

## The current clinical diagnosis and management of small bowel bleeding caused by a primary aortic fistula: A literature review

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### Abstract

Background: Primary aortic intestinal fistula is caused by erosion, rupture, and perforation of the adjacent digestive tract of the arterial wall, and the mortality rate is extremely high, the preoperative diagnosis rate is only 0%~36%, and the autopsy detection rate is only 0.04%~0.007%. Because there are no typical clinical symptoms that have not been detected, it is necessary to expand the sample size and further explore its etiology, pathophysiology, and pathogenesis to improve the diagnosis rate and the relevant diagnosis and treatment techniques. Methods: This study focuses on understanding primary aortic fistula-induced small bowel hemorrhage. We gathered electronic search data from Scopus, Medline, Google Scholar, PubMed, Springer, and CNKI. Recommendations were extracted from the identified articles. Conclusion: To identify small intestinal hemorrhages as quickly as feasible and provide prompt and effective care, professionals should devote more attention to diagnosing and treating small intestinal bleeding and increase public awareness of the condition.

**Keywords:** Abdominal aortic aneurysm, Anticoagulation therapy, Endoscopic hemostasis, Primary aortic fistula, Thrombocytopenia

### 1. Introduction

In recent years, reports of small bowel bleeding caused by primary aortic fistula have gradually increased, and the condition is critical, and the non-surgical treatment rate is as high as 100%. Clinical symptoms, signs, and symptoms of small bowel bleeding are atypical and lack specificity.

Because the small intestine is adjacent to neighboring organs such as the stomach, duodenum, and colon, small bowel bleeding can be differentiated from other gastrointestinal disorders. Clinically, the treatment methods for small intestinal bleeding include endoscopic hemostasis, endoscopic anticoagulation therapy, and surgical treatment, among which endoscopic hemostasis is currently the main treatment method. With the development of diagnostic techniques and treatments, the diagnosis and treatment of small bowel bleeding have

improved significantly, but a certain proportion of patients are still undetected due to the absence of typical clinical symptoms. This article reviews the current status of diagnosis and treatment of small intestinal bleeding (Kringen et al., 2011).

## **2. The pathogenesis of primary aortic fistula**

The cause of primary aortic fistula is not clear, and foreign studies have reported that it may be related to the following factors: The most common cause of PAEF is abdominal aortic aneurysm, 85% of which originates from atherosclerotic abdominal aortic aneurysm, 15% from infectious disease, and very rarely from malignancy, duodenal ulcer, foreign body, or after abdominal radiotherapy. Traumatic or fungal aneurysms are the second most common cause, and other less common causes include radiation, infection, tumors, peptic ulcers, inflammatory bowel disease, and foreign body ingestion (García-Compeán et al., 2019).

## **3. Clinical manifestations**

The clinical manifestations of small intestinal bleeding lack specificity, there may be no obvious gastrointestinal symptoms or only varying degrees of anemia, and some patients have anemia symptoms, which may be related to thrombocytopenia caused by ischemia and hypoxia. The main symptoms of primary aortic fistula include abdominal pain, abdominal mass, hematemesis, or melena. The triad of abdominal pain, abdominal mass, and gastrointestinal bleeding is typical of PAEF but occurs in only 11 to 25% of patients. Sentinel bleeding is a characteristic manifestation of gastrointestinal fistula, an intermittent mild to moderate bleeding that is a precursor to bleeding.

This is because the first bleeding is a temporary cessation of bleeding due to the closure of the leak by an organic thrombus, followed by catastrophic hemorrhage due to increased arterial pressure after the thrombus moves, sheds, or volume replenishes. Because patients may have different degrees of bleeding tendency, it can be manifested as hematemesis, blood in the stool, melena, and other digestive tract symptoms; Peripheral bleeding manifestations such as skin and mucous membrane bleeding points and ecchymosis may also occur; It can also be manifested as simple bleeding on the surface of the small intestinal mucosa. Patients with small bowel bleeding are prone to spontaneous peritonitis which may be associated with septic shock; Clinically, it is necessary to be vigilant about acute hemorrhagic shock caused by large and rapid bleeding; When patients with small intestinal bleeding have acute heavy bleeding, the mortality rate is higher than that of simple small intestinal bleeding. Because patients with small bowel bleeding often have other conditions, diagnosis warrants a thorough evaluation of the patient's condition and systemic condition (Saygili et al., 2015).

## **4. Examinations and Diagnosis**

With the deepening of research on the pathogenesis of small intestinal bleeding, scholars at home and abroad believe that small intestinal bleeding can be associated with a variety of gastrointestinal diseases, but it needs to be combined with other gastrointestinal diseases for differential diagnosis. Small bowel bleeding can be diagnosed by endoscopic findings, which can detect active bleeding foci and are important for differential diagnosis, especially notably, endoscopy entangles in the diagnosis of gastritis, ulcers, and other appearances, resulting in delayed treatment and serious consequences.

If there are no obvious gastrointestinal bleeding symptoms or gastrointestinal symptoms such as hematemesis and melena, the blood flow at the bleeding site can be observed through endoscopy, while in the absence of obvious gastrointestinal symptoms or hematemesis, differential diagnosis by endoscopy is required. If available, an endoscopic biopsy can be used to determine the location of the lesion. The distance of the small intestine from the mouth and anus, its length, and the folding of the bowel tubes make it difficult to diagnose

on routine examination. At present, there is no simple and reliable auxiliary examination method for small bowel bleeding, and it is generally confirmed by a variety of auxiliary examination methods, including gastrointestinal endoscopy, capsule endoscopy, CT, MRI, and angiography. However, due to the complexity of the pathogenesis and pathological changes of small bowel bleeding, a definitive diagnosis cannot be made by a single auxiliary examination (Liao et al., 2010).

**Gastrointestinal endoscopy:** In general, upper gastrointestinal endoscopy and colonoscopy are the preliminary diagnostic methods of small bowel bleeding, mainly used to exclude upper gastrointestinal bleeding and colonic bleeding, but the deepest can only reach the descending duodenal or even horizontal or the end of the ileum about 20cm from the ileocecal valve. Many studies at home and abroad have shown that repeated gastrointestinal endoscopy can reduce the missed diagnosis rate. However, for aortic fistula, the diagnostic sensitivity is only 25%.

**Capsule endoscopy:** As a breakthrough in SIB diagnostic methods, capsule endoscopy (CE) is widely accepted by patients of all ages because of its painless and convenient characteristics. According to the European Society of Gastrointestinal Endoscopy guidelines for the diagnosis and treatment of small bowel disease by small bowel capsule endoscopy (SBCE) and Device-assisted enteroscopy (DAE), capsule endoscopy is clearly proposed as the first-line means of evaluating small bowel bleeding (Nicholson et al., 2014). Many domestic and foreign reports have pointed out that the combined application of capsule endoscopy (SBCE) and other examinations can greatly improve the diagnosis rate and reduce the missed diagnosis rate. The biggest advantage of capsule endoscopy is that the operation is simple, non-invasive, with no anesthesia or sedation, and it is a one-time use, there is no risk of cross-infection, but capsule endoscopy still has many technical limitations, such as capsule endoscopy cannot be inflated, intestinal cavity collapse or insufficient expansion will affect the quality of endoscopic photography, through the duoductyle porpoise site encountered bile residue or intestinal lumen secretion mucus interference can affect observation, in addition, capsule endoscopy cannot yet reach the degree of artificial control, or even if it is achieved, it has not been widely used, For the rapid passage of the intestinal lumen site lesion detection rate is low, the lesion cannot be repeatedly observed back and forth, the lesion site cannot be biopsied, hemostasis or lesion resection treatment cannot be performed. In addition, it is sometimes difficult to distinguish between highly correlated lesions and less correlated lesions, even if less related lesions, such as micro erythema or erosions, are considered negative findings (Frischer et al., 2012).

**Intraoperative colonoscopy:** In the 20th century, IOE was the gold standard for detecting lesions of the small intestine, allowing exploration of the entire mucosa. It can be inserted through oral, route, or enterotomy, and is facilitated by a surgeon to push the small intestine proximal. A foreign study on the role of IOE in the post-VCE/DAE era proposed that intraoperative colonoscopy is still a necessary technique to evaluate patients with small bowel bleeding, and new and additional lesions can be found even after extensive preoperative evaluation; IOE helps guide the treatment of pre-operative lesions and can change treatment decisions in a significant proportion of patients, so IOE has a clear role in carefully selected patients with small bowel bleeding (Avitzur et al., 2014). CT: rapid, non-invasive contrast-enhanced CT examination is mostly a first-line diagnostic measure for aortic and intestinal fistula, but because it cannot be directly observed at the lesion site, but CT negative cannot be completely excluded, it cannot be used as a basis for diagnosis (Miyano et al., 2015). MRI: It can clearly observe the blood flow of the lesion site, which has the advantages of being non-invasive, reproducible, and radiation-free, and is currently the preferred method for the clinical diagnosis of small intestinal bleeding. In addition, studies have found that CT has limited diagnostic value for small bowel bleeding. At present, it is believed that MRI has limited diagnostic value for small intestinal bleeding, and it should be judged clinically in combination with other examination methods (Ge et al., 2011).

Angiography: contrast with contrast that shows bleeding in the small intestine and can also observe blood flow to the lesion after angiography. With the deepening of the research on small intestinal angiography technology, it has been found that this examination also has certain limitations, such as allergic reactions to contrast media, and anaphylactic shock of contrast media (Holleran et al., 2017).

#### **4.1. Prognosis**

Small bowel bleeding can be caused by a variety of factors, but most are idiopathic. The prognosis for small bowel bleeding is related to the disease itself, the age and severity of the patient, and whether endoscopic hemostasis is received. However, studies have shown that early endoscopic hemostasis therapy can significantly reduce the mortality rate of small bowel bleeding, and the younger the age, the lower the mortality. For patients under 40 years old, the mortality rate within one year after surgery is 13%~20%; The mortality rate of patients over 40 years old within one year after surgery is 27%~29%, which is like the study of European adults (< 50 years old).

In one retrospective study, patients with small bowel bleeding who underwent endoscopic hemostasis early had fewer days in hospital and complication rates than those who underwent endoscopic hemostasis later. 3 months after surgery, there were no significant differences in the number of hospital stays, complication rates, and mortality rates between the two groups. For elderly patients with small bowel bleeding, the choice of surgical method is particularly important, because this type of patient has more intraoperative bleeding, and if the bleeding cannot be stopped in time during surgery, the postoperative mortality rate is higher. A randomized controlled study of endoscopic hemostasis in patients with small bowel bleeding showed that the rate of rebleeding after endoscopic hemostasis was low and decreased over time (Dionisio et al., 2010). At present, more studies have clearly defined the diagnosis and surgical indications of small bowel bleeding in order to improve the prognosis of patients with small bowel bleeding. However, the prognosis is not ideal for most patients with asymptomatic or atypical intestinal bleeding. Therefore, clinicians should pay more attention to patients with asymptomatic or atypical intestinal bleeding and perform endoscopic hemostasis as soon as possible. In addition, multi-center clinical trial studies should be conducted for different populations to explore effective clinical strategies. In addition, prospective, randomized controlled trials of relevant populations are needed to verify the efficacy and safety of endoscopic hemostasis (Niv et al., 2012).

#### **5. Treatment**

The preferred method of treatment for small bowel bleeding is endoscopic therapy, which can be treated with endoscopic mucosal resection (EMR) for small bowel bleeding that is difficult to tolerate and that is widely bleeding from the bowel wall. Endoscopic treatment of small bowel bleeding includes traditional EMR, snare banding, ESD, argon-helium knife, laser coagulation, and microwave coagulation. Endoscopic mucosal resection (EMR) is an option when conservative management fails or traditional EMR cannot be tolerated.

The choice of surgery depends on the presence of intestinal obstruction and small bowel bleeding for more than 24 hours. For patients with small bowel bleeding with small bowel obstruction and heavy bleeding, surgical treatment should be preferred over aggressive anticoagulation, and parenteral nutrition or endoscopic hemostasis can be used to prevent rebleeding. For small intestinal hemorrhages caused by other causes, such as other organ injuries and coagulation dysfunction, endoscopic hemostasis or surgical procedures can be selected to stop bleeding. Patients with small bowel bleeding who have failed conservative treatment should be treated with endoscopic mucosal resection (EMR) or surgery, depending on the patient's condition. For small bowel bleeding with clear clinical bleeding, endoscopic mucosal resection (EMR) treatment is generally preferred, which can effectively control the progression of the disease, reduce the amount of bleeding, and achieve the

purpose of reducing gastrointestinal rebleeding while successfully stopping bleeding. If bleeding is not effectively stopped, surgical procedures such as endoscopic mucosal dissection (ESD), argon-helium knife, or microwave coagulation may be the choice of treatment. If rebleeding is possible after aggressive anticoagulation of small bowel bleeding, surgical treatment should be a prompt choice. Patients at risk of gastrointestinal bleeding and coagulopathy, such as active bleeding, acute hemorrhagic shock, or requiring urgent hemostasis, should be aggressively treated surgically (Clarke et al., 2008).

## **6. Complications**

Small intestinal bleeding seriously threatens the life and health of patients, and the complication rate is as high as 30%~80%, among which the bleeding volume > 400 ml can lead to life-threatening complications such as hemorrhagic shock or acute respiratory distress syndrome; Bleeding volume < 400 ml may present with gastrointestinal bleeding symptoms and signs. If small bowel bleeding is not controlled in time, it can lead to massive blood loss and systemic infection. When massive blood loss occurs in the small intestine, patients may develop acute hypovolemic shock, which can be life-threatening in severe cases. Small intestinal bleeding is not only a major gastrointestinal bleeding but also a manifestation of a systemic disease, if not timely intervention, can cause systemic multi-system complications, and seriously threaten the life and health of patients. Small bowel bleeding is often associated with life-threatening complications such as shock and acute respiratory distress syndrome, and if not treated in time, it can lead to death. Therefore, in the treatment of small intestinal bleeding caused by small intestinal bleeding, attention should be paid to monitoring and timely symptomatic treatment to reduce the occurrence of complications.

The incidence of small bowel bleeding due to small bowel bleeding can vary depending on factors such as the size, age, and clinical manifestations of bleeding, but in general, patients with large bleeding volume and risk factors for hemorrhagic shock are more likely to develop small bowel bleeding (Volke et al., 2010). The complications of small intestinal bleeding mainly include gastrointestinal hemorrhage, and the mortality rate of gastrointestinal hemorrhage is about 20%~25%; Gastrointestinal hemorrhage combined with shock, a mortality rate of 25%~50%; Secondary acute respiratory distress syndrome, a mortality rate of 10%~20%; Severe infection or shock, the mortality rate of 30%~40%. In addition, small intestinal bleeding caused by small bowel bleeding can also be combined with multiple organ dysfunction syndrome and severe coagulation dysfunction, leading to serious complications and poor prognosis.

In addition to surgical intervention to stop bleeding, small intestinal bleeding can also be stopped by endoscopic hemostasis, endoscopic anticoagulation therapy, and other means on the basis of medical drug treatment, and some patients can alleviate their condition through conservative treatment. Patients with intestinal bleeding that do not respond to conservative therapy should undergo prompt surgical intervention to stop bleeding, usually by cutting the mucosa, serous layer, and muscular layer, then the submucosal layer, then the serous layer and free muscular layer, and finally free mesentery. If the lesion is in the distal small intestine, different surgical options (for example, proximal small bowel resection of the proximal bowel segment) are required depending on the condition. Patients who do not respond to endoscopic therapy should be treated promptly with surgery to improve the cure rate of small bowel bleeding (Rajan et al., 2013).

## **7. Discussions**

Small bowel bleeding is clinically common, but due to the lack of effective differential diagnosis methods, it is easy to be missed or misdiagnosed in the early stage. In recent years, with the continuous development of endoscopic technology, the diagnosis rate of small bowel bleeding has increased significantly. Current treatments include endoscopic hemostasis, anticoagulation, and surgery. However, due to the fact that small

intestinal bleeding is adjacent to neighboring organs such as the stomach, duodenum, colon, and so on, and lacks specific manifestations, the diagnosis, endoscopic treatment, and prognosis evaluation of small intestinal bleeding have always been difficult clinical problems. Therefore, it is necessary to further explore the pathogenesis of small bowel bleeding in order to further improve the diagnostic techniques and treatment methods. In short, although the current treatment methods can effectively control the small intestinal bleeding caused by small intestinal bleeding to a certain extent, due to its atypical symptoms, lack of specificity, and complex bleeding causes, it is necessary to combine endoscopic examination, combined with the patient's clinical manifestations and other imaging examinations. After more than fifteen years of development, endoscopic technology is also constantly improving, the third generation of capsule endoscopy has been put into use, capsule endoscopy has important guiding significance for the diagnosis of the whole intestine, especially for patients with poor cardiopulmonary function, unable to tolerate gastrointestinal endoscopy or enteroscopy, maybe the only choice of endoscopy. Problems with inaccurate positioning of capsule endoscopes, uncontrollable movement in the body, delayed drainage of capsule endoscopes in patients with gastrointestinal motility disorders, lack of ability to treat or take biopsies, and battery life remain. Trials using magnetic navigation technology and robotic mobile platforms to control capsule endoscopes running in vivo are currently underway.

The new generation of capsule endoscopy will carry biopsy and treatment devices, and have the function of directional drug delivery, and the future capsule endoscope will develop in the direction of artificial intelligence endoscopy (Teshima et al., 2011). The invention and clinical application of a series of device-assisted enteroscopy such as double-balloon enteroscopy has benefited many patients with small bowel diseases, avoiding some unnecessary surgical treatment operations, and the application of clinical ultrasound endoscopy combined with double-balloon enteroscopy can guide the choice of treatment (Monkemuller et al., 2008) but in terms of diagnosing small bowel diseases alone, compared with the non-invasive and simple operation of capsule endoscopy, double balloon enteroscopy is not dominant, and the operation of double-balloon enteroscopy is cumbersome and complicated, and the examination is long.

The technical level of the operator physician is high, most of the patients need anesthesia or sedation during the operation, and some patients can lead poor tolerance can lead to examination failure, even if the design of the spiral enteroscopy greatly reduces the time required for the operation of the examination, but still has the disadvantage of limited depth of the lens and low completion rate of the whole small intestine examination, the current mobile spiral enteroscopy is under development, once successfully developed, it will greatly improve the efficiency of the examination (Xiao-Ming et al., 2018). With the continuous development of endoscopic technology and the application of new technologies, the diagnosis rate and treatment rate of small intestinal bleeding have increased significantly, but a certain proportion of patients are still undetected due to atypical clinical symptoms, so it is necessary to improve the diagnosis rate by expanding the sample size, further exploring its etiology, pathophysiological mechanism, and pathogenesis, and improving related diagnosis and treatment techniques (Bandorski et al., 2016). In addition, the publicity and popularization of knowledge related to small bowel bleeding should be strengthened, and clinicians should pay more attention to its diagnosis and treatment, so as to detect small bowel bleeding as soon as possible and give timely and effective treatment (Su et al., 2014).

## **8. Contribution of the study**

In order to enhance the prognosis of patients with small intestinal bleeding, this study contributes to and precisely specifies the diagnosis and surgical indications of small bowel bleeding. However, most patients with

silent or unusual intestinal bleeding have poor prognoses; as a result, doctors require additional research to determine the best course of treatment for each patient.

## **9. Implications of the study**

Our study found that while the diagnosis and treatment rates of small intestinal bleeding have significantly increased due to the continuous development of endoscopic technology and the application of new technologies, a certain percentage of patients are still undiagnosed as a result of atypical clinical symptoms. Clinicians should focus more on its diagnosis and care in order to identify small intestinal hemorrhages as soon as feasible and administer prompt, efficient care.

## **10. Conclusion**

The diagnosis and treatment rates of small intestinal bleeding have both increased significantly. Still, a significant proportion of patients remain undiagnosed due to atypical clinical symptoms, so it is necessary to improve the diagnosis rate by increasing the sample size, further investigating its etiology, pathophysiological mechanism, and pathogenesis, and improving related diagnosis and treatment techniques. Small intestinal bleeding should be publicized and popularized, and physicians should pay more attention to its diagnosis and treatment in order to detect small bowel bleeding as soon as possible and provide early and effective treatment.

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