Technical Article

Hepatic Artery Pseudoaneurysm after Surgical Treatment for Pancreatic Cancer: Minimally Invasive Angiographic Techniques as the Preferred Treatment

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Abstract

Background: Delayed intra-abdominal bleeding related to hepatic artery pseudoaneurysm is a potentially lethal complication after pancreaticoduodenectomy for pancreatic cancer. Locally advanced tumors, which result in vessel erosion or extensive operative skeletonization, may contribute to weakness of the arterial wall. Reoperation is often technically difficult with high rate of mortality; therefore, alternative less invasive options are ideal. **Aims:** The study was to present an alternative endovascular treatment of a large hepatic artery pseudoaneurysm after pancreatic resection for locally advanced multicystic adenocarcinoma. **Materials and Methods:** Transcatheteric mesenteric angiography with deployment of detachable coils in the pseudoaneurysm sac was utilized to manage the hepatic artery pseudoaneurysm. **Results:** Completion angiography confirmed cessation of contrast enhancement in the pseudoaneurysm sac with preservation of normal antegrade hepatic artery flow. **Conclusion:** Minimally invasive angiographic technique is the preferred treatment for hepatic artery pseudoaneurysm after pancreatic resections.

Keywords: Angiography, Coil embolization, Hepatic artery pseudoaneurysm, Stenting

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Introduction

In the modern era of surgery, perioperative mortality after pancreaticoduodenectomy has declined to less than 5% because of advancements in surgical technique and critical care management.[1] One of the most serious life-threatening complications after pancreatectomy is erosive hemorrhage due to pseudoaneurysm formation and rupture. Delayed massive intra-abdominal hemorrhage occurs in 1% to 8% of all pancreatic resections and accounts for 11% to 38% of the overall mortality.[2-4] The hepatic artery is occasionally damaged by tumor invasion, extensive surgical skeletonization, or postoperative inflammation related to an abdominal abscess or pancreatic leakage. The extensively eroded and friable artery cannot withstand intraluminal hydrostatic pressure, which, in turn leads to the development of a pseudoaneurysm. Because hepatic artery pseudoaneurysm is a relatively rare complication after pancreatic surgery, its diagnosis and treatment approach have not been widely described. As minimally invasive endovascular techniques become commonplace, an angiographic approach using endovascular coiling and stenting has been used as alternative treatment. In this study, we reviewed the currently preferred endovascular treatment options for hepatic artery pseudoaneurysm after pancreatic resection for pancreatic adenocarcinoma.

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Materials and Methods

An ethical approval and appropriate informed consent were obtained for this study. A 45-year-old-man presented with a multiloculated 6.0 × 9.2-cm cystic mass in the head/neck of the pancreas as seen on a CT scan, which was performed during evaluation for abdominal pain and early satiety. No significant past medical

and surgical history was reported. After appropriate preoperative work-up, the patient was taken to the operating room for elective pancreaticoduodenectomy. Intraoperative exploration revealed the cystic tumor to have originated from the neck/body of the pancreas, which required enblock distal pancreatectomy with splenectomy. On further dissection, significant tumor involvement of the retroperitoneum, hepatic artery, and portal veins was found, which rendered the resection noncurative. The patient made an uneventful recovery, and the final pathology was consistent with an infiltrating moderately differentiated pancreatic adenocarcinoma. The patient subsequently received postoperative radiation and multi-agent chemotherapy. Follow-up CT scan at 4 months showed an interval development of increased attenuation within the central aspect of the cystic mass representing blood, as well as a new 3.7 × 2.0-cm pseudoaneurysm with intravenous contrast extravasation [Figures 1 and 2]. Transcatheteric mesenteric angiography with deployment of detachable coils in the pseudoaneurysm sac was successfully performed [Figure 3]. Completion angiography confirmed cessation of the contrast enhancement in the pseudoaneurysm sac. The normal antegrade hepatic artery flow was preserved [Figure 4]. The patient made an uneventful recovery with complete resolution of the pseudoaneurysm.

Discussion

Pseudoaneurysms arise as a consequence of visceral inflammation adjacent to the arterial wall, which damages to the adventitia and leads to thrombosis of the vasa vasorum, which in turn results in localized weakness of the vessel wall. The three most common predisposing factors for pseudoaneurysm formation after surgery are digestion of the hepatic arterial wall that is caused by infectious bile from anastomotic leakage, arterial irritation due to a localized abscess in the inferior hepatic space, and mechanical injury of the artery during the operation (mainly due to lymph node dissection for malignancy). Massive arterial bleeding can occur late in the postoperative period. Lee *et al.* reported a median period of 21 days for

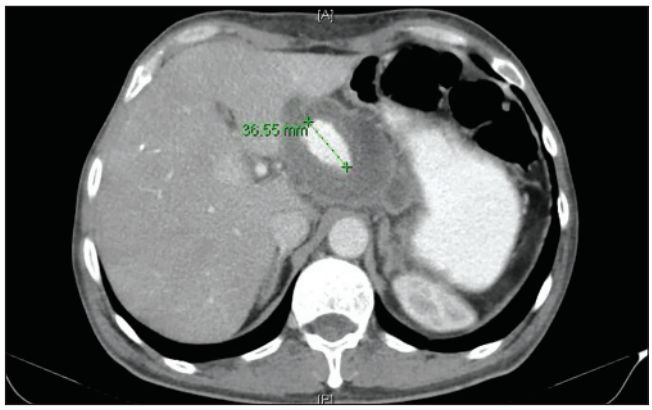

Figure 1: Axial imaging of the 3.7- × 2.0- cm hepatic artery pseudoaneurysm with central contrast extravasation

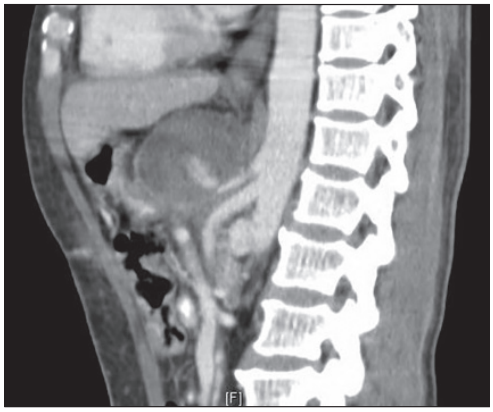

Figure 2: Sagittal imaging of the hepatic artery pseudoaneurysm showing its origin

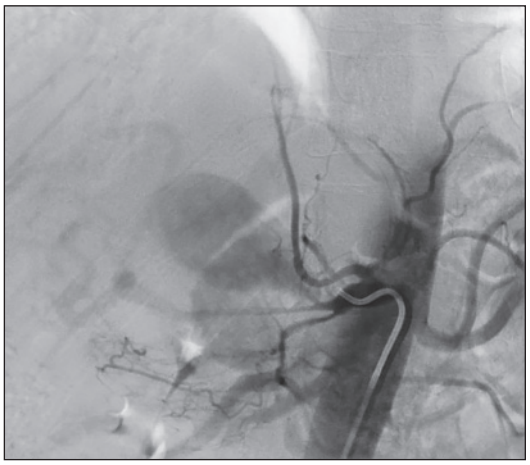

Figure 3: Succesful deployment of microcoils into the pseudoaneurysm sac

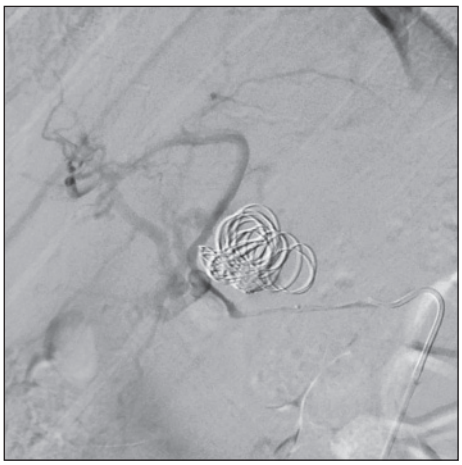

Figure 4: Completion angiography confirming the cessation of contrast enhancement with preservation of the antegrade hepatic artery flow

pseudoaneurysmal bleeding to occur after pancreatic resections. In several cases, bleeding can still be seen beyond 4 weeks postoperatively.[5-7] The most frequent clinical manifestations include acute hypotension and hemoperitoneum. Upper gastrointestinal bleeding can be seen if the pseudoaneurysm ruptures into the biliodigestive anastomosis.[8] Even though the risk of rupture theoretically increases as the diameter of the pseudoaneurysm increases, the size of the aneurysm has not been shown to be a factor predictive of rupture.[9]

The observation of sentinel bleeding should lead to emergency angiography. Urgent re-exploration to control the bleeding is rarely successful due to extensive inflammation from recent dissections.[10,11] Alternatively, selective angiography and transarterial embolization has been considered as the standard therapeutic management by many authors. Angiography enables precise localization of the pseudoaneurysm, which allows selective microcoil embolizations.[7] Various agents have been used for successful embolization, which include intravascular coils, gelatine foam, cyanoacrylate glue, ethanol sclerosant, and detachable balloons.[5] The reported success rate of transarterial embolization for a visceral artery pseudoaneurysm is 63% to 100%, with a morbidity rate of 14% to 25% and a mortality rate of 0% to 14%.[6,7,10] Either recanalization or rebleeding may occur in up to 37% of the patients,[6,12] and an interruption of the hepatic arterial flow is sometimes necessary to achieve hemostasis.[7,11] Briceño *et al*. suggested that angiographic embolization should be performed proximal and distal to the origin of the pseudoaneurysm rather than proceeding with embolization in the pseudoaneurysmal cavity to avoid wall rupture and persistent bleeding/recurrence of bleeding.[13]

Despite the dual blood supply from the hepatic artery and portal vein, there is a risk of major complication in the forms of liver infarction or abscess after transarterial embolization for pseudoaneurysms arising from the hepatic arteries. In the recent years, stent grafts have been used in an effort to avoid these potential complications.[14-16] Successful use of covered coronary and biliary stents has also been described.[17,18] This technique has the advantage of providing continued perfusion to the end organ, while excluding the neck of the pseudoaneurysm. In cases when portal vein occlusions are seen, maintaining hepatic artery flow was indispensable to avoid hepatonecrosis and concomitant liver failure. A pseudoaneurysmal wall that is extensively eroded may be overly friable to withstand pressure from the packing using endovascular coils and the brittle arterial wall may rupture, which leads to uncontrollable bleeding.[5] Several authors, therefore, suggest that management of hepatic artery pseudoaneurysm is safer by using stent grafts rather than coil embolizations, especially when the collateral arteries cannot be confirmed or known to be absent.[19] Surgical intervention with ligation of the bleeding vessel is considered for unstable patients and when embolization fails or is not feasible. A low number of blood transfusions required prior to angiography was associated with better survival, which may simply reflect hemodynamic stability from a less severe pseudoaneurysmal rupture. To date, no long-term data are available concerning the safety and patency of the covered stent for visceral pseudoaneurysms after pancreatic surgery.[20]

Conclusion

Pseudoaneurysm of the hepatic artery after a pancreatic resection is a relatively rare but potentially fatal complication. Angiography and transarterial embolization with possible placement of a covered stent are the recommended techniques for diagnosis and management. Technical success has been reported in the literature, and this method has been accepted as the preferred approach, when compared to the traditional open exploration.

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