Hepatic Artery Pseudoaneurysm Following Laparoscopic Cholecystectomy: A Rare and Diagnostic-Therapeutic Challenging Case Report

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Abstract:

Arterial pseudoaneurysm is considered one of the rarest yet potentially most dangerous vascular complications following laparoscopic cholecystectomy, typically developing secondary to direct or indirect injury to the hepatic artery or its branches. In this report, a 45-year-old woman who had undergone laparoscopic cholecystectomy ten days prior presented to the medical center with clinical manifestations of jaundice, abdominal pain, and upper gastrointestinal bleeding.

Imaging evaluations suggested the presence of an arterial pseudoaneurysm originating from the branches of the hepatic artery, accompanied by blood leakage into the biliary system. Based on the findings, the patient underwent diagnostic-therapeutic angiography, and endovascular embolization using coils was successfully performed, leading to the control of the hemorrhage source and stable clinical recovery.

This report emphasizes the importance of considering arterial pseudoaneurysm in patients with a recent history of biliary surgery who present with jaundice, abdominal pain, or gastrointestinal bleeding, as early diagnosis and endovascular interventional treatment can prevent severe complications such as massive hemorrhage, hemorrhagic shock, and death.

Keywords:* *Hepatic Artery Pseudoaneurysm, Laparoscopic Cholecystectomy, Hemobilia, Biliary Vascular Injury, Endovascular Treatment

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Background and Objective

Hepatic artery pseudoaneurysm is one of the rare but potentially life-threatening vascular complications following laparoscopic cholecystectomy, with an incidence reported to be less than 1%.[1,2] This complication typically develops as a result of direct mechanical injury, heat transfer from electrocautery, or improper clipping of the right hepatic artery or cystic duct.[3,4]

Local inflammation, postoperative infection, and direct contact of metal clips with the arterial wall are considered predisposing factors for the destruction of the intima layer and the formation of pseudoaneurysm.[3] The onset of symptoms can be associated with a time delay ranging from several days to a few weeks after surgery, which makes early diagnosis difficult.[1,2]

Clinical manifestations are highly variable and include vague abdominal pain, unexplained hemoglobin drop, hemobilia, and in severe cases, upper gastrointestinal bleeding or hemorrhagic shock.[1-4]

Due to its rarity and non-specific symptoms, hepatic artery pseudoaneurysm is often overlooked in initial evaluations.[3,4] CT angiography, as the primary method of choice, has high sensitivity in diagnosing the location, size, and relationship of the pseudoaneurysm with arterial branches.[1-3] Selective angiography remains the diagnostic gold standard and provides the possibility of simultaneous therapeutic intervention.[2,3]

In recent years, endovascular treatment including coil embolization or stent graft placement has been recommended as the first-line treatment.[1-3] These methods are associated with a high success rate, reduced morbidity, and avoidance of emergency laparotomy.[1,2] The choice of treatment method depends on the anatomical location of the lesion, the patient's hemodynamic status, and the need to preserve hepatic arterial flow.[2,3] Open surgery is indicated only in cases of hemodynamic instability or failure of endovascular treatment.[3] Considering the potentially fatal consequences of this complication, emphasizing clinical awareness and prompt diagnosis is essential to reduce mortality.[1-3]

Case Presentation

A 45-year-old female, with no significant history of underlying diseases or medication use, presented to the medical center complaining of intermittent right upper quadrant abdominal pain accompanied by nausea and fatty food intolerance. Initial evaluations, including abdominal sonography, revealed multiple gallstones without evidence of biliary duct dilatation or acute cholecystitis. With a diagnosis of symptomatic biliary colic, the patient underwent elective laparoscopic cholecystectomy without intraoperative complications and was discharged the following day in good general condition.

Ten days postoperatively, the patient presented with a clinical manifestation of epigastric and right upper quadrant abdominal pain. On examination, her hemodynamic status was stable (BP: 120/80 mmHg, HR: 78 bpm), but mild scleral icterus was observed. Laboratory evaluations revealed a drop in hemoglobin level from 14.2 g/dL to 10.4 g/dL. Additionally, an increase in total bilirubin (6.5 mg/dL) and direct bilirubin (4.5 mg/dL) correlated with the clinical findings of jaundice. Coagulation status (PT and INR) was within the normal range, indicating no primary coagulation system disorder in the patient (Table 1).

The patient, who had no history of anticoagulant medication use (such as warfarin, aspirin, or heparin), underwent diagnostic evaluations. The patient's hemodynamic status upon arrival was reported as stable, with a blood pressure of 120/80 mmHg and a heart rate of 78 beats per minute. Contrast-enhanced abdominal computed tomography (CT) scan, performed 4 hours after admissionconfirmed the presence of a hyperenhancing vascular lesion (pseudoaneurysm) in the porta hepatis. Diagnostic angiography was also performed 6 hours after admission.

Table 1- Laboratory findings of the patient at various stages of treatment

Laboratory Parameter	*Preoperative (Baseline)*	*Presentation (Day 10)*	*24Hours Post-Embolization*	*Discharge Time*	*Reference Range (Normal)*
Hemoglobin (g/dL)	*14.2*	*10.2*	*11.2*	*12.8*	*12–16*
Total Bilirubin (mg/dL)	*0.8*	*6.5*	*2.1*	*1.1*	*0.3–1.0*
Direct Bilirubin (mg/dL)	*0.2*	*4.5*	*1.2*	*0.4*	*0.0–0.3*
Platelet Count ($10^3/\mu L$*)*	*220*	*210*	*205*	*215*	*150-450*
PT	*12*	*12.5*	*12.2*	*12.1*	*11-13*
INR	*1*	*1.1*	*1*	*1*	*0.8-1.2*



Figure 1- Arterial pseudoaneurysm originating from one of the branches of the hepatic artery



Figure 2- Fluoroscopic view showing the guidance of the guidewire and microcatheter along the arterial pathway toward the lesion site prior to coil embolization

Given the recent history of biliary surgery and the clinical presentation of gastrointestinal bleeding and jaundice, further diagnostic workup was performed. Magnetic resonance cholangiopancreatography (MRCP) demonstrated normal biliary ducts with no evidence of retained stones. Contrast-enhanced computed tomography (CT) of the abdomen and pelvis revealed a hyper-enhancing vascular lesion in the hepatic hilum, suspicious for an arterial pseudoaneurysm originating from one of the branches of the hepatic artery (refer to the Figures section).

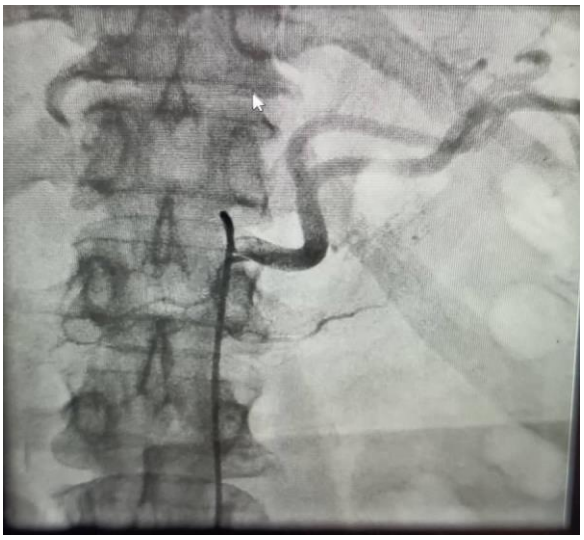


Figure 3- Initial diagnostic angiography (injection into the celiac trunk/hepatic artery) to evaluate the vascular anatomy and confirm the location of the pseudoaneurysm

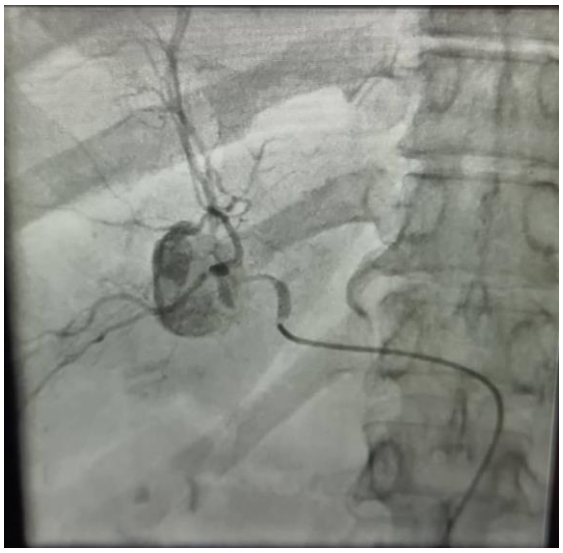


Figure 4- Initial Diagnostic Angiography: Visualization of the pseudoaneurysm

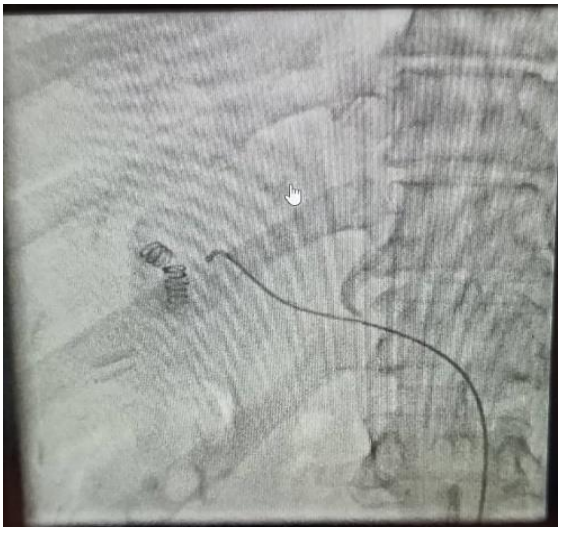


Figure 5- Fluoroscopic view of selective arterial catheterization and initial deployment of metallic coils (Initial Coil Deployment)

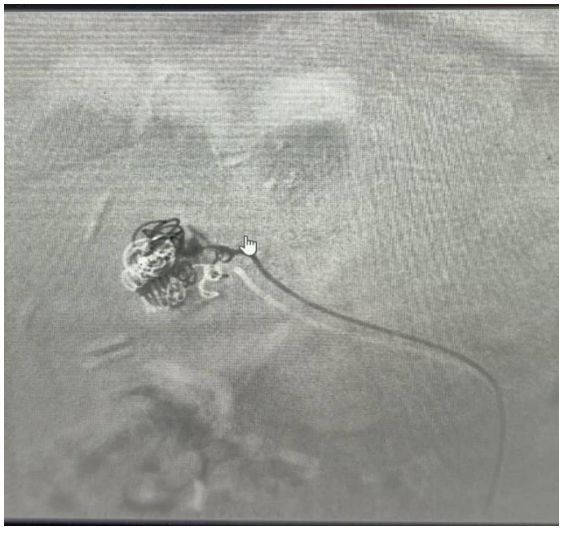


Figure 6- Fluoroscopic view demonstrating dense and complete coil packing (Dense Coil Packing / Coil Nest) to successfully occlude the pseudoaneurysm.

Based on the imaging findings, the patient was a candidate for diagnostic angiography. Visceral artery angiography confirmed the presence of an active pseudoaneurysm arising from one of the branches of the hepatic artery. During the same session, endovascular treatment was performed via selective embolization of the lesion using coils, which led to the complete closure of the pseudoaneurysm and cessation of contrast medium extravasation (refer to the figures section).



Figure 7- Final digital subtraction angiography (DSA) demonstrating successful occlusion and evaluation of the pseudoaneurysm

Following embolization, the patient was closely monitored without experiencing ischemic complications or recurrent bleeding. Clinical symptoms completely resolved, hemoglobin levels stabilized, and the jaundice gradually subsided. The patient was discharged in favorable general condition after two days of ward admission, and subsequent follow-ups revealed no evidence of recurrent bleeding or complications related to the endovascular treatment.

Discussion

Hepatic artery pseudoaneurysm (HAP) is considered one of the rarest yet potentially fatal vascular complications following laparoscopic cholecystectomy, with an incidence reported to be less than 1%, yet it is associated with a high mortality rate if diagnosed or treated belatedly. The rising prevalence of laparoscopic cholecystectomy in recent decades has drawn greater attention to rare vascular complications, including HAP, particularly in cases presenting with non-specific or delayed clinical manifestations.[5,6]

The mechanism underlying pseudoaneurysm formation following cholecystectomy generally involves direct thermal or mechanical injury to the hepatic artery or its branches, improper clipping, or severe inflammation of Calot's triangle. In some patients, these injuries lead to localized necrosis of the vascular wall and the formation of a pseudoaneurysm days or even weeks after surgery.[7] In the present case, the delayed presentation of clinical symptoms on the tenth postoperative day is consistent with findings reported in previous studies.

The clinical manifestations of HAP are variable, ranging from vague abdominal pain to severe gastrointestinal bleeding, hemobilia, and hemorrhagic shock. Unlike arteriobiliary fistula, which creates a sustained direct connection between the arterial and biliary systems, bleeding in HAP results from the rupture or leakage of the pseudoaneurysm; these two entities must be completely differentiated from one another pathologically and therapeutically.[8] In the present report as well, although the patient presented with hemobilia, the primary etiology was an arterial pseudoaneurysm rather than a true fistula.

The diagnosis of HAP requires a high index of clinical suspicion, particularly in patients with a recent history of biliary surgery. Contrast-enhanced computed tomography (CT), serving as an initial diagnostic tool, possesses high sensitivity in identifying vascular lesions, whereas MRCP can indirectly demonstrate evidence of hemorrhage into the biliary system.[9] Nevertheless, angiography remains the gold standard for both diagnosis and treatment.[10] The management of hepatic artery pseudoaneurysm has undergone a fundamental shift over the past two decades, with endovascular interventions accepted as the first-line treatment in the majority of patients. According to existing evidence, the choice of treatment modality depends on multiple factors, including the patient's hemodynamic status, pseudoaneurysm location, arterial anatomy, presence of collateral hepatic blood flow, and the medical center's facilities.[11,12]

Selective endovascular coil embolization is regarded as the most common and effective treatment modality for HAP, with various studies reporting an initial success rate exceeding 85–95%. This technique halts bleeding rapidly by inducing thrombosis

within the pseudoaneurysm sac or its feeding artery, while avoiding high-risk surgical interventions in the adhesive operative field resulting from the initial surgery.[13-15]

In instances where the pseudoaneurysm is situated on major hepatic arteries of high significance, or when preservation of arterial blood flow is mandatory, the use of an endovascular stent-graft has been proposed as an alternative option. Although available evidence in this regard is more limited, certain case reports and small series have demonstrated acceptable outcomes regarding bleeding control and the prevention of hepatic ischemia.[16] Nonetheless, technical complexity, the requirement for prolonged antiplatelet therapy, and the risk of stent thrombosis have limited the routine application of this approach.

Alternative methods include image- or EUS-guided thrombin injection, primarily considered in selected cases where suitable arterial access is lacking. These techniques demand high expertise and carry the risk of inadvertent embolization into the systemic or portal circulation.[17] Consequently, their use has been restricted to specialized tertiary centers.

Open surgery is presently viewed as a last-resort therapeutic option and is predominantly applied in patients with severe hemodynamic instability, or in cases where endovascular interventions have failed or are inaccessible. Surgical interventions entail ligation of the feeding artery, pseudoaneurysm resection, or vascular reconstruction, which are associated with higher rates of morbidity and mortality.[18]

In the present report, the selection of endovascular coil embolization was based on the patient's hemodynamic stability, precise localization of the lesion on angiography, and the feasibility of selective access to the involved artery. Treatment success, absence of ischemic complications, and sustained patient recovery once again reaffirm the pivotal role of the endovascular approach in managing HAP following laparoscopic cholecystectomy.[15,19]

Conclusion

Hepatic artery pseudoaneurysm is a rare yet life-threatening complication following laparoscopic cholecystectomy that can present with delayed and non-specific clinical features. Maintaining a high index of clinical suspicion in patients presenting with abdominal pain, jaundice, or gastrointestinal bleeding following biliary surgery plays a key role in early diagnosis. Contrast-enhanced cross-sectional imaging and angiography play an essential role in definitive diagnosis, and endovascular treatment—particularly coil embolization-is regarded as a safe and effective method with a high success rate. Timely diagnosis and prompt intervention can prevent severe complications and mortality.

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