Extraordinary revascularization of acute-on-chronic intestinal ischemia

Aidas Raudonaitis, Kęstutis Kavaliauskas¹, Adrijus Krimelis²
Department of Vascular Surgery, ¹Department of Surgery, ²Department of Radiology, Kaunas Medical University Hospital, Lithuania

Key words: acute-on-chronic intestinal ischemia, mesenteric arterial reconstruction.

Summary. Acute-on-chronic mesenteric ischemia is rare, symptomatic manifestation of arteriosclerosis, and there are important gaps in our knowledge and recognition of this potentially lethal condition. Careful exploration of anamnestic history and angiography remain cornerstones of early diagnosis. Prognosis crucially depends on rapid diagnosis and surgical management, to prevent, or at least to minimize bowel infarction. Delay in surgical intervention is associated with increasing mortality that is still high and varies from 60 to 100%. The prognosis dramatically improves if revascularization can be achieved prior to intestinal infarction. Patients surviving extended intestinal resection may develop short gut syndrome. Case rapport of acute-on-chronic mesenteric ischemia with extraordinary approach for superior mesenteric artery revascularisation is described. Literature review is presented.

Introduction

Acute mesenteric ischemia (AMI) is a life threatening vascular surgical condition that is described as sudden and acute intestine perfusion disorder lead to bowel ischemia and infarct. Mesenteric ischemia may result from a wide range of pathological processes, each possessing unique clinical feature, clinical difficulties, management strategies and outcome. Despite specificity and sensitivity of the diagnosis, the mortality of AMI has remained high over the past 30 years (1). Diagnosis of this condition usually is aggravated due to the deficiency of specific symptoms and prognosis is usually reported poor, with survival rates ranging from 0% to 40% (2). The reported incidences of AMI has increased and described substantially over the recent decades (3, 4, 5). This is due to increased number of elderly people with widespread cardiovascular disease, and to increased awareness of the condition.

Case report

A 74-year-old man was referred to surgeon by general practitioner relating to blurred abdominal pain and being in urgent need for hospitalization. His chef complaints were fatigue abdominal pain, which continues for 4 or 5 days. Anamnestic history of some sort of abdominal pain continued for 4 month. This time abdominal pain became more severe than it was before. In 1.5 month he has lost 15 kg of weight due to the fact that abdominal pain was more often in connection with food intake. He could tolerate only watery porridge. Also he complained of constipation for a long time and short distance claudicating. For many years he was a heavy smoker. One month ago he was operated on inguinal hernia as was thought that all abdominal complaints were in connection with hernia. But after procedure he was not feeling better. Then chest angina was suspected, and patient was referred to cardiologists with admission to the department of cardiology. Along with several cardiological and endoscopical investigations an abdominal ultrasound scanning was performed which revealed that abdominal aorta is heavily calcified; the orifice of superior mesenteric artery (SMA) is calcified as
well. Conclusion was made that abdominal pain is not a type of cardiological source and patient was transferred to general medical ward for investigation for malignant disease, as there was no accurate diagnosis. But after several investigational procedures and some treatment nothing suspicious about malignant process was revealed, and patient was discharged with mild relieve condition. Discharging diagnosis was arteriosclerosis of aorta and superior mesenteric artery and intestinal angina.

Physical examination on surgical ward showed us that patient is malnourished, palpable total abdominal pain without specific localization, no signs of peritonitis, and systolic bruit over epigastrium; no popliteal pulses were obtained in both legs. Laboratory blood tests were unchanged. Conservative treatment was ineffective, and the next day more intensive abdominal pain occurred with marked tenderness accompanied by slow bowel evacuation. Abdominal ultrasound scanning was performed which has showed questionable mesenteric perfusion, and then patient was referred to vascular surgeon. Aortogram was performed: SMA was completely occluded 0.5 cm below his orifice, complete absence of filling any intestinal arteries as well as evidence of severe atherosclerotic disease of the aorta (Figures 1 and 2).

Prompt operation, laparotomy, was performed. On abdominal exploration small intestine with focal necrosis were discovered; trunk of SMA is not pulsating, rigid, with arteriosclerosis plaques. There was no pulse on IMA to. SMA was exposed distally and opened underneath of duodenum. The lumen was almost completely obliterated with atherosclerotic plaques; Fogarty catheter to proximal direction was passed only 4 cm, and no central flow was found. Endarterectomy on SAM at the place of atriotomy and his branches was performed and back flow was received. Do to the fact that infrarenal aorta and iliac vessels were heavily calcified, decision was made to perform bypass with saphenous vein graft from the suprarenal part of the aorta, which was found also heavily calcified. On the exploration of celiac branches, we found hepatic artery rigid and unusually hypertrophied gastric arteries, with a diameter of 0.4 – 0.5 cm. Proximal end-to-end anastomosis for bypass was chosen from

**Fig. 1. Frontal aortogram**
Severe atherosclerotic disease of the aorta, complete absence of filling any intestinal arteries. Only orifice of SMA is filled by contrast (arrow), there is no contrast filling distally. Left renal artery stenosis of 60%.

**Fig. 2. Lateral aortogram**
Severe atherosclerotic disease of the aorta, complete absence of filling any intestinal arteries. Only orifice of 0.5 cm for SMA is filled by contrast (arrow), there is no contrast filling distally. Inferior mesenteric artery is also occluded.
left gastric artery. Bypass graft was placed behind the stomach and through mesocolon down to SMA for end-to-side distal anastomosis. After revascularization a demarcation line between necrotic and viable of 1.2 m intestine became obvious, and gut resection with anastomosis side-to-side was performed.

Postoperative period was uneventful, only short bowel syndrome has developed lately, and patient was successfully treated and recovered in gastroenterological department.

In half year after operation patient came to see vascular surgeon and according to his words his appetite became much better, he could eat whatever he wanted, put on weight about 7 kg, and all abdominal pains disappeared. Still only one complaint was that he evacuates 2–3 times a day. Control ultrasound duplex scanning showed that bypass graft is of 0.7 diameter, patent, peak systolic velocity of 41.44 cm/sec, end diastolic velocity of 10.81 cm/sec, resistance index of 0.74 (Figures 3a, 3b, and 4), that means no occlusion and stenosis (19).

**Literature review**

Acute mesenteric ischemia accounts for only 0.1% yearly hospitalizations and 1–2% of all surgical emergencies but are associated with a mortality rate higher than 70% and balances in the range of 60% to 100% (1, 2, 6, 7).

Most often AMI is caused by arterial occlusion. It means that approximately of 23% to 38% do to arterial embolus. Five per cent of all peripheral emboli lodge in SMA. Approximately of 30% to 50% of acute mesenteric ischemia is due to SMA arterial thrombosis, often at the site of pre-existent ostial lesion. Mesenteric venous thrombosis is responsible for up to 26 – 33 per cent of all cases of gut ischemia (8, 9, 10). Intestinal ischemia also occurs in the ab-

**Fig. 3a.** Doppler ultrasound of the upper abdomen

Bypass graft is seen in the middle of triangle among left segment of liver (top), stomach (right) and pancreas (below).
**Fig. 3b.** Control ultrasound duplex scanning of the upper abdomen demonstrates that bypass graft is of 0.7 diameter, patent, located in between liver (top) and pancreas (below).

**Fig. 4.** Bypass graft control ultrasound duplex scanning. Peak systolic velocity of 41.44 cm/sec, end diastolic velocity of 10.81 cm/sec, resistance index of 0.74
sence of mechanical vascular obstruction. The most frequent clinical setting producing nonocclusive mesenteric ischemia is severe systemic illness with circulatory insufficiency and end organ shock, prolonged visceral arterial vasospasm caused by drug intoxication, as with cocaine and ergot derivates (11).

Visceral artery disease is strongly associated with generalized atherosclerosis condition manifested with the presence of coronary artery disease, peripheral arterial disease and increasing age. Mesenteric disease is present in 18 percent of patients aged over 65 years and in 70% of those undergoes aortobifemoral operation (12).

Significant atherosclerotic obstruction of the visceral arteries is present in 6% to 10% of unselected autopsy cases. In more selected population undergoing abdominal aortography, significant stenosis of the celiac artery, the SMA, or both is present in 14% to 24% (13). In unselected Finnish autopsy study of 120 cases, 29% patients had significant stenosis of one mesenteric artery, and in 15% cases at least two mesenteric arteries were stenotic (14).

Despite the frequency of visceral artery stenosis, symptomatic chronic intestinal ischemia is rare because of the excellent circulatory network supplying the intestine. It is widely believed that intestinal collaterals are so extensive that at least two of the three intestinal vessels must be stenotic or occluded for symptoms to occur.

Together with classical tirade symptoms of chronic ischemia (postprandial abdominal pain, weigh loss, epigastria bruit), there are other symptoms reported as food fear in 33%, diarrhea in 57%, constipations in 29%, elevation of liver enzymes in 22% of cases (15).

SMA thrombosis develops often at the site of pre-existent ostial lesion, and is generally considered as a complication of previously untreated chronic intestinal ischemia.

However a surveillance for AMI caused by arterial embolism prognostically is more favorable in comparison with arterial thrombosis do to that thrombi usually dodges distal parts of SMA, below the middle colic artery branching place, and partial mesenteric perfusion is still possible over the branches of jejunal and middle colic arteries. Whereas thrombotic SMA occlusion usually occurs in proximal parts of artery before middle colic artery branching place thereby mesenteric perfusion is totally blocked for these patients, who has poorly developed collateral perfusion along celiac trunk and inferior mesenteric artery.

There are no specific symptoms for AMI. About 2/3 of these patients are female with average age of 70 years, have evidence of symptomatic vascular disease at the other sites, and have often have previous vascular surgery (10,11). Abdominal pain is present in almost all AMI cases (75% to 98%), but varies in severity, nature and location. A history of postprandial abdominal pain for several weeks or months preceding the acute episodes is common in patients with SMA thrombosis. Usually AMI clinical signs start with sudden onset of abdominal pain, that last permanently, occurs upper and middle part of abdomen. It is interesting to admit that there is no direct correlation between pain duration and structural damages of the bowel (16). On a physical examination abdominal tenderness could be observed; more than half of the patients has nausea and vomiting fatigue, and about one third has diarrhea manifestation. A characteristic early clinical feature is a disparity between the severity of the pain and paucity of the significant abdominal findings. Sudden severe pain accompanied by forceful intestinal emptying is strongly suggestive of acute arterial occlusion, especially when there are minimal or no abdominal findings. Gastrointestinal bleeding may precede any other symptoms of mesenteric ischemia, and stools are positive for occult blood in up to 75% of patients.

Conventional laboratory findings usually are little informative. Leukocytosis occurs usually for the biggest part of patients, but approximately 10% of them do not have it at all.

Several research studies have been carried out to find specific serum markers as diagnostic aid, but consistency and specificity of these findings have not been established for clinical practice (11, 17, 18).

The most attractive investigation for the assessment mesenteric ischemia would be duplex ultrasonography, but in acute cases these methods has limitations do to the bowel distention. And contrary, ultrasonography may have high...
sensitivity and specificity for the assessment of chronic intestinal ischemia.

Angiography remains the investigation of choice in patients with suspected acute mesenteric ischemia. Some authors argue that, even decision to operate has been made; angiography can still provide information useful to the surgeon with road map to accomplish adequate revascularization when it is indicated. An important reason for performing angiography is to identify patients with non-occlusive mesenteric ischemia in whom surgery should be avoided if possible (12, 20).

Perhaps the most serious drawback of angiography, however, is potential for introducing critical delay in the surgical correction of vascular insufficiency. Patients with an “acute abdomen”, and some would argue those who have clearly sustained a mesenteric embolus, should be preceded to laparotomy. Laparotomy is indicated during the course of AMI either to restore intestinal arterial flow. Revascularization should precede any evaluation of intestinal viability, since bowel that initially appears infarcted may show surprisingly recovery after restoration of blood flow.

One or combination of the following techniques for the blood flow restoration to SMA is successfully used: embolectomy, endarterectomy, bypass shunting, and ostial reimplantation to aorta. For occlusion due to an acute thrombosis of the SMA, endarterectomy may be attempted, but an aorta-to-SMA bypass using a segment of saphenous vein is the preferred method of reestablishing flow to the distal SMA, particularly when bowel resection has been performed.

Second-look operation regardless of the condition of the patient are frequently recommended to be performed in 18–36 hours after revascularization for AMI, particularly when bowel resection is performed. In some cases, especially when precarious bowel anastomosis are made in revascularized intestine, a third-look procedure in 4 to 6 days after the first procedure is recommended, in order to detect and treat any anastomotic leaks before the occurrence of peritonitis and sepsis (21). Approximately 20% of the patients suffer from chronic short bowel syndrome after extensive bowel resection, but rarely requires permanent parenteral nutrition (22).

Conclusions
Described clinical case report represents classical signs of chronic intestinal ischemia, also called “intestinal angina”, that should be remembered, appropriately considered and referred to vascular surgeons for elective operation with limited risk for the patient. Early and properly diagnosed acute-on-chronic intestinal ischemia is amenable to surgical treatment with predictably immediate and long-term results. Revascularization acute-on-chronic mesenteric ischemia has been shown to be technically possible and of substantial benefit to patients who would otherwise be treated as terminal cases. Even short bowel syndrome can be successfully treated. Patients can return to a near normal lifestyle with acceptable for them quality of life. Described extraordinary reconstruction bypass case from the left gastric artery to AMS, expands vascular reconstruction possibilities for the mesenteric occlusion.

Úminės mezenterinės išemijos neiprasta revaskulizacija
(klinikinio atvejo aprašymas ir literatūros apžvalga)

Aidas Raudonaitis, Kęstutis Kavaliauskas1, Adrijus Krimelis2
Kauno medicinos universiteto klinikų Kardiochirurgijos klinikos Kraujagyslių chirurgijos skyrius, Čhirurgijos klinikos Chirurgijos skyrius, Radiologijos klinikos Tomografijų skyrius

Raktažodžiai: ūminė ir lėtinė žarnyno išemija, rekonstrukcinės kraujagyslių operacijos.

Santrauka. Űminė žarnyno išemija, kilusi dėl lėtinės aterosklerozinės kilmės žarnyno išemijos,

Adresas susirašinėjimu: A.Raudonaitis, KMU Kardiohirurgijos klinika, Eivenių 2, 3007 Kaunas
El. paštas: aidas.r@takas.lt

References
29. Gentile AT, Moneta GL, Taylor LH. Isolated bypass

Received 15 April 2002, accepted 27 May 2002