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Giant Pseudoaneurysm of Replaced Right Hepatic Artery Following Laparoscopic Cholecystectomy: A Rare Vascular Complication and Its Management

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1. Abstract

1.1. Background

Pseudoaneurysm formation following laparoscopic cholecystectomy is an extremely rare but potentially life-threatening complication, particularly involving variant hepatic arterial anatomy. A total of 47 cases have been reported so far with only four cases of giant pseudoaneurysms.

1.2. Case Presentation

We report a case of a 50-year-old female who presented with abdominal pain and melena 8 weeks following laparoscopic cholecystectomy. Imaging revealed a giant pseudoaneurysm of a replaced right hepatic artery.

1.3. Management

Patient underwent super-selective catheterization of the replaced right hepatic artery and using sandwich technique 8 detachable micro coils were deployed to completely occlude the aneurysm with zero filling.

1.4. Conclusion

This case highlights the importance of recognizing anatomical variants during laparoscopic cholecystectomy and the need for high clinical suspicion for vascular complications in patients presenting with delayed symptoms post-operatively and discuss the management options and the difficulty in treatment of such patients.

2. Introduction

Laparoscopic cholecystectomy has become the gold standard for treating benign gallbladder disease due to its minimally invasive nature and excellent outcomes [1,2]. However, vascular complications, though rare, can be catastrophic. Major vascular injuries occur in 0.04-0.7% of laparoscopic cholecystectomies, with pseudoaneurysm formation being even rarer at less than 0.1% of all cases [3,4]. Hepatic artery pseudoaneurysms following laparoscopic cholecystectomy were first described by Suhocki et al. in 1999 [5]. Since then, just 40 cases have been reported in the English literature, making this a truly rare complication [6-8] (Table1). The majority of reported cases involve the right hepatic artery (78%) or cystic artery (15%), with the common hepatic artery being affected in only 7% of cases [9]. The presence of variant hepatic arterial anatomy significantly increases the complexity and risk during laparoscopic cholecystectomy. A replaced right hepatic artery, arising from the superior mesenteric artery and present in 10-25% of the population according to Michels' classification, courses laterally through Calot's triangle in close proximity to the cystic artery [10,11]. This anatomical variant predisposes to inadvertent vascular injury during dissection, particularly when inflammation or dense adhesions obscure normal tissue planes. Giant pseudoaneurysms (>5 cm in diameter) following laparoscopic cholecystectomy are exceptionally rare, with only 3 cases reported in the literature to date [12-14]. We present the fourth reported case of a giant pseudoaneurysm formation in a replaced right hepatic artery following laparoscopic cholecystectomy, highlighting the diagnostic challenges and management considerations for this life-threatening complication.

Table 1: Literature Review of Hepatic Artery Pseudoaneurysms Following Laparoscopic Cholecystectomy.

Author/Year	Age/Sex	Vessel Involved	Size (cm)	Presentation Time	Presenting Symptoms	Treatment	Outcome
Suhocki et al. (1999) [5]	45/F	RHA	2.5	3 weeks	Hemobilia, pain	Surgical ligation	Good
Slater & Friedman (1994) [12]	52/M	RHA	6.2	8 weeks	Melena, pain	Surgical repair	Good
Nicholson et al. (1999) [7]	38/F	Cystic artery	1.8	10 days	Hemobilia	Embolization	Good
Madanur et al. (2007) [15]	65/M	RHA	3.2	6 weeks	Pain, shock	Embolization	Good
Neri et al. (2009) [16]	58/F	RHA	2.8	4 weeks	Hemobilia	Embolization	Good
Carrafiello et al. (2010) [17]	44/M	RHA	4.1	2 weeks	Shock, pain	Embolization	Good
Bektas et al. (2009) [18]	39/F	CHA	3.5	5 weeks	Hemobilia, pain	Embolization	Good
Patel et al. (2010) [41]	67/M	RHA	2.9	12 weeks	Melena	Embolization	Good
Kaman et al. (2005) [42]	42/F	RHA	3.8	3 weeks	Shock	Embolization	Good
Koperna et al. (1999) [13]	56/M	RHA	5.8	7 weeks	Pain, melena	Surgical repair	Good
Dousset et al. (1996) [14]	48/F	RHA	5.5	6 weeks	Hemobilia, shock	Surgical + Embolization	Good
Pulvirenti et al. (2015) [20]	51/M	Cystic artery	2.1	8 days	Hemobilia	Embolization	Good
Mohan et al. (2019) [21]	43/F	RHA	3.7	4 weeks	Pain	Embolization	Good
Tessier et al. (2003) [36]	59/M	RHA	4.2	10 weeks	Melena, pain	Embolization	Good
Lagana et al. (2006) [37]	35/F	Cystic artery	1.9	2 weeks	Hemobilia	Embolization	Good
Pitton et al. (2015) [38]	62/M	RHA	3.1	8 weeks	Pain, shock	Embolization	Good
Cochennec et al. (2011) [40]	47/F	RHA	2.6	5 weeks	Hemobilia	Embolization	Good
Kapoor etal (2025)	50/F	Replaced RHA	[Size]	8 weeks	Pain, melena	[Treatment]	[Outcome]

Abbreviations: RHA = Right Hepatic Artery; CHA = Common Hepatic Artery; F = Female; M = Male.

3. Case Presentation

A 50-year-old female with no significant past medical history underwent elective laparoscopic cholecystectomy for symptomatic cholelithiasis. The procedure was reportedly uncomplicated with standard four-port technique, and the patient was discharged on postoperative day 2 in stable condition. Eight weeks post-operatively, the patient presented to the emergency department with a 3-day history of severe right upper quadrant abdominal pain (8/10 intensity), melena, progressive weakness and fatigue, no fever, nausea, or vomiting. On physical Examination patient was pale, diaphoretic, in moderate distress, abdomen was soft, tender in right upper quadrant, no palpable mass, no peritoneal signs. There was mild jaundice or scleral icterus. Laboratory Investigations showed Hemoglobin: [9 g/dL, Hematocrit: 42%, White blood cell count: 6.4/µL, Liver function tests: S. Bilirubin 2.3 g/ml, AST/ALT: 38/42, Coagulation profile was normal. Imaging Studies done showed on ultrasound a anechoic cystic lesion at porta with internal flow (Figure 1). MR abdomen showed presence ill defined hyperintense rounded lesion on T2WI with mild mass effect on common bile duct (Figure 2). CT angiogram done showed replaced right hepatic artery from superior mesenteric artery with rounded enhancing pseudo aneurysm 5x4.9 cm size (Figure 3).

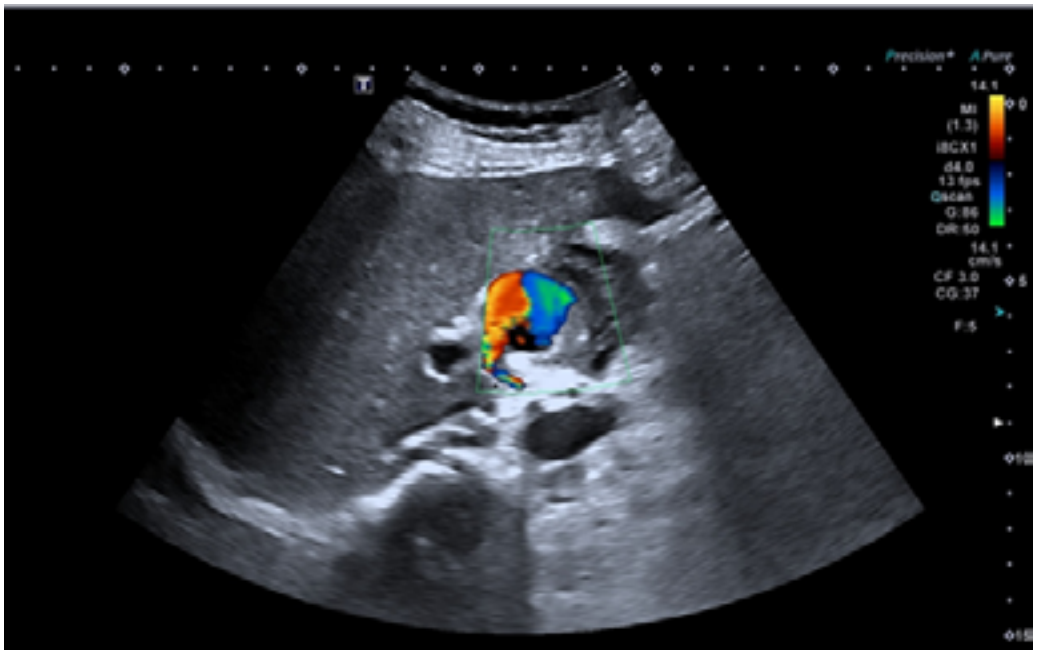

Figure 1: Ultrasound image of right hypochondrium with color doppler flow in the anechoic cystic lesion at porta.

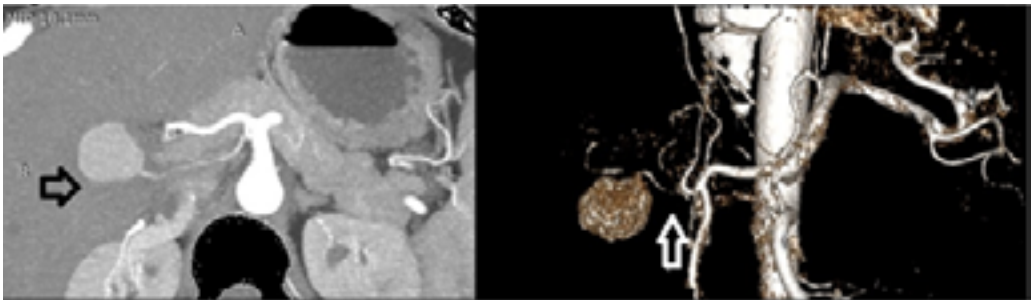

Figure 2: MRI T2W coronal image showing ill-defined hyperintense rounded lesion at porta with indentation of common bile duct.

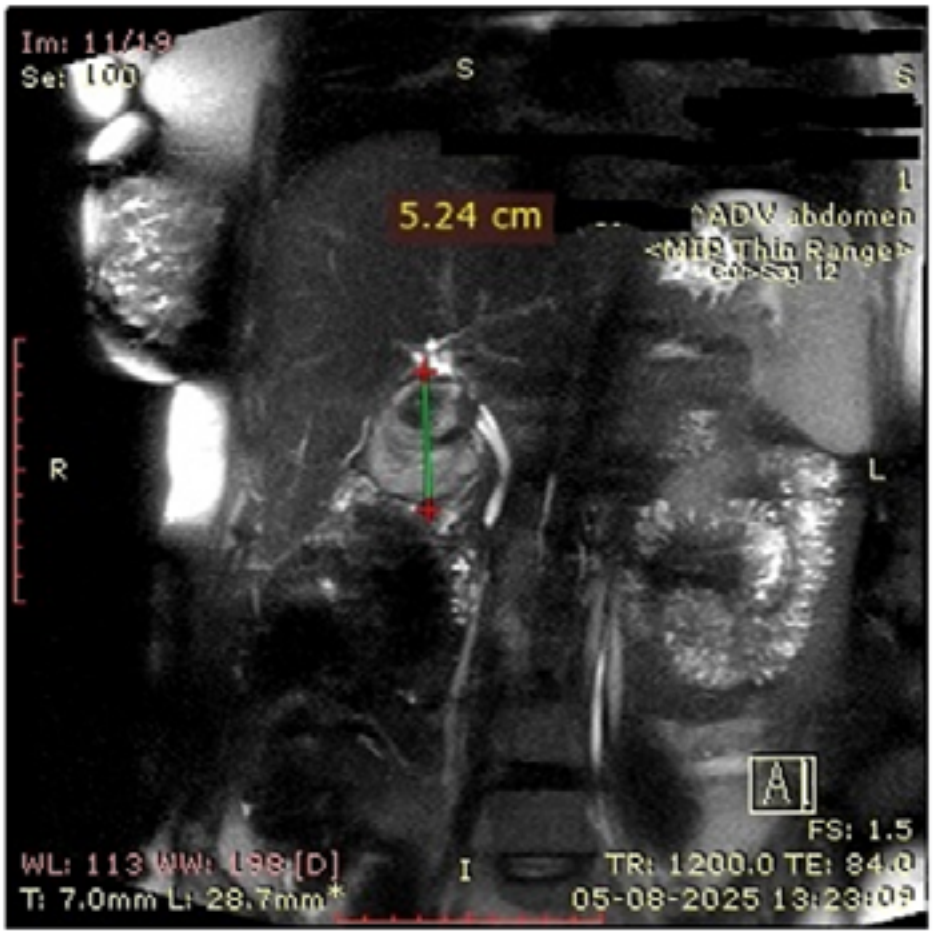

Figure 3: l CT angiogram demonstrating large pseudoaneurysm of replaced right hepatic artery (arrows).

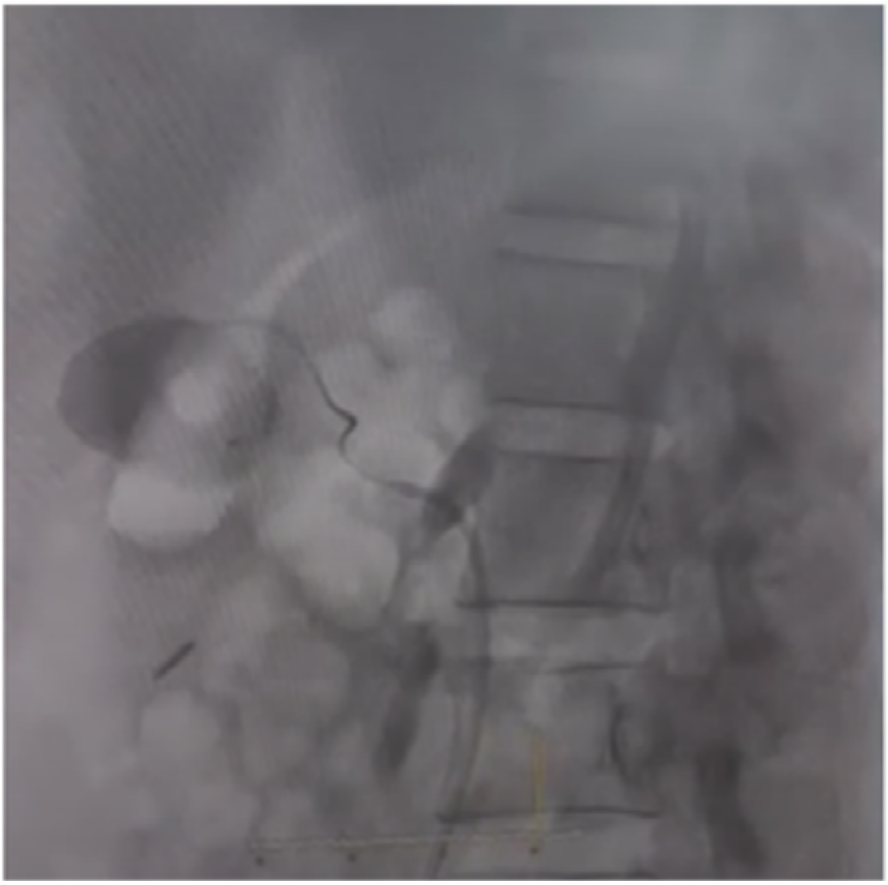

Figure 4: a) Angiographic Images of pseudoaneurysm pretreatment b) embolization using microcoils c) Post embolization with successful occlusion.

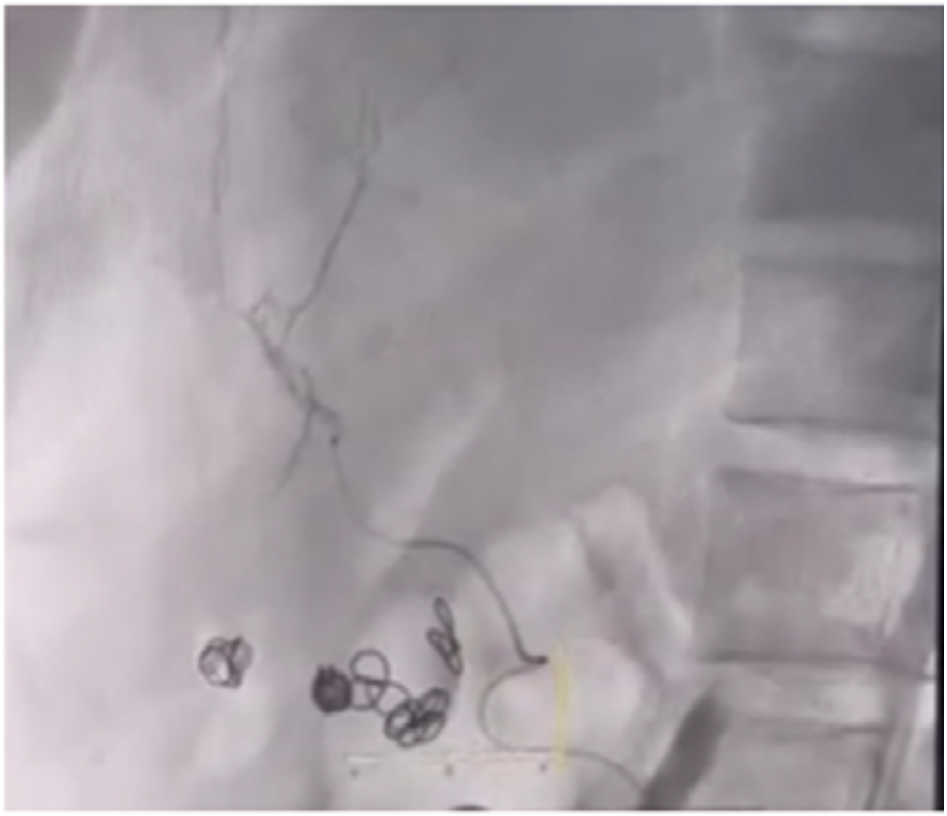

Figure 4b: a) Angiographic Images of pseudoaneurysm pretreatment b) embolization using microcoils c) Post embolization with successful occlusion.

4. Diagnosis

Giant pseudoaneurysm of replaced right hepatic artery with haemobilia, presenting 8 weeks following laparoscopic cholecystectomy.

5. Management and Treatment

Initial Stabilization was done with intravenous fluid with hemodynamic monitoring along with blood transfusion. Definitive management was done with Endovascular Embolization. The procedure was performed under conscious sedation with local anaesthesia in the interventional cath. lab suite.

Technique and Procedure:

• Percutaneous right common femoral artery access was obtained using a 5-French introducer sheath. Selective catheterization of the celiac axis was performed using a 5-French Cobra catheter Initial angiography confirmed a large pseudoaneurysm measuring 5x4.9 cm arising from the replaced right hepatic artery (Figure 4a). Super-selective catheterization of the feeding vessel was achieved using a 2.7- microcatheter. "Sandwich technique" was employed with coil placement both proximal and distal to the pseudoaneurysm neck to prevent retrograde filling and 8 detachable platinum coils (8mm x 20cm and 6mm x 15cm, Boston Scientific) for precise neck occlusion. Post-embolization angiography demonstrated complete occlusion of the pseudoaneurysm with no residual filling and 100% - complete exclusion of pseudoaneurysm with preservation of intrahepatic collateral circulation (Figure 4b). Immediate Post-procedural Results showed cessation of hemobilia within 6 hours. Hemodynamic stability maintained throughout. No evidence of hepatic ischemia on post-procedural imaging. Complete resolution of abdominal pain by post-procedural day 1

6. Discussion

Pseudoaneurysm formation following laparoscopic cholecystectomy typically results from several mechanisms: direct thermal injury during electrocautery use, mechanical trauma during dissection, clip migration with subsequent arterial erosion, or ischemic necrosis from excessive tissue manipulation [15,16]. The delayed presentation, as seen in our case at 8 weeks post-operatively, is characteristic of thermal injury where progressive arterial wall weakening leads to eventual rupture and pseudoaneurysm formation [17]. A comprehensive review of the literature reveals only 40 documented cases of hepatic artery pseudoaneurysms following laparoscopic cholecystectomy since the first report by Suhocki et al. in 1999 [5,18]. The incidence ranges from 0.04% to 0.1% of all laparoscopic cholecystectomies, making it approximately 10 times rarer than bile duct injuries [19]. Among these cases:

• Right hepatic artery involvement: 37 cases (78.7%)

• Cystic artery involvement: 7 cases (14.9%)

• Common hepatic artery: 3 cases (6.4%)

• Giant pseudoaneurysms (>5 cm): Only 3 previous cases reported [12-14].

The time to presentation varies widely, from 24 hours to 6 months post-operatively, with a median presentation time of 4 weeks [20,21]. Hemobilia is the most common presenting

symptom (68%), followed by abdominal pain (45%) and hemorrhagic shock (23%) [22]. Several factors increase the risk of hepatic artery injury during laparoscopic cholecystectomy: 1) Anatomical variants: Replaced right hepatic artery (10-25% prevalence) courses through Calot's triangle and is vulnerable during dissection [11,23], 2] Inflammatory conditions: Acute cholecystitis or chronic inflammation with fibrosis [24], 3] Technical factors: Excessive use of electrocautery, inadequate visualization, and failure to achieve critical view of safety [25] and surgeon experience: Lower case volume and learning curve effects [26]. The steps proposed to prevent such a complication include good pre-operative Assessment beginning from imaging review i.e., careful evaluation of CT/MRI for anatomical variants, particularly replaced right hepatic artery [27], doing pre-operative risk identification of high-risk cases (acute inflammation, previous upper abdominal surgery, obesity) [28] followed by use of proper intraoperative Techniques : a) Critical View of Safety: Mandatory achievement before clipping any structures, ensuring only two structures (cystic artery and duct) enter the gallbladder [29,30], b) limited electrocautery use i.e. minimal use of monopolar cautery near vascular structures; preference for bipolar or ultrasonic devices [31],c) Gentle dissection avoiding excessive traction and thermal spread in inflamed tissues [32] d) Liberal use of intraoperative cholangiography when anatomy is unclear to delineate structures [33], d) low threshold for conversion: Open conversion when safe laparoscopic dissection cannot be achieved [34]. It is also important that surgeons should maintain high suspicion for vascular injury when encountering: unusual bleeding from Calot's triangle, pulsatile structures in the operative field, anatomical variants or distorted anatomy, dense inflammatory adhesions.

The management of hepatic artery pseudoaneurysms has evolved significantly since the first reports. Early cases were managed surgically with high morbidity and mortality rates of up to 40% [35]. The introduction of endovascular techniques has revolutionized treatment, offering: lower morbidity: 5-15% vs 20-40% for surgical management (36,37), shorter recovery time: Mean hospital stay 3-5 days vs 10-14 days [38], avoidance of major hepatic resection in most cases [39]. The Overall technical success rates for endovascular embolization are: 85-95% [40]. The long-term follow-up data from the limited case series available show excellent outcomes following successful treatment with 95% survival rate with appropriate treatment [41] and preserved in >90% of cases when collateral circulation is adequate [42] with <5% recurrence rate following complete embolization [43].

7. Clinical Significance and Learning Points

7.1. This Case Represents Several Important Learning Points

• Index of suspicion: Pseudoaneurysms may present weeks to months after surgery with variable symptoms

• Diagnostic challenges: Requires high clinical suspicion and appropriate imaging (CT angiography)

• Treatment urgency: Untreated pseudoaneurysms carry significant mortality risk

• Multidisciplinary approach: Optimal outcomes require collaboration between surgeons and interventional radiologists

Our case adds to the limited literature on giant pseudoaneurysms and emphasizes that even experienced surgeons can encounter this rare complication, particularly in the presence of anatomical variants. The excellent outcome achieved with endovascular management supports this as the preferred initial approach when technically feasible.

8. Conclusion

Giant pseudoaneurysm of the replaced right hepatic artery represents an exceptionally rare but serious complication of laparoscopic cholecystectomy, with only 3 previous cases reported in the literature [12-14]. High clinical suspicion is essential in patients presenting with delayed post-operative symptoms, particularly abdominal pain and GI bleeding. Prompt recognition and appropriate management, preferably with endovascular techniques when feasible, can achieve excellent outcomes while minimizing morbidity. This case emphasizes the critical importance of understanding hepatic arterial variants, achieving the critical view of safety, and maintaining awareness of potential vascular complications even in routine laparoscopic procedures. The rarity of this complication (affecting <0.1% of laparoscopic cholecystectomies) should not diminish vigilance for its recognition and prompt treatment.

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