdomen. After the initial laparotomy, abdominal closure via negative pressure wound therapy is most commonly used. The open abdomen may help reduce the risk of abdominal compartment syndrome in patients requiring prolonged resuscitation. Various abdominal closure techniques have been described, however, the guiding principle is constant traction on the fascia to facilitate closure.

## Treatment of venous thrombosis

MVT has a distinctive clinical finding on CTA scan, and when noted in a patient without findings of peritonitis, non-operative management should be considered. The first-line treatment for mesenteric venous thrombosis is anticoagulation. Systemic thrombolytic therapy is rarely indicated. When clinical signs demand operative intervention, one should resect only obvious necrotic bowel and employee damage control techniques liberally, since anticoagulation therapy may improve the clinical picture over the ensuing 24–48 h. Early use of heparin has been associated with improved survival.

Patients with peritonitis require emergency surgery. Intraoperative management is dictated by the surgical findings, which range from a segmental infarction of small bowel to necrosis of the entire bowel, with or without perforation. The aim of resection is to conserve as much bowel as possible. Second-look laparotomy, 24–48 h later, may avoid the resection of bowel that may be viable. A second-look procedure is mandatory in patients who have extensive bowel involvement.

Most published data on interventional radiological treatments for MVT are from small case series. Systemic intravenous tPA has been successfully reported. Trans-jugular intrahepatic portosystemic shunt can be used for MVT with the rationale of decreasing portal pressure, which works as a vacuum of clot fragments and improves the effectiveness of thrombolysis in the case of acute thrombosis.

Supportive measures include nasogastric suction, fluid resuscitation, and bowel rest.

## Treatment of NOMI

Management of NOMI is based on treatment of the underlying precipitating cause. Fluid resuscitation, optimization of cardiac output, and elimination of vasopressors remain important primary

measures. Additional treatment may include systemic anticoagulation and the use of catheter-directed infusion of vasodilatory and antispasmodic agents, most commonly papaverine hydrochloride. The decision to intervene surgically is based on the presence of peritonitis, perforation, or overall worsening of the patient's condition.

If a patient presents with peritoneal signs, an exploratory laparotomy is required for resection of frankly necrotic bowel. Unfortunately, these patients are often in critical condition and the mortality remains very high (50–85%). Damage control mode is an important adjunct, given the critical state of these patients.

### Extensive infarction

In cases of extensive infarction of most of the small bowel with or without a portion of the colon, the surgeon could face with a philosophical decision whether to do anything. Resection of the entire involved bowel will result in short bowel syndrome with its serious associated consequences. This may not be a preferable state, particularly in elderly infirm patients, who may not tolerate long-term parenteral nutrition. A preoperative discussion with the patient and the patient's family concerning these issues is warranted and often necessary peri-operatively as well so that an agreeable plan can be reached [1-4].

## Conclusion

AMI has high mortality so as result, i made this lecture to emphasis early diagnosis by CTA and D-dimer, in advanced cases vascular and cardiac consultation are mandatory.

Revascularization, damage control, stoma, icu, continuous venous dialysis, relaparotomy, all improved prognosis and this the aim of this lecture.

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