Superior mesenteric arteriovenous fistula: Case report and literature review

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A case of postoperative superior mesenteric arteriovenous (AV) fistula is presented. Review of the literature reveals the lesion to be an uncommon complication of abdominal trauma and surgery; less than 35 cases have been reported since the first in 1960. The fistula should be suspected in any patient who has undergone abdominal surgery or who has recently sustained penetrating abdominal trauma and who presents with crampy abdominal pain, diarrhea, and an abdominal bruit. Identification and precise localization is best accomplished by selective superior mesenteric arteriography. Symptoms and signs are those of transient intestinal ischemia and portal hypertension in association with an abdominal bruit or thrill. However, evidence of a high cardiac output state also may be present. In the reported case, the patient related episodes of chest tightness and a syncopal event. Mortality is due primarily to the sequelae of portal hypertension, which result from increased systemic-to-portal inflow of blood through the fistula. Therefore, early correction should be undertaken. Treatment should consist of laparotomy with ligation and division of the fistula. Successful percutaneous transcatheter embolization of a superior mesenteric AV fistula has been reported.

Superior mesenteric arteriovenous (AV) fistula is an uncommon complication following penetrating or blunt abdominal trauma, surgery, or aneurysm. To date, fewer than 35 cases of superior mesenteric AV fistula have been documented since

Movitz and Finne's¹ first report in 1960.

We present a case in which the fistula was secondary to right hemicolectomy for invasive carcinoid of the base of the appendix. The significance of superior mesenteric AV fistula, as well as its etiology, diagnosis, and treatment, is discussed.

Report of case

A 27-year-old man was admitted with a chief complaint of lower right quadrant abdominal pain. Six months earlier, the patient underwent right hemicolectomy for invasive carcinoid of the base of the appendix, which had been found incidentally at surgery for acute suppurative appendicitis.

Postoperatively, he had experienced recurrent episodes of lower right quadrant abdominal pain associated with nausea and loose bowel movements. Symptomatic treatment with analgesics had produced no pain relief. He also related episodes of chest tightness on exertion, which had been relieved by rest; these were worse at the end of the day. The patient denied emesis, melena, hematochezia, fever, chills, night sweats, or flushing associated with the pain. Results of a postoperative 5-hydroxyindoleacetic acid determination (24-hour urine collection) had been within normal limits.

Two weeks prior to admission, the patient had experienced abdominal pain and syncope. He was examined in the emergency department, treated with tylenol with codeine, and released. One week later, he was examined by his surgeon, who discovered an abdominal bruit in the lower right quadrant. Ultrasonography of the abdomen and aorta disclosed no abnormalities.

On admission, selective superior mesenteric arteriography revealed a direct communication between an ileal branch of the superior mesenteric artery and vein, with rapid filling of the superior mesenteric vein and portal vein (Fig 1). Also, marked dilatation of the superior mesenteric vein was noted. At laparotomy, a thrill was palpated in the mesentery. Exploration confirmed the arteriographic report, with AV fistula found between an ileal branch of the superior mesenteric artery and vein. Following quadruple ligation of the fistula, the thrill

Fig 1 Selective superior mesenteric arteriogram shows early filling of superior mesenteric vein (closed arrow) and portal venous system. The open arrow indicates the superior mesenteric artery; the arrowhead indicates the AV fistula.

resolved.

The patient had an uncomplicated recovery, with resolution of the abdominal bruit, abdominal pain, diarrhea, and chest tightness. He was discharged on the sixth postoperative day.

Discussion

Etiology

Penetrating abdominal trauma has been the most commonly reported²⁻¹⁰ cause of superior mesenteric AV fistula. In descending order of incidence, gunshot, stab, and shotgun wounds and shrapnel injury have been reported causes.¹⁰ Injury usually has involved an artery and vein in close proximity.¹¹

Surgery is the next most common etiology. The majority of postoperative superior mesenteric AV fistulas have occurred after bowel resection. However, the fistula has been reported^{12,13} after gastrectomy and laparotomy for lysis of adhesions without bowel resection. The direct cause of postsurgical fistula is the use of mass ligatures in the mesentery, which provides the initial arteriovenous communication required for the formation of a fis-

tula.¹¹⁻¹⁵ Moreover, Lee and associates¹² have commented that mesenteric vessels are especially vulnerable to fistula formation "because they course closely together anatomically."

There have been isolated reports of superior mesenteric AV fistula resulting from blunt abdominal trauma¹⁰ and of spontaneous AV fistula formation secondary to rupture of a superior mesenteric artery aneurysm into its adjacent vein¹⁶. However, such causes are rare.

Diagnosis

The diagnosis of superior mesenteric AV fistula generally can be made on the basis of history and physical examination. Crampy abdominal pain, diarrhea, an abdominal bruit or thrill, and, occasionally, the presence of signs of portal hypertension, especially in patients with a history of bowel surgery or penetrating abdominal trauma, should raise the clinical suspicion of mesenteric AV fistula.^{5,11,13}

Crampy abdominal pain and diarrhea have been attributed to transient ischemia of that portion of bowel distal to the fistula.^{3,5,9-11} Nicholas and Lane⁵ state that "the fistula can produce ischemia on both an arterial and a venous basis." Ischemic changes in the bowel, including discoloration and mucosal ulceration, also have been reported.^{5,12} Venous congestion with associated hemorrhage into the muscular layers of bowel wall and edema of bowel and mesentery have been reported^{1,5,6,12} at laparotomy and at autopsy. Reported cases^{6,9} of clinical presentation as abdominal pain, bloody diarrhea, fever, and leukocytosis without infection support this theory.

In Bole and coworkers² case, hemodynamic studies demonstrated a high flow state across the AV fistula, with markedly diminished blood flow distally. These findings correlated with arteriographic findings of delayed visualization of the superior mesenteric artery distal to the shunt. They also support the theory of bowel ischemia as the cause of the clinical symptoms and signs of superior mesenteric AV fistula.

Hyperkinetic, turbulent blood flow across the fistula accounts for the presence of a bruit or thrill,² which was present in virtually all reported cases,¹⁰ including ours. Hemodynamic alterations in patients with superior mesenteric AV fistula are seen primarily in the portal circulation. Portal hypertension and its sequelae secondary to abnormal systemic-to-portal blood flow have been documented.^{3,5,6,8,10,12,13} Death from superior mesenteric AV fistulas has resulted in approximately 10% of

cases from the sequelae of portal hypertension.¹⁰

At first, it was thought^{3,6} that adverse systemic hemodynamic effects from systemic-to-portal fistulas were minimal or absent because of the damping effect created by the interposition of the liver between the abnormal AV communication and the right side of the heart. Unlike patients with systemic AV fistulas, there initially appeared to be no propensity by patients with systemic-to-portal fistula to develop clinical signs of a high cardiac output state.⁸ However, later reports^{2,5,13} have documented increased circulatory demand, which was reflected primarily as increased cardiac output. In a case of superior mesenteric AV fistula reported by Paloyan and associates,¹⁵ symptoms and signs of a high cardiac output state included cardiomegaly, hypertension, electrocardiographic demonstration of left ventricular hypertrophy, and peripheral edema. All cardiac abnormalities resolved after correction of the fistula. It is clear that while major hemodynamic effects occur in the portal circulation, there is potential for serious cardiac complications in patients with superior mesenteric AV fistula.

The single best diagnostic study is selective superior mesenteric arteriography, although diagnosis by digital subtraction angiography, ultrasonography, computed tomography, and magnetic resonance imaging has been reported.^{16,17} Arteriography allows precise definition and localization of the fistula,¹⁰⁻¹² as well as evaluation of the portal venous system.¹² Angiographic findings demonstrate early filling of the superior mesenteric vein and portal system, with dilatation of the mesenteric and portal venous system. Narrowing and delayed filling of the superior mesenteric artery distal to the fistula may also be observed.

Although aortography may also be a useful procedure, flush aortography may not demonstrate the fistula if it overlies an opacified aorta.⁹⁻¹¹ Consequently, if aortography alone is used, biplanar aortography should be the procedure of choice.^{10,11}

Treatment

Recommendations have been made regarding prevention of postsurgical superior mesenteric AV fistula since the first reported case by Movitz and Finne,¹ who stressed control with individual ligation of contiguous arteries and veins and avoidance of mass ligatures or transfixion ligatures. Subsequent authors^{11,12,14} have echoed their recommendations.

Prevention of post-traumatic superior AV fistula is less feasible, however, and early recognition and

treatment should be the rule. At least one case report⁷ described recognition and treatment at primary laparotomy of a superior mesenteric AV fistula secondary to stab wound.

Surgical treatment generally consists of ligation and division of the fistula. However, depending on the fistula's size and location and associated pathologic findings, treatment might require arterial or venous reconstruction or bowel resection.^{12,14}

In 1982, Uflacker and Saadi¹⁸ described the successful use of transcatheter embolization of a superior mesenteric AV fistula with stainless steel spring coils. While percutaneous transcatheter embolization is an attractive alternative to surgery, its use for fistulas of the mesenteric circulation is too limited to draw conclusions about its place in the treatment of these lesions. However, with advances in technology and expertise in interventional radiology, the procedure holds promise for the future.

Comment

The major significance of superior mesenteric AV fistula is its adverse effects on the portal circulation and blood supply to the bowel distal to the fistula. Mortality from superior mesenteric AV fistula can be directly attributed to these effects.^{6,10} Therefore, diagnosis should lead to immediate treatment.

It appears that size, location, and duration of the fistula determine the severity of its effect upon the systemic and portal circulatory systems, as well as upon the severity and nature of symptoms.^{5,11} Large, proximally located lesions tend to have the most pronounced effect on portal circulation, cardiac output, and blood supply to the bowel distal to the fistula, while smaller, more distal lesions have a lesser effect.¹¹

Clinically apparent high cardiac output states with its sequelae, while rare, may be significant in these cases.¹⁵ Our patient had symptoms attributable to a high cardiac output state, including chest tightness and a syncopal event. However, adequate hemodynamic measurements were not made to document the cardiac output status.

Summary

A case of postoperative superior mesenteric arteriovenous fistula has been presented. Its etiology, diagnosis, and management are discussed. Regardless of its presentation, the potentially serious effects of superior mesenteric AV fistula have been documented, and the only prerequisite to treatment should be its diagnosis.

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