DIFFICULTY DIAGNOSIS OF A LETHAL GASTROINTESTINAL COMPLICATION AFTER CARDIAC SURGERY: ISCHEMIA BOWEL COMBINED WITH GASTROINTESTINAL HEMORRHAGE

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Abstract

Gastrointestinal complications following cardiac surgery are uncommon. However, among these complications, that with the highest incidence rate is gastrointestinal hemorrhage, whereas the highest mortality rate is associated with acute mesenteric ischemia. Here, we report a case of coronary artery disease which received coronary artery bypass grafting surgery. Following the patient’s discharge from our hospital, gastrointestinal hemorrhage was noted. The clinical presentations were hematemesis and melena. The treatment of gastrointestinal hemorrhage entails adequate resuscitation and panendoscopy for hemostasis. It is also necessary to closely monitor indicators of the invasive treatment such as unstable hemodynamic status, blood transfusion requiring more than 5 units, and rebleeding after treatment. Owing to the coexistence of acute mesenteric ischemia and gastrointestinal hemorrhage in this patient, the treatment modality of gastrointestinal hemorrhage made the diagnosis of acute mesenteric ischemia more difficult and more time consuming (due to the symptoms and signs of gastrointestinal hemorrhage). Consequently, without early awareness and prompt treatment, such as laparotomy or endovascular management, mortality in patients with similar multiple conditions will increase dramatically. From a review of the literature, and on the basis of our experience, we have come to recognize the important role played by multi-detector row computed tomography (MDCT) angiography in diagnosing this difficult condition. The patient in the present study had gastrointestinal hemorrhage with unstable hemodynamic status after adequate resuscitation and angiography with endovascular treatment had been indicated, MDCT angiography enabled identification of the site of bleeding and also detected the poor circulation status of the bowel wall (this finding implying the poor mesenteric circulation). In order to improve the difficult diagnosis and high mortality associated with the type of condition observed in this patient, we suggest early MDCT angiography since it is both non-invasive and is able to detect multiple conditions.

Key words: Mesenteric ischemia, Gastrointestinal hemorrhage, Multi-detector row computed tomography

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Introduction

The occurrence of gastrointestinal complications after cardiac surgery is not common. Intestinal ischemia after open heart surgery is a rare but often fatal complication. The gastrointestinal complications with the highest incidence rate is gastrointestinal hemorrhaging, and the complication with the highest mortality rate is ischemic bowel disease. It is difficult to establish a general consensus with respect to the treatment of acute mesenteric ischemia because of its low incidence rate and our poor understanding of its pathophysiology. The high mortality rate of acute mesenteric ischemia correlates to difficulty or delay in diagnosis and the occurrence of comorbidities or massive necrotic bowel resection. Early diagnosis and treatment by endovascular surgery or laparotomy result in the best survival rate. A diagnosis of acute mesenteric ischemia is difficult if gastrointestinal hemorrhage coexists. This is due to the use of anti-platelet agents and an endoscopic survey will attribute the symptoms and signs to a gastrointestinal hemorrhage. This will make the diagnosis of ischemic bowel disease more difficult and time-consuming.

The most likely diagnosis which will be made on the basis of clinical symptoms and a history of anticoagulant agent use is a gastrointestinal hemorrhage. This will be confirmed by endoscopic survey (as per the guidelines for treatment of a gastrointestinal hemorrhage). Treatment will be administered according to this diagnosis. However, the treatments for a hemorrhage and mesenteric ischemia are different, as hemorrhage requires adequate resuscitation with endoscopic follow up, and mesenteric ischemia requires urgent endovascular management or laparotomy. This difference in treatment will result in a high mortality rate for mesenteric ischemia due to a delay in diagnosis of more than 12 hours. In our experience, the most lethal gastrointestinal complication after cardiac surgery is not ischemic bowel disease but instead a combination of other gastrointestinal complications that prevent early diagnosis of ischemic bowel disease. In this case, multi-detector row-computed tomography (MDCT) is helpful in the diagnosis of both conditions. Based on a literature review and according to our experiences, we believe that MDCT angiography plays an important role in improving the survival rate of patients afflicted with ischemic bowel disease.

Case presentation

A 78 year-old male patient with shortness of breath was admitted to our hospital. Coronary artery disease with left main coronary artery 70% stenosis, bifurcation area 80% stenosis and right coronary artery 80% stenosis was diagnosed by cardiac catheter study. A left common iliac artery occlusion was also noted with well collateral circulation. No clinical symptoms or signs of peripheral vascular disease were noted. An operation with off-pump coronary artery bypass grafting was performed 4 days later. There was no intra-aortic balloon pump (IABP) support before and after the operation. After surgery, atrial fibrillation with rapid ventricular response was noted and Cordarone intravenous drip was administered for this condition. The post-operation clinical course was uneventful and administration of Cordarone in an oral form began five days later. This patient was admitted into the intensive care unit for 6 days and discharged from the ward 12 days after the operation. Clopidogrel (Plavix) 75mg per-day was also administered after surgery.

One day after being discharged from the ward, this patient returned to our emergency room due to hematemesis and melena. Laboratory study revealed a hemoglobin level of 13.9 gm/dl. Two hours later, the hemoglobin level was 11.4 gm/dl. Blood transfusion with packed red blood cells (PRBC) 3 units was given. Panendoscopy was arranged and it revealed a duodenal ulcer with bleeding at the 2nd portion. (Fig. 1) Drug induced duodenal ulcerative bleeding was suspected and this patient was admitted to the ward for blood transfusion, vital sign monitoring and continuous evaluation. After admission, blood transfusion
continued with more than 2 units of PRBC. Hematochezia was noted at this time. This patient was transferred to the intensive care unit for close observation with a hemodynamic status monitor and resuscitation. On the 2nd day after admission, 8 units of PRBC and fresh frozen plasma (4 units) were transfused. The patient’s hemodynamic status became unstable and tachycardia and hypotension (heart rate: 130–140 beats/min, systolic blood pressure: 90–100 mmHg) were noted under continuous blood transfusion. Panendoscopy was performed at the intensive care unit and a duodenal ulcer with active bleeding was noted. Although a Hemoclip and Bosmin injection were used, active bleeding persisted.

A radiologist was consulted for angiography. MDCT angiography was suggested by the radiologist to identify the hemorrhage site in the gastrointestinal tract. MDCT angiography revealed pneumatosis intestinalis (Fig. 2) and portal gas (Fig. 3). Contrast extravasation over the duodenum was noted. The superior mesenteric artery and vein were patent, which was confirmed by the sequence of the contrast medium. Unstable hemodynamic status persisted with tachycardia and hypotension (heart rate: 130–140 beats/min, systolic blood pressure: 80–90 mmHg) and resuscitation continued with blood and crystalloid fluid transfusion. Non-occlusive type ischemic bowel disease with necrosis was suspected and an emergency operation was performed with massive necrotic small bowel resection. This patient expired 4 days after the operation due to septic shock and multiple organ failure.

**Discussion**

In this case, a diagnosis of acute mesenteric ischemia was delayed because this patient had a history of antiplatelet agent use and presented with melena and hematemesis, which are the primary clinical symptoms of upper gastrointestinal hemorrhage (the complication with the highest incidence rate). Patients at a high risk for acute mesenteric ischemia are those undergoing major vascular surgery and those on hemodialysis. Intestinal ischemia is a rare complication following a coronary artery bypass grafting with a rate of incidence ranging from 0.1 to 0.3%.

**Upper gastrointestinal tract hemorrhage**

An upper gastrointestinal hemorrhage commonly presents with hematemesis and/or melena. The initial evaluation involves an assessment of hemodynamic stability, medication/treatment history (including the use of aspirin or anticoagulant agents), physical examination, nasogastric tube lavage, gastroenterology and surgical consultation. The initial management of upper gastrointestinal bleeding is assessment and sta-
bilization with volume resuscitation. All patients with hemodynamic instability or active bleeding (hematemesis or hemachexia) should be transferred to an intensive care unit for close monitoring of hemodynamic status and resuscitation. Clinical risk factors for a poor outcome include older age (>60 y), severe comorbidity, active bleeding (witnessed hematemesis, fresh blood per nasogastric tube, hemachexia), hypotension or shock, red blood cell transfusion of more than 6 units, inpatient status at time of bleeding and severe coagulopathy.

Endoscopy is effective both in diagnosis and treatment of upper gastrointestinal hemorrhage. Adequate resuscitation before endoscopy can minimize treatment-associated complications. If an anti-platelet agent such as Clopidogrel is used, the fresh-frozen plasma and vitamin K should be given to correct the function of platelets. Angiography is invasive but effective both in the diagnosis and treatment of upper gastrointestinal hemorrhage, though it is limited in sensitivity and MDCT angiography may be needed to identify the bleeding site in the gastrointestinal tract. Further transfusions of blood are associated with a high mortality rate. When a blood transfusion consisting of more than 5 units is required, the need for surgery is 57% and the mortality rate is 43%. Thus, when transfusion involves more than 5 units, a more invasive treatment must be

Fig 2. MDCT: Pneumatosis intestinalis of small bowel.

Fig 3. MDCT: Portal gas: Gas mostly distributed over the peripheral area of the liver (A) and the gas is in the portal vein (B).
In this case, the diagnosis was confirmed by endoscopic findings and the symptoms (hematemesis, hematochezia and melena) were attributed to a duodenal ulcer hemorrhage. Treatment was administered as suggested by the literature and guidelines.

**Ischemic bowel disease**

Hudson et al. reported that the incidence of gastrointestinal complications following cardiac surgery is relatively low, averaging approximately 1% in most series. These complications include upper gastrointestinal bleeding (27%), ischemia bowel (17%), cholecystitis (14%), small bowel obstruction (14%), perforated ulcer (14%), lower gastrointestinal bleeding (10%) and esophagitis (4%). Although mesenteric ischemia occurs infrequently, the mortality rate ranges from 60% to 100% depending on the source of obstruction. The presence of unstable symptoms, preoperative intra-aortic balloon pump (IABP) support, ischemic bowel and the need for gastrointestinal surgical intervention adversely affects mortality.

The most typical symptoms of acute mesenteric ischemia are sudden and severe catastrophic abdominal pain, and this pain is often disproportionate relative to the findings of a physical examination. It should be noted that in an elderly patient, this finding may be obscure and sometimes there are no early findings. Acute mesenteric ischemia is not an isolated clinical entity, but a complex of diseases including acute mesenteric arterial embolus and thrombus, mesenteric venous thrombus, and non-occlusive mesenteric ischemia (NOMI). In this case, no arterial or venous thrombus was noted both in image study and during operation. NOMI is preferred. NOMI is defined as “intestinal necrosis with a patent arterial tree” and has also been termed “hemorrhagic enteropathy,” “hemorrhagic necrosis of gastrointestinal tract,” “intestinal infarction without mesenteric vascular occlusion” and “hemorrhagic necrotizing enteropathy.”

Over the last few decades, the frequency of NOMI has increased dramatically in those patients undergoing cardiac surgery and hemodialysis. NOMI occurs most often with low mesenteric flow status rather than occlusion and risk factors for NOMI include atrial fibrillation and recent surgery. Inadequate splanchnic circulation is also related to the use of vasopressors and/or cardiac failure from vasospasm related to elevated sympathetic activity, hypovolemia, cardiogenic/hemorrhagic shock or sepsis. By interfering with the autoregulation of mesenteric circulation, catecholamine and medications such as digitalis can also cause vasospasm.

In the case of the patient described in this paper, there was no abdominal pain and the diagnosis of acute mesenteric ischemia was delayed until MDCT angiography was arranged. The difficulty of making an early diagnosis is due to the fact that the incidence of gastrointestinal hemorrhage is higher than mesenteric ischemia. After diagnosis was confirmed by endoscopic findings, the symptoms and signs were attributed to gastrointestinal hemorrhage until the development of an unstable hemodynamic status (due perhaps to severe sepsis or metabolic acidosis). As described previously, this delay will cause the mortality rate to be much higher than it would be if early diagnosis and treatment had been achieved.

**Image diagnosis:**

The roles of plain X-ray, computed tomography (CT) and noninvasive modalities are still limited with respect to the early diagnosis of acute mesenteric ischemia. Currently, a plain X-ray mostly is used mostly for the exclusion of other possible diseases causing acute abdominal pain. MDCT and magnetic resonance angiography are promising diagnostic modalities and may be more useful than conventional CT scans because they can provide high-resolution functional images that indicate low oxygen saturation.

CT is a fast, noninvasive and widely available modality that has improved enormously in recent years. In 2000, the American Gastrointestinal Association concluded that, with the exception of superior mesenteric vein thrombosis, CT
was of limited use in the diagnosis of acute mesenteric ischemia. MDCT has subsequently emerged as the gold standard for the evaluation of mesenteric ischemia. Wieser et al. reported that the positive and negative predictive values of MDCT in a series of 291 patients were found to be 90% and 98%, respectively. In another prospective series of 62 patients evaluated for mesenteric ischemia with MDCT and mesenteric angiography, the sensitivity and specificity of MDCT was found to be 96% and 94%, respectively.

Selective mesenteric angiography remains the superior diagnostic imaging modality, followed by subsequent catheter-based treatment options such as intra-arterial local vasodilator infusion, percutaneous transluminal angioplasty or stenting of a proximal stenosis of the superior mesenteric artery. The most effective diagnostic tests are catheter-angiography with the option of therapeutic intervention and MDCT. Selective mesenteric angiography is considered to be the gold standard for the diagnosis of acute arterial occlusion. Abrupt cutoff of the superior mesenteric artery with the absence of collateral circulation is diagnostic with virtually 100% sensitivity in acute embolic occlusion. Routine use of angiography improves survival rate with an acceptable complication rate. In some conditions, it is recommended that the patient be taken directly to the operating room, because in critical patients with peritoneal signs and suspected acute mesenteric ischemia, the use of angiography will delay surgical treatment.

MDCT angiography is noninvasive and is potentially beneficial in the diagnosis of both acute mesenteric ischemia and gastrointestinal hemorrhage. Early MDCT angiography is helpful for this high mortality condition (acute mesenteric ischemia masked by gastrointestinal hemorrhage) but the indication is unclear.

**Laboratory test:**

Serum lactate, an established marker of cell hypoxia, has been shown to have a sensitivity of 96% in patients with mesenteric ischemia. However, lactic acidosis is often a late finding in the diagnosis pathway with concomitant shock, bowel necrosis and circulatory collapse. D-dimer and α-GST are also helpful in the early diagnosis of acute mesenteric ischemia. The problem is that these studies were not indicated for gastrointestinal hemorrhage patients.

**Treatment:**

In extreme cases of upper gastrointestinal hemorrhage, after adequate resuscitation and an endoscopic survey, laparotomy may be required to identify the bleeding site. Acute mesenteric ischemia remains a serious condition requiring emergency surgical treatment. The mortality rate remains high due to nonspecific symptoms and delayed diagnosis. Acute mesenteric arterial occlusion is treated by immediate laparotomy, revascularization and bowel resection. NOMI requires restoration of altered hemodynamics and selective vasodilatation. The therapeutic options for NOMI are dependent on the interval between the onset of symptoms and the start of treatment. Early diagnosis with a pharmaco-angiographic procedure is efficient with Papaverin hydrochloride injection. The presence of peritoneal signs or an ischemic time longer than 12 hours may indicate the need for urgent laparotomy. In the subset of patients who suffer from nonocclusive ischemia, intra-arterial vasodilator therapy has been largely responsible for the decrease in mortality from 70% in the 1980’s to 50-55% during the last decade.

**Conclusion**

Acute mesenteric ischemia is an extremely lethal condition. Early recognition and prompt treatment of mesenteric ischemia is the only method available to produce a successful outcome. Therefore, we believe that the most lethal complication occurring after cardiac surgery is mesenteric ischemia masked by other common complications of the gastrointestinal tract such as a hemorrhage. New imaging techniques such as MDCT angiography play an important role
in improving this high-mortality condition. Further studies are required to identify the patients or conditions for which more invasive studies or MDCT are indicated.

References

導致病患死亡的心臟手術後消化道併發症：腸系膜缺血合併消化道出血 -- 診斷上的困難

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摘要

對於心臟手術後的患者，消化道併發症的發生率大約是1％，其中以消化道出血最為常見，而死亡率最高的則是急性腸系膜缺血。此次敘述的病例是心臟手術後同時發生消化道出血與急性腸系膜缺血的併發症。以此案例而言，因為臨床上心臟手術後的消化道併發症，在臨床上以消化道出血最為常見，再加上抗凝血藥物使用的病史與內視鏡的確定診斷，病狀會被認爲是消化道出血所引起的，治療的方法也會根據消化道出血來制定，但消化道出血與急性腸系膜缺血的治療方法不僅完全不同，更會因為保守的支持性療法，造成急性腸系膜缺血早期診斷的困難與延誤，而使得死亡率更高。根據文獻的回顧與此案例的經驗，早期安排多層螺旋電腦斷層血管攝影，針對消化道出血的出血點檢測以及動脈血管攝影與栓塞有助益，也可利用腸壁的顯影不足來早期診斷腸系膜缺血，對於死亡率的降低，將扮演重要的角色。

關鍵詞：腸系膜缺血，消化道出血，多層螺旋電腦斷層