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Report of a Case of Ruptured Pseudoaneurysm of the Superior Mesenteric Artery

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Abstract: *Pseudoaneurysms of the superior mesenteric artery are relatively rare in clinical practice, often presenting with atypical clinical manifestations that can lead to misdiagnosis and serious consequences. This paper reviews a case of ruptured pseudoaneurysm of the superior mesenteric artery and discusses its clinical presentation and management strategies, drawing upon relevant literature.*

Keywords: *Superior mesenteric artery; Pseudoaneurysm; Interventional therapy*

1. Introduction

Among pseudoaneurysms, splenic artery pseudoaneurysm predominates, with superior mesenteric artery pseudoaneurysm (SMAP) being comparatively infrequent[1]. Its symptoms often include abdominal pain, nausea, vomiting, local compressive symptoms, and gastrointestinal bleeding. Approximately half of patients may present with a pulsatile abdominal mass or abdominal bruit[2-5] . The formation of SMAP is often associated with inflammatory conditions such as pancreatitis, infectious diseases and complications following abdominal surgery. Despite its rarity, SMAP poses a high risk of massive bleeding, acute thrombosis, and small bowel infarction, with mortality rates exceeding 35% in such complications[1, 6]. Therefore, early and immediate treatment is crucial for all cases of SMAP.

2. Case report

A 48-year-old female patient was admitted on October 29, 2023, presenting with persistent abdominal pain persisting for 20 days, which worsened over the preceding week. The patient initially experienced back pain and mild abdominal discomfort 20 days ago after consuming spicy food, which partially alleviated following symptomatic treatment at a local hospital. One week prior to admission, the abdominal pain intensified, unaccompanied by nausea, vomiting, or additional symptoms. Subsequent examination at the local hospital identified abdominal and pelvic fluid accumulation along with a hematoma. The patient, accompanied by family members, was transferred to our hospital for further management. There was no notable medical history. Upon admission, physical examination revealed a flat abdomen without peristaltic waves, mildly tense abdominal muscles, and mild tenderness in the upper abdomen without rebound tenderness. A palpable mass, approximately 1.5 cm in diameter, was detected with a slightly firm consistency and mobile nature. Shifting dullness was negative, and bowel sounds were normal. Laboratory investigations revealed a normal white blood cell count, hemoglobin level of 97.70 g/L, high-sensitivity C-reactive protein (CRP) concentration of 23.60 mg/L, lipase level of 338.00 mg/L, serum iron (Fe) level of 7.3 umol/L, and normal amylase activity. On that day, the patient was instructed to fast and commenced treatment comprising iron supplementation and gastric protective measures. On the subsequent day, the patient's abdominal pain intensified. Physical examination disclosed tense abdominal muscles, tenderness with rebound tenderness in the left upper quadrant, enlargement of the mass, and slightly diminished bowel sounds. Urgent blood tests revealed a white blood cell count of 12.35 × 10^9/L and hemoglobin level of 87.90 g/L. Abdominal contrast-enhanced CT scan findings (Figures 1a, 1b) revealed a poorly defined, round isodense lesion beneath the pancreatic head, measuring approximately 2.1 × 2.2 × 1.5 cm, with a branch of the superior mesenteric artery (SMA) traversing it. The lesion was surrounded by indistinct fat stranding and increased density, suggestive of a potential rupture and hemorrhage of a pseudoaneurysm, accompanied by multiple exudates and hematomas in the vicinity. Following multidisciplinary consultation, the diagnosis of ruptured hemorrhage from a superior mesenteric artery pseudoaneurysm (SMAP) was established for the patient.

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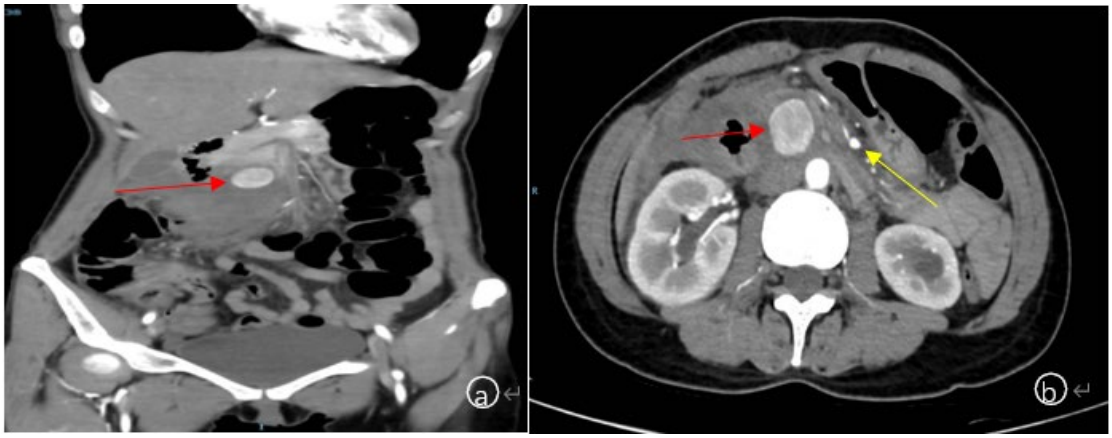
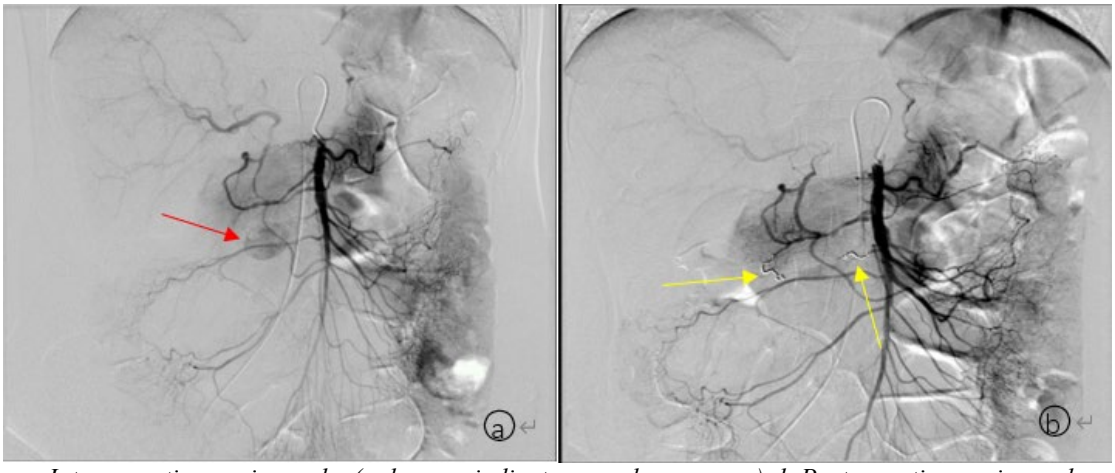
Later that evening, the patient was transferred to our interventional operating room for percutaneous embolization of the superior mesenteric artery and angiography. The procedure was performed under general anesthesia, beginning with a Seldinger technique puncture of the right femoral artery, followed by insertion of a 5F Cobra vascular sheath. A 5F RH catheter was then positioned at the origin of the superior mesenteric artery, guided by a hydrophilic wire. Intraoperative angiography revealed (Figure 2a) contrast agent leakage from two small branches of the superior mesenteric artery, forming a localized aneurysmal cavity. Using coaxial microcatheter technology, we selectively cannulated both arterial branches, confirmed the branch with contrast extravasation through repeat angiography, and identified additional arterial branches supplying the intestine. Subsequently, we sequentially occluded them using five 3mm COOK coils (Figure 2b). Repeat angiography of the superior mesenteric artery showed no significant contrast extravasation and marked attenuation of contrast enhancement within the aneurysmal sac. Following surgery, the patient was transferred to the hospital ward where they received symptomatic treatment, including antibiotics, iron supplementation, and nutritional support. One week post-surgery, a follow-up CT(Figure 3) scan revealed marked improvement in the absorption of multiple exudates. The patient recovered and was discharged from the hospital on the 9th day after surgery. A follow-up abdominal enhanced CT scan performed 2 months later revealed nearly complete absorption of peripheral exudates.



a.Abdominal contrast-enhanced CT scan shows local tumorous enhancement of a branch of the SMA (Coronal view: indicated by the red arrow, showing a pseudoaneurysm). b.Abdominal contrast-enhanced CT scan (Cross-sectional view: indicated by the red arrow, showing a pseudoaneurysm; yellow arrow indicates the superior mesenteric artery).

Figure 1: Preoperative abdominal contrast-enhanced CT scan of the patient



a.Intraoperative angiography (red arrow indicates pseudoaneurysm). b.Postoperative angiography (yellow arrow indicates coil position). The pseudoaneurysm significantly reduced after surgery

Figure 2: Intraoperative and postoperative digital subtraction angiography (DSA) of the patient

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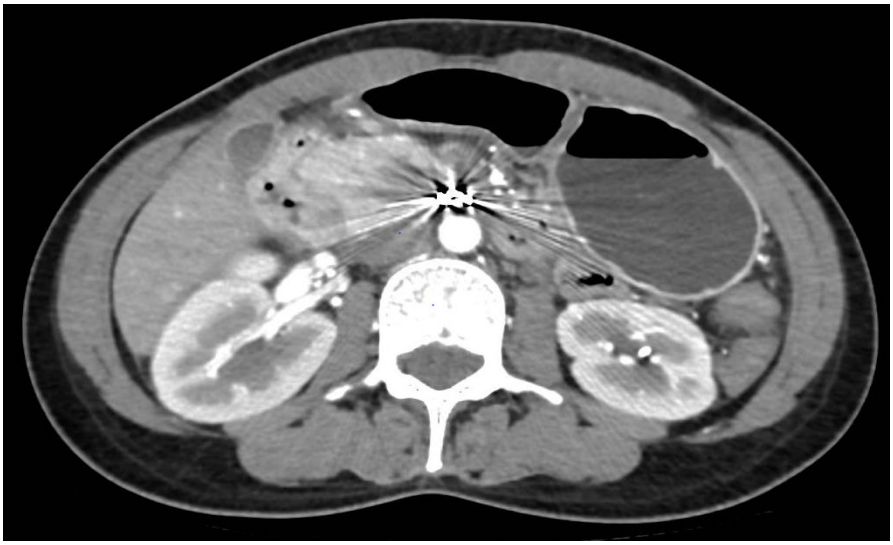

Figure 3: Abdominal contrast-enhanced CT scan (one week postoperatively, showing significant reduction in perivascular effusion compared to preoperative scan)

3. Discussion

Pseudoaneurysms of the Superior Mesenteric Artery (SMAP) feature a wall comprising non-vascular structures, rendering them significantly more susceptible to rupture and hemorrhage when contrasted with true aneurysms. Pseudoaneurysms can exhibit a rupture rate as elevated as 76.3%[7]. In its intact state, patients may manifest solely with abdominal pain radiating to the back or may be asymptomatic. Upon rupture, symptoms can include exacerbating abdominal pain, nausea, vomiting, and potentially shock. Furthermore, physical examination may disclose findings such as a pulsatile mass, tenderness, rebound tenderness in the upper abdomen, decreased bowel sounds upon auscultation, and laboratory results indicating chronically low levels of hemoglobin and iron.These clinical manifestations, signs, and laboratory abnormalities frequently signify disease progression and necessitate differentiation from other acute abdominal pathologies like pancreatitis, cholecystitis, cholangitis, appendicitis, gastrointestinal bleeding, and perforation.

Imaging studies are pivotal in the differential diagnosis of acute abdominal conditions, with abdominal enhanced CT being paramount for detecting pertinent complications. In this case, abdominal enhanced CT identified a pseudoaneurysm within the abdominal cavity, indicative of underlying vascular pathology. Computed tomography angiography (CTA) can precisely localize the lesion and distinguish between true and pseudoaneurysms. Digital subtraction angiography (DSA), regarded as the gold standard for pseudoaneurysm diagnosis, offers precise evaluation of extravasation sites and assessment of collateral vessel and affected artery involvement, boasting a sensitivity of up to 100%[8]. Additionally, ultrasound serves as an initial diagnostic tool for visceral arterial aneurysms, detecting intra-abdominal hematomas or fluid collections.

Presently, management of SMAP predominantly encompasses both surgical and endovascular modalities. Prior to the 1980s, surgical intervention served as the cornerstone of treatment. Advances in endovascular techniques have progressively supplanted certain surgical interventions. Endovascular therapies primarily encompass coil embolization under catheter guidance and stent graft deployment to isolate the aneurysm[9]. Owing to the abundant collateral circulation of the superior mesenteric artery (SMA), pseudoaneurysms situated in its secondary and tertiary branches are amenable to treatment via endovascular embolization. Studies have demonstrated a success rate of 66.7% for endovascular embolization, a figure that can reach 100% with advanced embolization techniques[9]. In this instance, the patient presented with a ruptured aneurysm situated on a secondary branch of the SMA. We employed coil embolization to occlude the branch vessels, confirmed by post-operative imaging revealing no contrast extravasation. Besides coil embolization, alternative materials such as gelatin foam, polyvinyl alcohol (PVA) particles, and acrylic-based gelatin microspheres are also viable options[10, 11]. Moreover, pseudoaneurysms situated within the main SMA or in its immediate vicinity require stent graft placement to isolate the aneurysm and maintain adequate intestinal blood flow. According to studies by HEMP J H[12] and others, the stent graft should extend at least 1 cm beyond both proximal and distal ends of the aneurysm. Subsequently, antiplatelet therapy may be employed based on individual patient factors to

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mitigate thrombotic risks. Despite the benefits of endovascular therapy, including minimal invasiveness, high safety, precise localization, and reduced postoperative complications, long-term risks such as recurrence, vascular recanalization, and rupture persist[13]. Thus, routine imaging follow-up after discharge is imperative for monitoring patient outcomes. Additionally, thrombin injection under ultrasound or CT guidance is viable for small-necked SMAPs with sluggish blood flow[10, 14, 15]. AA[10]and colleagues demonstrated that thrombin injection can be administered via microcatheters. However, a drawback is the inability to visualize thrombin under X-ray, posing challenges in detecting distal arterial embolization[12, 15].

Surgical management of SMAP encompasses vascular bypass, excision of the aneurysmal sac, and ligation of the affected vessel[10]. Presently, surgery is indicated for patients who are not candidates for endovascular interventions due to: 1. Development of a sizable hematoma leading to intestinal compression and mechanical obstruction; 2. Severe infections precluding stent graft placement; 3. Pronounced vascular curvature (associated with higher mortality rates when emergency endovascular treatment is attempted, remains contentious); 4. Lesion size and configuration significantly impeding endovascular therapy; 5. Hemodynamic instability (debated, yet favoring surgical intervention)[8, 16]. Nevertheless, these criteria are not absolute, and the selection of therapy hinges on clinical circumstances, lesion severity, perioperative challenges, and overall patient status, necessitating prompt clinical decision-making.

It is noteworthy that visceral ischemia represents the most critical complication following both traditional surgical and endovascular interventions. While patients may not initially manifest acute symptoms, ischemia can precipitate severe complications, underscoring the urgency of prompt diagnosis and intervention. In this case, prior to embolizing the arterial blood supply to the aneurysm, we meticulously delineated the arterial supply territory to the intestine using angiography. Subsequent angiography affirmed the presence of collateral vessels capable of perfusing the intestinal region, with the objective of mitigating the risk of postoperative intestinal ischemic necrosis. Upon detection of clinical signs indicative of postoperative intestinal ischemia, prompt initiation of emergency surgical interventions is imperative, encompassing restoration of intestinal perfusion, assessment of bowel viability, and segmental resection of necrotic bowel segments[8]. Ultrasound serves to distinguish early postoperative intra-abdominal fluid accumulation and re-bleeding, whereas CT or CTA may offer superior diagnostic capabilities for postoperative abdominal masses.

In this instance, the onset of the patient's condition was insidious, and the underlying etiology remains elusive. The sole potential trigger may have been the consumption of substantial quantities of spicy food, yet presently, there is a dearth of pertinent case reports and supporting evidence. As clinical physicians, confronted with uncertain etiologies, particularly in patients presenting with acute abdominal symptoms, it is imperative to maintain vigilance regarding the potential for rupture and hemorrhage of visceral artery pseudoaneurysms (SMAP), utilizing imaging modalities to precisely localize the lesion for accurate diagnosis. Upon diagnosis of SMAP, timely intervention is crucial in mitigating morbidity and mortality rate[17]. Absent timely intervention, mesenteric ischemia may ensue, mandating concurrent bowel resection[18] . In cases of ruptured SMAP, both surgical and endovascular interventions prove efficacious, with endovascular therapy emerging as the preferred option among patients and clinicians, albeit open surgical procedures remain a viable alternative. Rigorous preoperative assessment and meticulous intraoperative protocols substantially diminish the incidence of postoperative complications, thereby enhancing patient prognosis.

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