

# Surgical management of ischemic bowel Surgery: Review

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## Abstract:

The aim of this review is to discuss the surgical treatment of ischemic bowel, that's why it's very important to understand the anatomy, etiology and pathophysiology of this disease. We outline the diagnosis types and surgical treatment. We conducted a search through electronic databases; PubMed, and EMBASE, for studies published in English language thought instant to 2017. Studies discussing the Surgical management of ischemic bowel surgery were included whether were reviews or control studies. The etiology of ischemic colitis is multifactorial and also the medical presentation variable. The medical diagnosis is based upon a combination of clinical suspicion, endoscopic and also histological results. Treatment and also result rely on the seriousness of the illness. The majority of situations of the non-gangrenous type are transient and also solve spontaneously without difficulties. Identifying danger factors in younger patients and also sustaining a high index of suspicion is necessary to institute appropriate care. Most of patients respond to medical management. High morbidity and also death and immediate operative intervention are the trademarks of gangrenous ischemic colitis.

## Introduction:

Ischemic colitis is one of the most usual type of gastrointestinal (GI) ischemia, representing 50 to 60% of all situations [1] as well as accompanying an occurrence of 4.5 to 44 instances each 100,000 individual years [2]. It represents 1 in 2000 medical facility admissions [3]. The reasons for ischemic colitis many, yet all bring about lessened perfusion of the colon, which subsequently brings about mucosal injury or perhaps full-thickness necrosis. For over a century, gangrene of the colon has actually been well defined in the clinical literature after ligation of a significant colic artery. Nevertheless, the possible short-term nature of the condition without gross vascular occlusion was not defined up until 1963, when Boley et alia [4] recognized 5 patients with "relatively easy to fix vascular occlusion of the colon." Around the very same time, Marston et alia presented the term "ischemic colitis." Marston even more identified the condition right into 3 kinds: gangrenous, stricturing, and also short-term [5]. Although these categories continuously be true today, the clinical acute condition is split into just 2 teams: full thickness with gangrene and also partial thickness, restricted to the mucosa as well as submucosa. Given that these very first summaries, ischemic colitis has actually ended up being a well-recognized problem brought on by lowered or disrupted blood circulation to the colon. Many instances of ischemia are short-term, do not result in complete thickness necrosis, and also can be handled conservatively.

Developing the proper medical diagnosis and also supplying suitable and also prompt treatment remains to be an obstacle. As the illness is commonly short-term and also offers with self-limiting and also obscure abdominal and intestinal tract signs, the precise etiology is seldom determined. Danger elements consist of age above 65, background of cranky bowel illness, chronic obstructive lung condition, constipation, thrombophilia, and also systemic arterial illness. Individuals of

women sex have actually been discovered to be at greater threat [2], [6] although this has actually not been constant throughout all released.

The aim of this review is to discuss the surgical treatment of ischemic bowel, that's why it's very important to understand the anatomy, etiology and pathophysiology of this disease. We outline the diagnosis types and surgical treatment.

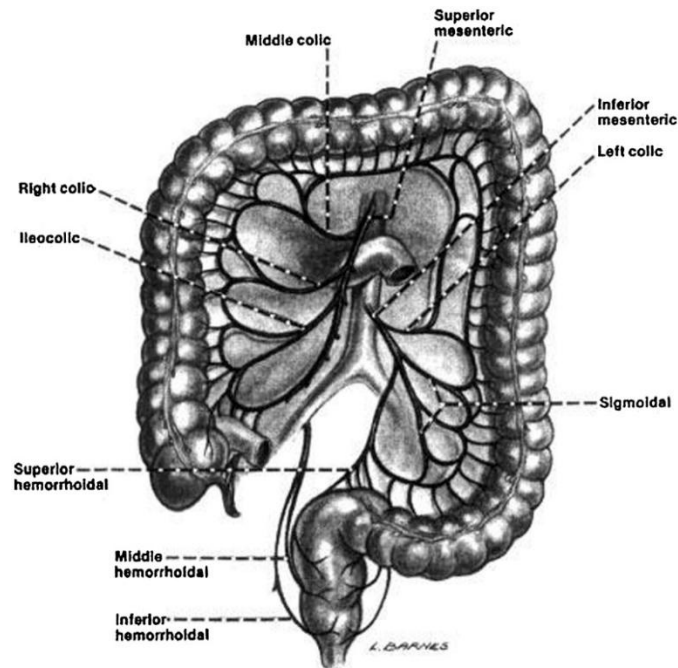
### **Methodology:**

We conducted a search through electronic databases; PubMed, and EMBASE, for studies published in English language thought instant to 2017. Studies discussing the Surgical management of ischemic bowel surgery were included whether were reviews or control studies. We excluded case reports. Moreover, references of included studies were scanned for more relevant articles.

### **Discussion:**

#### • **Anatomy**

Understanding of the vascular anatomy of the colon is essential to understand the progression of ischemic colitis. The colon gets its blood supply from the superior mesenteric artery (SMA) as well as the inferior mesenteric artery (IMA). The anus obtains its blood supply from the combined interior iliac arteries as well as the inferior mesenteric artery (**Fig. 1**).



**Figure 1.** Vascular supply of the colon [7].

The SMA gives rise to the middle colic, right colic, and also ileocolic arteries, which supply the proximal two-thirds of the transverse colon, rising colon, and also cecum. Variants in anatomy accompany ~ 20% of the populace having a missing middle colic artery [8]. The IMA branches right into the left colic, sigmoid, and also superior rectal (hemorrhoidal) arteries supplying the distal transverse colon, coming down colon, sigmoid colon, and also proximal facet of the anus, specifically. The combined internal iliac arteries give rise to the middle and also inferior rectal (hemorrhoidal) arteries that provide the mid and also distal anus, and also remain in connection with the superior rectal (hemorrhoidal) arteries as well as the blood supply from the IMA.

Along with these primary arterial branches, there is an abundant collateral blood circulation. The marginal artery of Drummond overlaps the perimeter of the colonic mesentery, giving rise to the vasa recta and also connecting the inferior mesenteric artery to the superior mesenteric artery [9].

In ~ 70% of patients with peripheral vascular illness, the marginal artery of Drummond makes up

the primary collateral as well as just considerable resource of arterial blood to the distal colon [8]. The arc of Riolo, though extremely variable in the populace, straight links the superior mesenteric as well as inferior mesenteric systems. These collateral vessels aid to make sure sufficient perfusion ought to among the major branches end up being occluded. Face to faces with chronic occlusion of among the primary vascular branches, the arc of Riolo or low artery of Drummond could expand to make up for the reduced circulation.

Regions of the colon most sensitive to reduced blood circulation and also most likely to struggle with ischemia are the splenic flexure (Griffiths factor) as well as sigmoid colon (Sudek's factor). These "watershed" regions are where the blood circulation from the superior mesenteric artery and also inferior mesenteric artery satisfy, and also where the inferior mesenteric artery, as well as rectal arteries, meet. Watershed regions particularly depend on the marginal artery of Drummond to supply collateral circulation. In anatomic researches, it has actually been revealed that ~ 50% of the populace has actually an improperly created marginal artery, as well as ~ 5% have an insufficient artery resulting in raised danger for ischemic injury [10]. There is additionally proof that the colic arteries come to be much more tortuous with advanced age [11]. Generally, the watershed composition of the colon offers a superb reason the left colon, as well as splenic flexure, is associated with 75% of ischemic colitis situations [12] and also why the rectum (with its abundant battle blood supply) is associated with just 5% of instances.

### · Etiology

The reasons for digestive ischemia many and also can be split right into 2 teams: occlusive illness and nonocclusive illness. Both results in a decrease in mesenteric blood circulation to the colon bring about ischemia. The extent of the ischemia will certainly identify whether transmural death

(gangrenous colitis) happens or so the mucosa and/or submucosa is included (nongangrenous colitis). Segmental, nongangrenous ischemic colitis represent 80 to 85% of situations and also typically solves with medical management [3]. Gangrene takes place in the continuing to be situations as well as constantly calls for medical treatment.

Regularly no clear reason for the ischemia is determined, making the medical diagnosis difficult. Angiography is hardly ever practical in the workup of ischemic colitis, as big vessel occlusion is virtually never ever determined. One of the most likely reason in these circumstances is local, nonocclusive ischemia in association with tiny vessel illness. Patients with ischemic colitis have the tendency to have several threat variables for vascular illness such as individuals over 65 years old, individuals with cardiac arrhythmia, and also thrombophilia. For vague factors, patients with irritable bowel syndrome (IBS) have actually a threefold boosted danger for ischemic colitis. Patients with chronic obstructive lung condition (COPD) have a 2- to fourfold raised danger compared to the basic populace [2]. Constipation has actually likewise been recognized as a threat aspect for the growth of ischemic colitis. This is thought to be because of boosted intraluminal pressures triggering compression of the blood vessels and also resultant lowered mucosal vessel circulation [13]. Simultaneous use laxatives could worsen the issue, possibly bring about perforation. Ladies are more probable to struggle with ischemic colitis compared to are men [6]. Various other usual danger variables involved hypertension, kidney failing or nephropathy, as well as diabetes mellitus [14].

### • Pathophysiology

Colonic ischemia is typically the outcome of an unexpected, short-term, decrease in blood circulation that wants to satisfy the metabolic needs of the area of colon. The first, as well as most

extreme ischemic adjustments, are constantly in the colonic mucosa. The ischemic modification will ultimately expand from the mucosa to the serosa. The mucosal adjustment will certainly be most noticeable on the antimesenteric mucosal cellular lining of the colon. Throughout durations of hypotension, blood circulation is rerouted to the mind at the expense of the splanchnic flow. Throughout these episodes, patients are much more at risk to ischemic insults. The mucosal injury will certainly establish in ~ 20 mins to 1 hr, whereas transmural infarction takes place within 8 to 16 hrs [15]. Extra disrespect happens when blood circulation is improved as well as reperfusion injury happens. Reperfusion injury is connected with the launch of responsive oxygen types, which trigger lipid peroxidation within cell membrane layers, causing cell death [16].

In healthy and balanced people, the splanchnic blood circulation obtains 10 to 35% of the cardiac outcome. In a canine version, blood circulation to the intestinal tract needed to be lowered by 50% to generate ischemia, revealing that the intestinal tract is rather immune to durations of bad perfusion [17]. The regional autoregulation of the splanchnic vasculature enables upkeep of digestive tract perfusion and also oxygen removal up until mesenteric arterial pressure drops listed below 40 to 45 mm Hg [18]. Nevertheless, offered the high capillary density of the bowel and also the boosted permeability, any type of rise in the capillary pressure could result in substantial liquid loss leading to edema of the bowel. In addition, as permeability rises and also ischemia advances, microbial translocation will certainly happen causing systemic absorption of endoluminal toxic substances as well as prospective development to multiorgan failing [19].

#### • **Diagnosis**

Offered the vague scientific discussion, wide differential medical diagnosis, and also problem in locating a provoking occasion, the medical diagnosis of ischemic colitis is commonly postponed

while discovering the much more usual etiologies. Analysis analysis of these patients have to consist of stool cultures to assess for transmittable colitis, Clostridium difficile antigen to evaluate for Clostridium difficile colitis, calculated tomography (CT) check to examine for diverticulitis, and also a mix of CT imaging and also endoscopy to search for inflammatory digestive tract illness or colonic carcinoma. In a lot of cases, endoscopic biopsy might contribute in setting apart ischemic colitis from ulcerative or infectious colitis [20]. The mix of background, health examination results, lab information, radiographic imaging, endoscopy, and also biopsy enable the precise medical diagnosis. Additionally, routine-screening electrocardiogram (ECG), transthoracic echocardiogram, or even Holter monitoring has actually been recommended because of the high capacity for cardiac emboli. In more youthful patients, a reason is frequently a lot more conveniently determined as a result of a greater organization with medicines, immoral medications, sickle cell illness, thrombophilia, or vasculitis [21].

### **Imaging**

**X-Rays.** Ordinary radiographs are hardly ever useful in the medical diagnosis of ischemic colitis. Unless the illness has actually advanced to transmural necrosis as well as perforation triggering pneumoperitoneum, the searchings for could be refined or lacking. Thumbprinting is a traditional finding for mucosal edema, and also though general for ischemic colitis, it might be useful in routing management. Pneumatosis intestinalis could likewise be determined if mucosal damages has actually accompanied flow of gas right into the bowel wall surface. Although this result is concerning, it is general to ischemic colitis and also warrants better examination. The first set of ordinary radiographs is practical to guarantee that there has actually been no visceral perforation with proof of pneumoperitoneum, as this would certainly mandate more-aggressive management.



**Computed Tomography.** CT is one of the most practical in the first evaluation of the patient with stomach discomfort. It could omit various other reasons for stomach discomfort, recommend a place as well as a resource of anemia, as well as recognize problems connected with more-advanced illness.

In the nongangrenous type of the illness, the CT will regularly reveal bowel wall surface enlarging, thumbprinting, and also pericolonic stranding with or without ascites. The dual halo or target indicator might exist [22]. Segmental bowel wall surface enlarging is seen in many cases with a typical wall surface density of 8 mm [23]. After reperfusion, there might be proof of submucosal edema or hemorrhage. Emboli or thrombus creating full arterial occlusion is sometimes seen with matching slim, unenhancing colonic wall surface because of total absence of reperfusion. Pneumatosis coli, or air within the mesenteric or portal venous system, is an extra threatening result related to bowel infarction; nevertheless, it can be related to COPD, infectious colitis, steroid therapy, or after radiation or radiation treatment, or related to obtained immunodeficiency syndrome (AIDS) [22]. However, CT discoveries do not associate with, neither do they forecast, the advancement of bowel infarction [23].

### **Ultrasound**

Color Doppler sonography has actually just recently been revealed to be an extremely delicate forecaster of colonic ischemia. Recognition of colonic wall surface enlarging and also transformed pericolonic fat, in addition to missing or hardly noticeable shade Doppler circulation make the pointer of ischemic condition [24]. Serial evaluations could supply added details relating to the development of illness; nonetheless, sonography is restricted by overlapping bowel gas, the experience of the operator, as well as inadequate level of sensitivity for low-flow vessel illness [25].

## **Colonoscopy**

In recent times, colonoscopy has actually changed barium injection as one of the most typical analysis approach and also the gold requirement for verification of IC. It is a lot more delicate as well as enables visualization of colonic mucosa as well as histological evaluation of biopsies. Nevertheless, with the exception of colonic gangrene, neither endoscopic neither histological searchings for specify [26] as well as extremely depend upon the period and also intensity of ischemic injury. Medical diagnosis calls for very early colonoscopy (< 48 h). Serial research studies about the scientific setup are required to develop the medical diagnosis.

Ischemic tissue damages to the colon are believed to be an outcome of both regional hypoperfusion throughout the ischemic duration and also reperfusion injury when blood circulation returns. When the ischemic duration is quick, reperfusion could be considerable and also represent the majority of the histologic and also endoscopic damages existing in IC [2]. Reperfusion injury might be connected with the launch of oxygen cost-free radicals which trigger lipid peroxidation within cell membrane layers, leading to cell lysis as well as tissue damages.

When the ischemic duration is a long period of time, hypoperfusion denies the engaged bowel of oxygen as well as nutrients, causing hypoxia as well as straight cell death [2]; damages proceeds from the lumen in an outward direction to the serosa (from the mucosa as well as submucosa to much deeper layers).

### **· Surgical Treatment**

In the acute setup, the personnel treatment is determined by the level of injury to the bowel and also the total problem of the patient. All nonviable bowels have to be resected. A damage-control strategy might be shown if intraoperative tracking exposes hypothermia, coagulopathy, and also

acidosis. Review procedures might work if there are locations of doubtful perfusion. The choice to carry out an anastomosis needs to be based upon the prompt problem of the patients in addition to an evaluation of their comorbidities as well as dietary condition.

After resolution of the acute assault, a handful of patients will certainly create strictures in the colon. Colonoscopy with biopsy is suggested to assess for malignancy or various other pathology. Relying on the seriousness of the signs and also the level of constriction, expansion or surgical resection might be suggested.

Comprehensive little bowel ischemia provides a medical quandry for the surgeon, that should identify the demand for as well as the level of resection essential at the time of preliminary laparotomy. Numerous approaches have actually been recommended to identify bowel feasibility at the time of surgical procedure, consisting of fluoroscein as well as Doppler research studies, however, none allows recurring analysis of the continuing to be bowel section after surgery [27], [28]. The three-stage technique that we explain authorizations serial endoscopic and also radiologic analysis of the partially sensible section. Nonfunctional or strictured sectors can be resected, if required, therefore making the best use of digestive tract conservation. Not all patients with the ischemic digestive tract, nevertheless, are prospects for this treatment. Bowel with plainly irreparable complete density injury or gangrene at first procedure, or without proof of peristalsis or blood circulation at "review" procedures have to be resected. Patients with ongoing or unexpected degeneration triggered by consistent ischemia or perforation of entailed bowel might need more resection in the very early postoperative duration. Likewise, the patient and also family have to be prepared to endure the numerous procedures should recover digestive connection when this plan is applied. The judgment as well as experience of the surgeon hence play an essential duty in establishing that is a suitable prospect for this treatment. The three-staged management approach

for ischemic bowel triggered by external strangulation gives an alternate method to the conventional technique of considerable resection of drastically ischemic bowel. It allows serial examination of partially feasible digestive tract, therefore offering ultimate salvage of digestive tract with relatively easy to fix high-grade ischemic adjustments in chosen patients.

### **Conclusion:**

The etiology of ischemic colitis is multifactorial and also the medical presentation variable. The medical diagnosis is based upon a combination of clinical suspicion, endoscopic and also histological results. Treatment and also result rely on the seriousness of the illness. The majority of situations of the non-gangrenous type are transient and also solve spontaneously without difficulties. Identifying danger factors in younger patients and also sustaining a high index of suspicion is necessary to institute appropriate care. Most of patients respond to medical management. High morbidity and also death and immediate operative intervention are the trademarks of gangrenous ischemic colitis.

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