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Case Report

Radiological diagnosis and management of postlaparoscopic cholecystectomy right hepatic arterial pseudoaneurysm: A case report ^{☆,☆☆}

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ABSTRACT

Injuries to blood vessels occur in 0.8% of the cases following laparoscopic cholecystectomy. They may result from direct penetration while insertion of trocar or by thermal injury (electrocautery). Pseudoaneurysm of hepatic artery is a rare occurrence. It is a serious complication following acute or chronic injuries to hepatic artery, with only 0.06% to 0.6% of the cases being reported. Endovascular embolization is usually the first line treatment in the management of pseudoaneurysm of hepatic artery with high success rate. Surgical intervention should be considered if the embolization fails, pseudoaneurysm are infected or other vascular structures are compressed. Our case highlights a 48-year-old male presenting with complaints of pain abdomen and jaundice later diagnosed to be a case of pseudoaneurysm of right hepatic artery and was successfully managed with angiographic embolization, which is the first line of management.

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Abbreviations: ECG, Electrocardiography; ALT, Alanine transaminase; AST, Aspartate transaminase; ALP, Alkaline phosphatase; US, Ultrasonography; CECT, Contrast enhanced computed tomography; MRCP, Magnetic resonance cholangiopancreatography; CBD, Common bile duct; CECT (3D-VRT CECT), 3D Volume-rendering technique; IHBDs, Intrahepatic biliary ducts.

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Introduction

Injuries to blood vessels occur in 0.8% of the cases following laparoscopic cholecystectomy [1]. They may result from direct penetration while insertion of trocar or by thermal injury (electrocautery) [2]. Pseudoaneurysm of hepatic artery is a rare occurrence. It is a serious complication following acute or chronic injuries to hepatic artery [3]. Till date, 0.06% to 0.6% cases of pseudoaneurysm following injuries to hepatic and cystic arteries have been reported [4]. Also, 50% cases of aneurysms from the hepatic arteries are pseudoaneurysms [5]. It may be due to its close proximity to the gallbladder fossa [6]. Pseudoaneurysm of hepatic artery occurs due to the injury to hepatic arterial wall and hemorrhage into the surrounding tissue resulting in the formation of hematoma [7]. Cases of pseudoaneurysm of hepatic artery are not usually reported. It may be due to the fact that they are not documented at the time of surgery and are encountered later [8]. Endovascular embolization is usually the first line treatment in the management of pseudoaneurysm of hepatic artery with high success rate. The treatment initiation must be urgent as it may complicate into catastrophic gastrointestinal and intraperitoneal bleeding [9].

We report a case of a 48-year-old male with complaints of pain abdomen (epigastric region) and was found to be having icterus on examination, who was later diagnosed to be a case of pseudoaneurysm of right hepatic artery and was managed successfully with angiographic evaluation.

Case presentation

A 48-year-old male presented to the Emergency ward with pain abdomen for 3 days, increasing in severity for 1 day. The pain was gradual in onset, localized predominantly in the epigastric region, of a burning nature, radiating towards the chest and back, and relieved temporarily with analgesics. There was no history of fever, chills, nausea, vomiting, altered bowel habits, reflux symptoms, shortness of breath, hematemesis, black tarry stool, or loss of consciousness.

The patient had a recent history of Laparoscopic cholecystectomy 2 months back for symptomatic cholelithiasis. He also gave a history of Essential Hypertension for 12 years, controlled under medication (Amlodipine 5 mg). He consumed alcohol (a drink of beer) daily, otherwise, he didn't smoke or do illicit drugs.

Physical examination revealed icterus in the conjunctiva of both eyes, and diffuse mild tenderness over the epigastrium and right hypochondrium, without guarding or rigidity. The scar marks of the previous cholecystectomy were healthy, without any tenderness or discharge. Other examination findings were normal. ECG revealed sinus rhythm with no signs of acute ischemia. Initial lab results revealed deranged liver function tests with obstructive pattern of jaundice: serum bilirubin (total) of 9.8 mg/dL, serum bilirubin (direct) 7.0 mg/dL, ALT 136.45 IU/L, AST 201.53 IU/L, ALP 220.75 U/L; all other lab findings were within the normal limits.

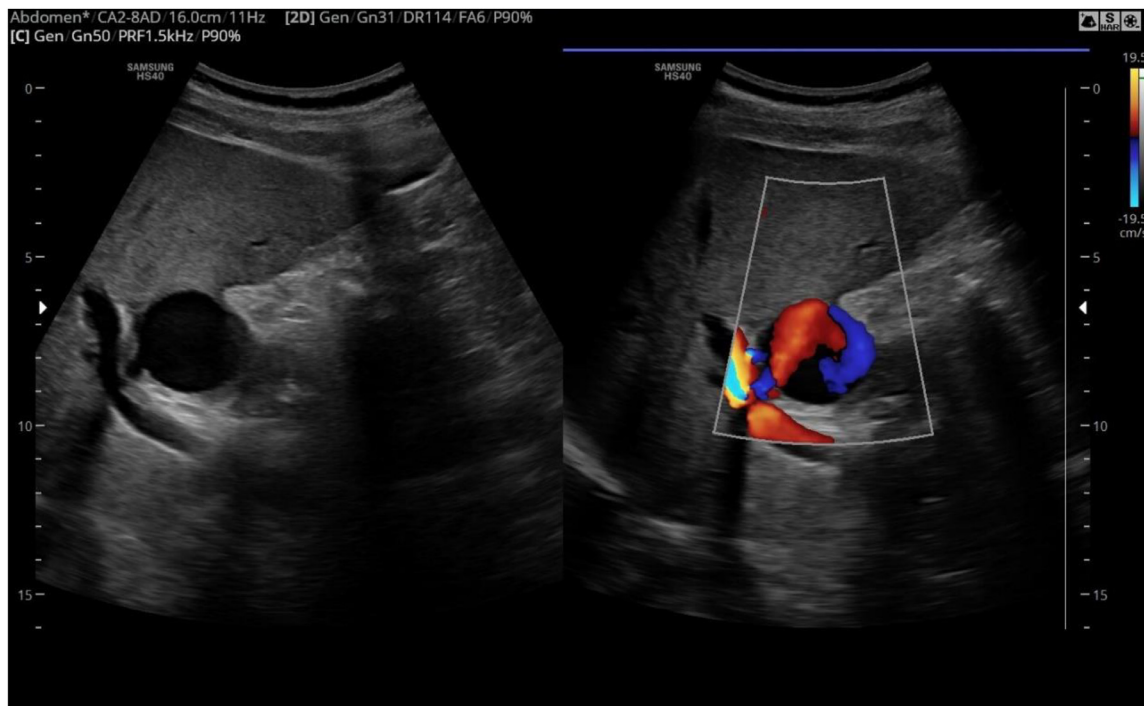


Fig. 1 – Duplex ultrasonography showing the hypoechoic round pseudoaneurysm arising from the hepatic artery at the porta hepatis, on B-mode. Corresponding color doppler image shows the characteristic "ying-yang" pattern of flow within the pseudoaneurysm.

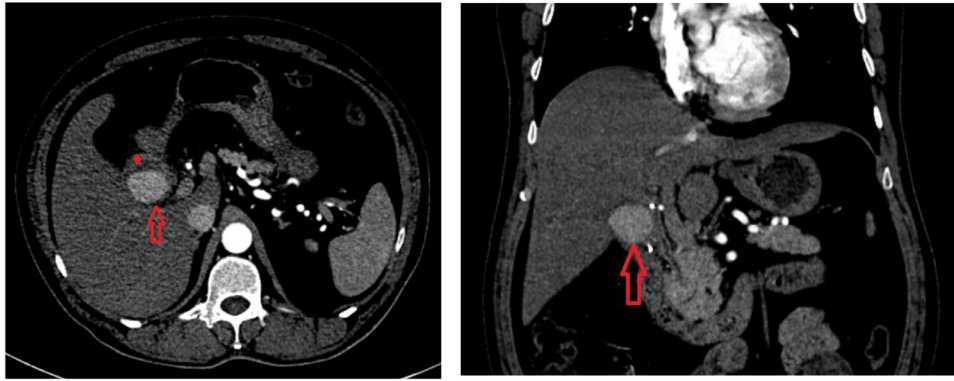


Fig. 2 – Axial and coronal reformatted contrast enhanced computed tomography (CECT) images showing contrast filled pseudoaneurysm (red arrow) at the hepatic hilum with partially thrombosed non-enhancing portion (red pointer on axial image).

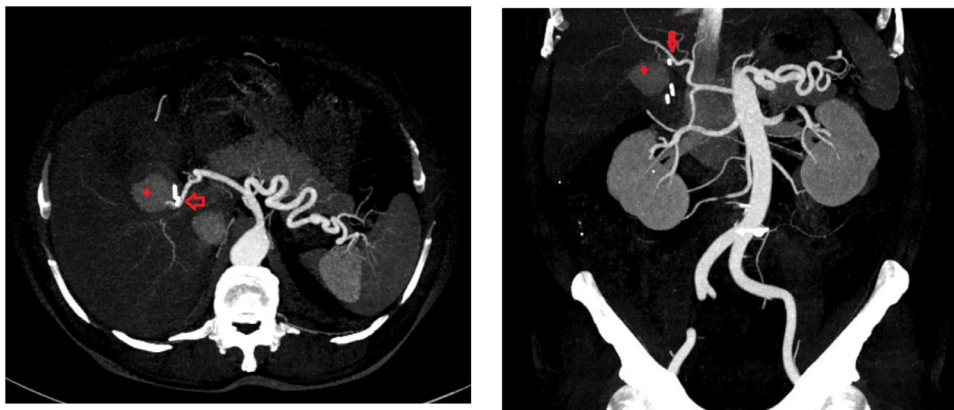


Fig. 3 – Axial and coronal reformatted contrast enhanced computed tomography (CECT) maximum intensity projection images showing the pseudoaneurysm (red pointer) arising from the right hepatic artery (red arrow).

Ultrasonography of the abdomen revealed a well-defined hypoechoic focal outpouching arising from the right hepatic artery at the porta hepatis. On color Doppler, the lesion showed “ying-yang” pattern of flow (Fig. 1). The US examination also showed dilated bilateral intrahepatic biliary ducts (IHBDs). With these findings, an initial diagnosis of pseudoaneurysm of the right hepatic artery was made; and the radiologist recommended a CECT of the abdomen for confirmation of the diagnosis.

The CECT abdomen showed a round contrast-filled focal outpouching measuring 3.8×3.6 cm in the hepatic hilum with a peripheral nonenhancing hyperdense rim (Figs. 2 and 3). The lesion was seen arising from the right hepatic artery, 2.8 cm from its origin. The lesion was extrahepatic in location and was abutting the common bile duct medially, compressing and narrowing it to cause proximal dilatation of the biliary tree. The lesion was posteriorly abutting the right portal vein, inferiorly to the D1 part of the duodenum, and laterally to the segment V of the liver. No evidence of contrast blush was noted in subsequent phases of imaging. There was

Michels Type I hepatic arterial anatomy and Nakamura Type A portal venous anatomy. With these findings, a diagnosis of partially thrombosed pseudoaneurysm arising from the right hepatic artery was reported. 3D-VRT reconstructed CECT image demonstrated the location of right hepatic arterial pseudoaneurysm close to the postlaparoscopic cholecystectomy site (Fig. 4).

MRI images showed the pseudoaneurysm as hypointense lesion on T1 sequence and hyperintense lesion on T2 sequence (Fig. 5).

MRCP study was also performed to confirm the cause of IHBDs dilatation. It revealed status postcholecystectomy and confirmed the pseudoaneurysm compressing the proximal CBD with mild upstream biliary dilatations (Fig. 6).

Hence, a diagnosis of posttraumatic partially thrombosed pseudoaneurysm from the right hepatic artery was made, and an interventional radiologist was consulted for further management. The patient was successfully treated with angiographic embolization (pre- and postembolization image shown by Fig. 7).

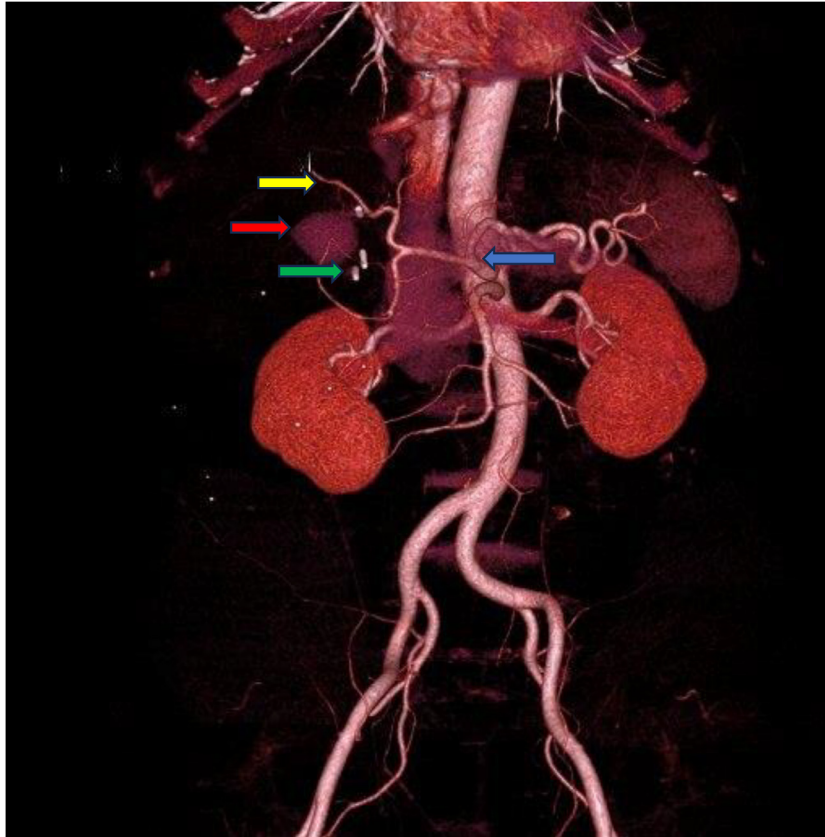


Fig. 4 - Three-dimensional-Volume Rendering Technique (3D-VRT) reconstructed contrast enhanced computed tomography (CECT) image demonstrates the location of right hepatic arterial pseudoaneurysm (red arrow) close to the postlaparoscopic cholecystectomy site. (Yellow arrow shows right hepatic artery, blue arrow shows the celiac trunk and green arrow shows surgical clips).

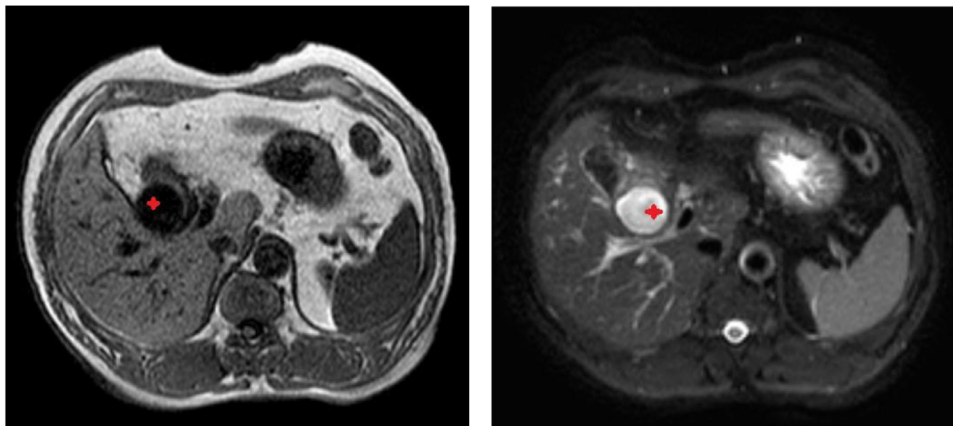


Fig. 5 - Magnetic resonance imaging (MRI) showing the pseudoaneurysm (red pointer) as hypointense lesion on T1 sequence and hyperintense lesion on T2 sequence.

Discussion

A pseudoaneurysm is a mass of blood that forms after a vascular injury and is retained by the tissue surrounding the affected vessel [2]. It can be distinguished from true aneurysm

by the fact that, the true aneurysm is confined by the vessel wall or one of its layers [2]. Iatrogenic injury is more common for the causation of pseudoaneurysm of hepatic artery than hepatic trauma [10]. They usually occur as an isolated complication, but more commonly associated with iatrogenic bile duct injuries. Also, in 25%-35% of the cases of bile duct in-

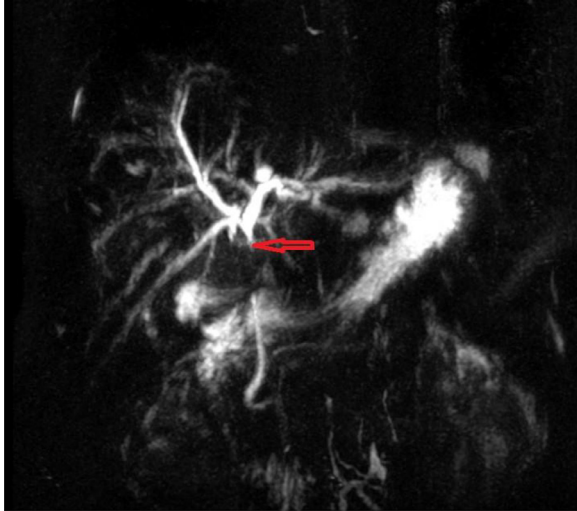


Fig. 6 – Magnetic resonance cholangiopancreatography (MRCP) image showing the narrowing of the common hepatic duct (red arrow) at the site of pseudoaneurysm with resultant upstream dilatation of the biliary ducts.

injuries, there is incidence of vascular complications [11]. Literature suggests the higher association of postoperative hepatic artery pseudoaneurysm from laparoscopic procedures than the open surgeries [12]. Pseudoaneurysm of hepatic arteries occur as a complication of procedures like transhepatic cholangiography, percutaneous liver biopsy, or transhepatic drainage catheter placement [3]. Pseudoaneurysms of hepatic artery are associated with injury to the hepatic arterial wall during open or laparoscopic hepato-pancreato-biliary procedures and usually develop later in timeline after the injury. This leads to the elevation of intravascular pressure forcing the blood to percolate through the intimal layer of the damaged artery thus forming a perfused sac, establishing communication with the arterial lumen [13]. In our case, the pseudoaneurysm occurred after 2 months (8 weeks) of postlaparoscopic cholecystectomy. The usual mode of presentation of hepatic artery pseudoaneurysm include upper gastrointesti-

nal bleeding, haemobilia, and abdominal pain [8]. Our patient presented with epigastric pain and had icterus on examination. The cause of icterus may be due to the pseudoaneurysm compressing the proximal CBD as shown by MRCP findings. Pseudoaneurysm of hepatic artery is diagnosed non-invasively with contrast-enhanced CT, Doppler US and selective arteriography. However, Selective catheter angiography remains the gold standard in accurate and early detection. Modern imaging tools include high-resolution vascular imaging, 3D angiography, and advanced US with turbulent arterial waveform [4]. Pseudoaneurysms exhibit a “ying-yang” bidirectional flow pattern. Partially thrombotic pseudoaneurysms often reveal blood flow through the thrombus, showing a false arterial lumen [14]. The diagnosis in our case was made by Doppler US, CECT abdomen (coronal reformatted and 3D reconstructed), and MRCP. The pseudoaneurysms of hepatic artery are very much prone to rupture with an estimated mortality rate of more than 50%. So, they need early intervention [15]. Selective hepatic artery angiography and embolization is considered as the first line of treatment for embolization with success rate of over 80%, good tolerance, and minimal risk [16]. The chances of mortality and morbidity are 25% and 67% lower than surgery respectively [13]. However, variations in the arterial origin and course may lead to failure of embolization [9]. However, surgical intervention should be considered if the embolization fails, pseudoaneurysm are infected or other vascular structures are compressed [17]. Vascular stenting can also be considered as an alternative to embolization. It has added advantage of maintaining the luminal patency and thus avoid complication like liver necrosis [18]. Percutaneous embolization may also be an alternative that allows successful embolization in cases where conventional embolization fails [19]. But in rare cases, percutaneous embolization may complicate with non-target embolization and pseudoaneurysm sac rupture [20]. Percutaneous thrombin acts by forming a fibrin clot within the pseudoaneurysm lumen, which causes stasis and acts as a mesh for endogenous platelet aggregation and thrombus formation. However, it is associated with increased risk of recanalization [20].

Our patient was managed with angiography and embolization, which reported normal finding in follow up imaging.

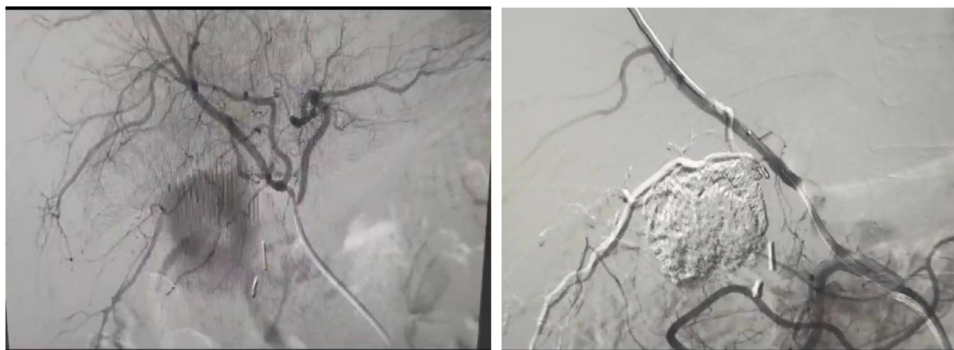


Fig. 7 – Intraoperative digital subtraction angiography (DSA) images of the right hepatic artery pseudoaneurysm - pre- and postendovascular glue embolization.

Conclusion

Pseudoaneurysm of right hepatic artery, although rare, should be suspected in patients presenting with the complaints of pain abdomen and jaundice after a history of postcholecystectomy status. Angiographic embolization is the treatment of choice, which must be undergone urgently due to the high mortality and morbidity of right hepatic artery pseudoaneurysm rupture.

Ethical approval

The study is exempt from ethical approval in our institution.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

REFERENCES

- [1] Finley DS, Hinojosa MW, Paya M, Imagawa DK. Hepatic artery pseudoaneurysm: a report of seven cases and a review of the literature. *Surg Today* 2005;35(7):543–7. doi:10.1007/s00595-005-2987-6.
- [2] Milburn JA, Hussey JK, Bachoo P, Gunn IG. Right hepatic artery pseudoaneurysm thirteen months following laparoscopic cholecystectomy. *EJVES Extra* 2007;13(1):1–3.
- [3] Sethi H, Peddu P, Prachalias A, Kane P, Karani J, Rela M, et al. Selective embolization for bleeding visceral artery pseudoaneurysms in patients with pancreatitis. *Hepatobiliary Pancreat Dis Int* 2010;9(6):634–8.
- [4] Machado NO, Al-Zadjali A, Kakaria AK, Younus S, Rahim MA, Al-Sukaiti R. Hepatic or cystic artery pseudoaneurysms following a laparoscopic cholecystectomy: literature review of aetiopathogenesis, presentation, diagnosis and management. *Sultan Qaboos Univ Med J* 2017;17(2):e135–46. doi:10.18295/squmj.2016.17.02.002.
- [5] Abbas MA, Fowl RJ, Stone WM, Panneton JM, Oldenburg WA, Bower TC, et al. Hepatic artery aneurysm: factors that predict complications. *J Vasc Surg* 2003;38(1):41–5. doi:10.1016/s0741-5214(03)00090-9.
- [6] Lampropoulos C, Markopoulos G, Tsochatzis S, Bellou A, Amanatidis T, Kehagias D, et al. Symptomatic pseudoaneurysms following laparoscopic cholecystectomy: focus on an unusual and dangerous complication. *J Minim Access Surg* 2021;17(4):450–7. doi:10.4103/jmas.JMAS_164_20.
- [7] Christensen T, Matsuoka L, Heestand G, Palmer S, Mateo R, Genyk Y, et al. Iatrogenic pseudoaneurysms of the extrahepatic arterial vasculature: management and outcome. *HPB (Oxford)* 2006;8(6):458–64. doi:10.1080/13651820600839993.
- [8] Hewes JC, Baroni ML, Krissat J, Bhattacharya S. An unusual presentation of hepatic aneurysm as a complication of laparoscopic cholecystectomy. *Eur J Surg* 2002;168(10):566–8.
- [9] Sagar S, Soundarajan R, Gupta P, Praveen Kumar M, Samanta J, Sharma V, et al. Efficacy of endovascular embolization of arterial pseudoaneurysms in pancreatitis: a systematic review and meta-analysis. *Pancreatology* 2021;21(1):46–58. doi:10.1016/j.pan.2020.11.017.
- [10] Tessier DJ, Fowl RJ, Stone WM, McKusick MA, Abbas MA, Sarr MG, et al. Iatrogenic hepatic artery pseudoaneurysms: an uncommon complication after hepatic, biliary, and pancreatic procedures. *Ann Vasc Surg* 2003;17(6):663–9. doi:10.1007/s10016-003-0075-1.
- [11] Stewart L, Robinson TN, Lee CM, Liu K, Whang K, Way LW. Right hepatic artery injury associated with laparoscopic bile duct injury: incidence, mechanism, and consequences. *J Gastrointest Surg* 2004;8(5):523–30 discussion 530–1. doi:10.1016/j.gassur.2004.02.010.
- [12] Connor S, Garden OJ. Bile duct injury in the era of laparoscopic cholecystectomy. *Br J Surg* 2006;93(2):158–68. doi:10.1002/bjs.5266.
- [13] Lumsden AB, Mattar SG, Allen RC, Bacha EA. Hepatic artery aneurysms: the management of 22 patients. *J Surg Res* 1996;60(2):345–50. doi:10.1006/jsre.1996.0055.
- [14] Azzo C, Driver L, Clark KT, Shokoohi H. Ultrasound assessment of postprocedural arterial pseudoaneurysms: techniques, clinical implications, and emergency department integration. *Cureus* 2023;15(8):e43527. doi:10.7759/cureus.43527.
- [15] Foley WD, Berland LL, Lawson TL, Maddison FE. Computed tomography in the demonstration of hepatic pseudoaneurysm with hemobilia. *J Comput Assist Tomogr* 1980;4(6):863–5. doi:10.1097/00004728-198012000-00023.
- [16] Green M, Duell R, Johnson C, Jamieson N. Haemobilia. *Br J Surg* 2001;88:773–86. doi:10.1046/j.1365-2168.2001.01756.x.
- [17] Zhornitskiy A, Berry R, Han JY, Tabibian JH. Hemobilia: historical overview, clinical update, and current practices. *Liver Int* 2019;39(8):1378–88. doi:10.1111/liv.14111.
- [18] Cui L, Kong L, Bai YH, Li XH, Wang XQ, Hao JJ, et al. Covered stent placement for hepatic artery pseudoaneurysm. *Abdom Radiol (NY)* 2020;45(10):3337–41. doi:10.1007/s00261-020-02452-3.
- [19] Vyas S, Ahuja CK, Yadav TD, Khandelwal N. Emergency ultrasound-guided percutaneous embolization of post-traumatic bleeding hepatic artery pseudoaneurysms. *Minim Invasive Ther Allied Technol* 2012;21(5):372–6. doi:10.3109/13645706.2011.642077.
- [20] Kang SS, Labropoulos N, Mansour MA, Michelini M, Filliung D, Baubly MP, et al. Expanded indications for ultrasound-guided thrombin injection of pseudoaneurysms. *J Vasc Surg* 2000;31(2):289–98. doi:10.1016/s0741-5214(00)90160-5.