Research Paper Clinical Research

Ischemic colitis after abdominal aortic surgery

Adrian Molnar MD, PhD, Cardiovascular Surgery Clinic, "Niculae Stancioiu" Heart Institute

Diana Sacui, MD Cardiovascular Surgery Clinic, "Niculae Stancioiu" Heart Institute

Traian Scridon, MD, PhD Cardiovascular Surgery Clinic, "Niculae Stancioiu" Heart Institute

ABSTRACT

Ischemic colitis represents a major and potentially lethal complication after abdominal aortic surgery. The high incidence of this dangerous complication determined us to study the clinical and imagistic features of the disease, as well as its physiopathology and treatment procedures, in a group of 416 patients operated in our clinic in a five-year period (between January 2008 and December
2012). Postoperative colitis occurred in 6 patients (1.44%), with a higher frequency (4 of 6) in the patients operated for aortic aneurysm. The treatment was conservative for 3 patients, and surgical in the other 3 cases (bowel resection). The mortality rate was 33%, the main cause of death being the multiple system and organ failure.

KEYWORDS ischemic colitis, abdominal aortic surgery, inferior mesenteric artery re-implantation

Introduction
Abdominal aortic surgery is responsible for many complications, and a mortality of 2.5 - 9%.

After the development of new endoscopic surgical techniques, Becquemin J-P et al. [1] realized a comparative study of the incidence of ischemic colitis between open surgery and endovascular aneurysm repair (EVAR) for abdominal aortic aneurysms (AAA); the results showed that ischemic colitis remains a serious complication following AAA repair, but EVAR was associated with a lower rate of colonic ischemia. The logistic regression analysis showed that only rupture, long duration of operation, and prior renal disease were independently associated with ischemic colitis. Within the two treatment modalities, the mortality rate remained identical. [1]

However, ischemic colitis is one of the most frequent and dangerous complications, and one which creates a lot of controversy in abdominal surgery.

Material and methods
Between 2008 and 2012 in the Cardiovascular Surgery Clinic of the Heart Institute from Cluj-Napoca, Romania, we performed 416 reconstructive procedures on abdominal aorta, 340 aortic-bifemoral bypass for chronic critical limb ischemia, and 76 for aortic aneurysm.

We did not include in this study the patients with emergency procedures (ruptured aortic aneurysm) and patients with reconstructive procedures on visceral arteries.

The mean age of patients was 63.0 +/- 7.3 years, and 85% of them were males.

The most frequent medical history for our patients were the ischemic heart disease and arterial hypertension.

Postoperative ischemic colitis (POIC) appeared in 6 patients (1.44%). The mean interval for diagnosis was 4.7 days (range between 0 and 17 days) after surgery. The diagnosis was established by clinical and echo-Doppler examination in 4 cases and by iterative laparotomy in 2 cases. The most frequent cases were encountered in the patients operated for abdominal aortic aneurysm – 66.6% (4/6) (Table 1).

Table 1. Ischemic colitis prevalence according to the underlying pathology.

Underlying Pathology	No. of patients
Chronic critical limb ischemia	2
Abdominal aortic aneurysm	4

Results
The treatment was conservative in 3 cases (50%), represented by antibiotic therapy and parenteral alimentation, and surgical in the other 3 cases (50%) - bowel resection.

Mortality was 33%, 2 patients died with a multiple organic failure syndrome, determined by the ischemic colitis, both patients being treated by surgical intervention.

Discussion
Frequency
Ischemic colitis after reconstructive surgery on the abdominal aorta is a well known complication with a high incidence 0.3 – 10% (a mean clinical incidence of 3% and colonoscopic incidence of 6%), and a high mortality rate. Ernest and co. realized a systematic colonoscopic study on 50 patients after aortic surgery stabilizing an incidence rate for aneurysm pathology of 7.4%, and 4.3% for atherosclerotic occlusive pathology [2].

Physiopathology
1.Devascularization
There are several factors, which contribute to the appearance of ischemic colitis: the clamping time, the need of vasopressor drugs, inferior mesenteric artery and/or hypogastric artery ligature, the atherosclerotic embolisation or the prosthetic thrombosis.

2.Ischemia – Reperfusion
Ischemic colitis can be generated, even if we have a very short aortic clamping time, and a permeable inferior mesenteric artery and/or hypogastric artery. The precipitating factor seems to be the conversion of the enzyme xanthine dehydrogenase

(present in high concentrations in the gut mucosa) to xanthine oxydase, resulting in the release of oxygen derived free radicals. The released free radicals disrupt cell membranes and enzyme systems and still further damage the mucosal barrier, allowing several toxic substances to be absorbed through the portal blood and peritoneum. The most familiar of these is lipopolysaccharide endotoxin, which is derived from Gram negative organisms, but others include pseudomonas exotoxin, myocardial depressant factors, histamine, and free potassium ions. Moreover, we know that even in normal circumstances, bacteria can translocate from the gut into other areas, and this process is obviously enhanced in ischemia. As a result of these combined effects visceral ischemia may injure the liver, pancreas, myocardium, and lungs, and may also cause down regulation of the immune system. All in all, it is not surprising that an acute reduction in the blood supply to the gut is lethal. Moreover, the generation of free radicals seems to be accentuated by the restoration of the blood supply to the ischemic tissue (reperfusion injury), which explains the classic observation that release of an experimentally applied ligature on the superior mesenteric artery leads to circulatory collapse [2].

Clinical diagnosis

Making a retrospective analysis on our patients symptoms, we can demonstrate that the main diagnostic clinical symptoms are: the early postoperatively diarrhea (60%), the pain in left iliac fossa (44%), and rectal hemorrhage (30%). Less specific elements for diagnosis are: hypo- or hyperthermia (70%), shock (56%), and the occlusive syndrome (38%).

Systemic bacteremia with anaerobic germs is very rare, always being associated with peritonitis by colic perforation (12%) (Table 2).

Table 2. Clinical characteristics of patients who developed ischemic colitis.

Clinical Characteristic	Incidence (%)
Early postoperative diarrhea	60
Pain in left iliac fossa	44
Rectal hemorrhage	30
Hypo- or hyperthermia	70
Shock	56
Occlusive syndrome	38
Systemic bacteremia with anaerobic germs	12

There are other studies that analyzed Prognostic factors of ischemic colitis after infrarenal aortic surgery (Paineau et al.) [3]: early digestive symptoms, use of vasopressors, diagnosis in intensive care unit and a pH <7.35 at D1 were independently associated with acute ischemic colitis. These factors could help take the decision to operate POIC, especially to lower the effect of multiple organ failure syndrome (MOFS). [3]

Imagistic examination

Colonoscopy is the standard examination for establishing diagnosis and for the possibility of taking biopsy samples. On a series of 26 patients, J.C. Farkas found right and left colon lesions in 4 cases, left colon in 18 cases, left colon and rectum in 2 cases, rectum in 2 cases [4].

Another imagistic examination is the abdominal echo-Doppler, which can visualize the origin of superior and inferior mesenteric artery and the possible obstructions with thrombus or atherosclerotic plaque.

We did not use the colonoscopic examination on our patients, the diagnosis being established by clinical and abdominal echo-Doppler examination in all cases.

Medical treatment

The condition resolves completely with conservative treatment in most cases, but late diagnosis or severe ischemia can be associated with high rates of complications and death. [5]

Without a severe infectious syndrome or peritonitis, the antibiotic therapy did not demonstrate its utility; the empiric administration of antibiotics could determine a selection of the resistant germs. Preoperatively digestive decontamination can be an alternative; instillation of Gentamycin in the digestive tube on animals, diminishes the systemic endotoxinemia in experimental ischemic colitis and reduces the number of deaths. Other protective measures are: maintenance of normal homeostasis, which has become routine in intensive care units, vasodilator drugs such as Papaverine injected directly into the superior mesenteric artery; antibiotics (Polimyxin B) may have a specific effect against lipopolysaccharide endotoxin, and anticoagulants. From the laboratory evidence it would seem logical to use antioxidants such as allopurinol, superoxide dismutase and dimethyl sulphoxide. [2, 6, 7, 8, 9, 10]

Preventive surgical treatment

Many authors proposed the re-vascularization of inferior mesenteric artery whenever it was possible. Systematic re-implantation of inferior mesenteric artery diminished the incidence of ischemic colitis. [7, 10]

Curative surgical treatment

Surgical indication is established by the presence of multiple organic failure syndrome. Even the presence of one isolated sign can impose the indication for resection. The ideal is a resection in the health tissue, spotted by endoscopy. A second look is indicated if in postoperative period an aggravation in patient status appears, and allows a complementary resection in 60% of cases. [4, 7, 9]

Mortality

Mortality rate varies between 27 and 100%, being determined by the evolution of multiple organic failure syndrome, persistent ischemia of the unresected bowel, or another surgical complication: peritonitis, necrotizing pancreatitis. Attention to preoperative, intraoperative, and postoperative aspects can reduce the incidence and severity of ischemic colitis and significantly reduce morbidity and mortality. [11]

Conclusions

The development of ischemic colitis following abdominal aortic surgery is associated with substantial morbidity and mortality. Ischemic colitis appears in general on a debilitated patient, with cardiac and / or respiratory failure, and it complicates in most cases with a multiple organic failure syndrome. The high mortality rate militates on developing the preventive treatment and early diagnosis of this syndrome.

REFERENCES

[1]. Becquemin, J-P., Majewski, M., Fermani, N., Marzelle, J., Desgrandes, P., Allaire, E., Roudot-Thoraval, F. (02/2008). Colon ischemia following abdominal aortic aneurysm repair in the era of endovascular abdominal aortic repair. Journal of Vascular Surgery, 47(2) , 258 – 263. | | [2]. Bjork, M., Heberg, B. (1994). Early detection of major complications after abdominal aortic surgery: predictive value of sigmoid colon and gastric intramucosal pH monitoring. British Journal of Surgery, 81, 25-30. | | [3]. Paineau, J., Darras, S., Patra, P., Goueffic, Y. (07/2011). Prognostic factors of ischemic colitis after infrarenal aortic surgery. Ann. Vasc. Surg., 25 (5), 612-619. | | [4]. Farkas, J.C., Calvo – Verjat, N., Laurian, C., Marzelle, J., Fichelle, J.M., Gigou, F., Bleriot, J.P., Dazza, F.E., Carlet, J., Cormier, J.M. (1992). Acute Colorectal Ischemia after Aortic surgery : Pathophysiology and prognostic criteria. Ann. Vasc. Surg., 6 , 111-118. | | [5]. Baixauli, J., Kiran, R.P., Delaney, C.P. (11/2003). Investigation and management of ischemic colitis. Cleveland clinic journal of medicine, 70 (11). | | [6]. Marston, A. (1990). Acute intestinal ischaemia. BMJ, 301, 1174 – 1176. | | [7]. Marshall, J.C., Christou, N.V., Horn, R., Meakins, J.L. (1989). The microbiology of multiple organ failure, the proximal gastrointestinal tract as an occult reservoir of pathogens. Arch.Surg. , 123, 309 – 315. | | [8]. Longo, W.E., Lee, T.C., Barnett, M.G., Vernava, A.M., Wade, T.P. (1996). Ischemic colitis complicating abdominal aortic aneurysm surgery in the US veteran. J. Surg. Res., 60, 351 – 354. | | [9]. Ernst, C.B., Hagihara, P.F., Daugherty, M.E., Sachatello, C.R., Griffen, W.O. (1976). Ischemic colitis incidence following abdominal aortic reconstruction : A prospective study. Surgery, 80, 417 – 421. | | [10]. Carrico, C.J., Meakins, J.L., Marshall, J.C. (1986). Multiple organ failure syndrome: The gastrointestinal tract: The motor of MOF ? Arch. Surg., 121, 197 – 201. | | [11]. Sanfelippo, P.M. (03-04/1999). Steps to Minimize Ischemic Colitis Following Abdominal Aortic Surgery. Vascular Surgery, 33 (2), 175. |