

Intrahepatic Artery Pseudoaneurysm as a Delayed Presentation of Blunt Abdominal Trauma

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Abstract

Arterial pseudoaneurysm is an uncommon life-threatening complication in blunt trauma patients. Blunt liver injury may lead to hepatic artery pseudoaneurysm. Radiological intervention is the method of choice in diagnosis and treatment of hepatic artery pseudoaneurysm. However, surgical intervention is advised for unstable patients with large leaking defects. This study reports a case of 53-year-old female who was admitted with vague abdominal pain. She had experienced a blunt abdominal trauma a year ago and had gone under liver packing procedure. The CT-scan results showed hematoma in RUQ region and leaking pseudoaneurysm of right hepatic artery. Hematoma was drained and partial liver resection and hepatic arterioraphy were done through laparotomy.

Keywords: Hepatic Artery, Pseudoaneurysm, Blunt Abdominal Trauma

1. Introduction

Hepatic artery pseudoaneurysm (HAP) is a rare complication of liver injuries following blunt abdominal trauma (1-3). HAP rupture is the most dangerous and fatal obstacle, which usually presents itself as vague abdominal discomfort, gastrointestinal bleeding, and hemobilia (4-6). Although radiological intervention may prevent the need of aggressive treatments, mortality rate is still about 20% to 50% (7, 8). Hereon, we present a case of intrahepatic artery pseudoaneurysm 1 year after multiple trauma.

2. Case Presentation

A 53-year-old female patient was admitted to our surgical department with abdominal pain. The pain started 8 days before patient's admission and it was located in RUQ and became severe during the last 3 hours before admission. The patient had no fever, nausea, vomiting, melena, or hematemesis. During her recent physical exam in our surgical department, she was awake with unstable vital signs. Her heart rate was 115 per minute and blood pressure was 100/90 mmHg. Abdominal examination revealed severe tenderness around RUQ and epigastric area. Heart sounds were normal and there was no evidence of respiratory distress. Her laboratory data showed anemia and leukocytosis. The emergency abdominal ultrasonography demonstrated a suspicious mass in her liver. Furthermore, emergency MDCT scan demonstrated extended hematoma

in the anterior segment of the right lobe of the liver and a contrast leakage, which raised the suspicious of leaking pseudoaneurysm of right hepatic artery (Figures 1 and 2).

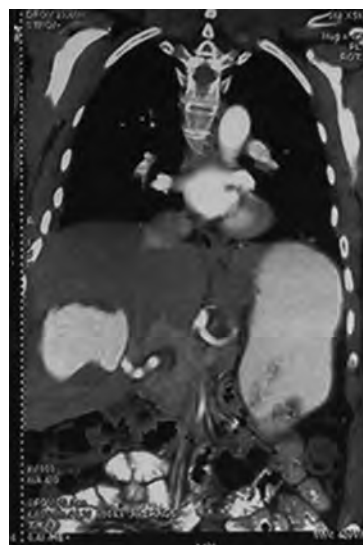


Figure 1. Multi Slice CT-Scan with Contrast

According to her past medical history, she had been registered in a local hospital with vague abdominal pain and resistant hypotension, tachypnea, and tachycardia after experiencing a car-motorcycle accident about a year ago. According to her previous documents, emergency

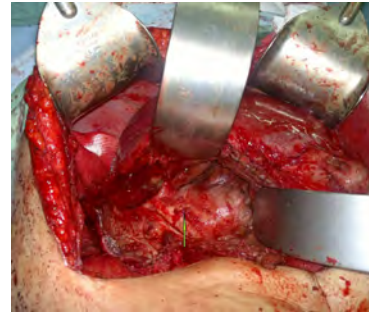


Figure 2. Contrast Leakage in the Arterial Phase

FAST had shown free liquid in abdominal region, while there had been a hypoechoic area in the middle part of the right liver lobe, highly suggestive of hematoma. Fourth left rib and several right ribs were fractured in her chest X-ray. Thus, resuscitative measures such as NGT, bilateral chest tube, central venous catheter, and sufficient hydration had been adapted for the patient. Due to her signs and symptoms, internal bleeding of liver injury due to trauma had been the most probable diagnosis. After laparotomy, liver packing had been done for the patient; there was no bleeding at the site 48 hours after laparotomy. According to her previous surgical report, a 7 to 8 cm laceration was observed on the 7th segment. Proper hepato-tomy and vessel ligation were done. She was released 7 days after the recovery, but no follow-up was done.

Based on her past medical history and our recent findings, she became a candidate for surgery. After general anesthesia, a Chevron incision was made and exploring begun. During our first inspection, segments 2, 3, and 4 were hypertrophic. The right and left lobes of the liver were released from its ligaments. First, the Pringle maneuver was done. After that, a large hematoma was opened and large amount of blood and clots were suctioned from the area. A fibrotic layer, surrounding the hematoma, and a defect were found in the side of the hepatic artery at its base (Figure 3). Due to the destruction of segments 5, 6, 7, and 8, we performed a partial hepatic resection. Hepatotomy was continued and the hepatic artery, which was the leading cause of bleeding in the lesion, went through arteriography. Based on our surgical observation, it was assumed that the fibrotic layer of the hematoma and liver segments hypertrophy demonstrated a silent long-lasting pseudoaneurysm. However, its sudden massive rebleeding made it symptomatic. In the end, the rest of the hepatic area was amended and the surgical incision was closed.

Figure 3. Surgical View



The arrow shows the arteriography location.

3. Discussion

Liver is prone to injury during blunt abdominal trauma because of its fixed location and histological structure. About 25% of liver injuries after blunt trauma leads to complications of biliary tree disruptions such as hemobilia, biloma, peritonitis, and abscess formation, however, they are resolved nonoperatively in 80% of the cases (3, 5, 9, 10). To date, only 13 cases of HAPs have been reported as this condition is rare (Table 1). As a matter of fact, hepatic artery pseudoaneurysm is a delayed outcome of blunt liver trauma, which mostly involves common (CHA) and right hepatic artery (RHA) (9, 11). Based on our literature review, 8 cases of HAPs were found in RHA and CHA. Female gender, obesity, vessel calcification or atherosclerosis, and anticoagulant usage are some risk factors of iatrogenic arterial pseudoaneurysm although vascular injuries are the fundamental well-known cause of HAP in blunt trauma cases (5, 8, 9, 12).

HAPs are commonly asymptomatic. However, rupture and bleeding (into gastrointestinal tract or the peritoneum) force these patients to refer to emergency departments as well as posing a 25% to 50% risk of mortality (3, 9, 13). One study in 2015 reported the death of a HAP patient due to hypovolemia and shock although necessary measures had been taken operatively at the time of admission (Table 1). CT scan is the mostly used diagnostic tool in HAPs. Some centers suggest doing CT scan as a follow-up a week after confirmed blunt liver injuries (8, 9). In these 13 HAPs, CT scan was used after trauma patients had shown symptoms of GIB, abdominal discomfort, and fever (Table 1). Interestingly, bleeding through laparotomy incision led to HAP diagnosis by CT scan 3 weeks after blunt chest trauma (5). One research study on 188 blunt liver trauma cases declared that 4% of HAP forms within 5 days of trauma. Nonetheless, no relationship was found between HAP incidence and grade of liver injury (7). On the other hand,

some retrospective studies on liver blunt trauma cases found CT scan follow-up nonessential (7-9). Also, CT scan exposes children and pregnant liver trauma victims to radiation. Despite the fact that CT scan is the gold standard approach in diagnosing HAPs, using Doppler ultrasonography as a follow-up is still on an ongoing debate among radiological investigations (4, 7-9, 11).

With respect to HAP management, surgical repair and simple ligation were firstly used to control the pseudoaneurysm bleeding. Large size or unstable pseudoaneurysm, lack of necessary equipment and staff during radiology intervention, and active or massive bleeding are the most certain indications of surgical management among HAPs. Moreover, surgical approach successfully reduces the risks of rebleeding and hepatic abscess formation, while it provides the opportunity of direct visualization of pseudoaneurysm in spite of its invasive nature (3, 6, 8, 9, 11, 13-15). Considering the reported cases of HAP after blunt liver trauma (Table 1), angiography is the first reliable method of diagnosis and treatment. In general, angioembolization is the initial line in management of HAPs (6, 8, 15, 16), which successfully controlled the bleeding in 80% of the cases. Among these reported cases, handling bleeding was achieved with success by noninvasive management (Table 1). This approach eliminates the need of using an exploratory laparotomy and general anesthesia although it has its own disadvantages such as rupture, infection, sepsis, contrast-induced nephropathy, radiation exposure, ascites, gall bladder necrosis, biliary disturbance, and recurrence or nullification due to retrograde flow of collaterals. Also, suitable hardware, radiation safety, and trained technical staff besides the embolization method can affect the outcome of radiological interventions (2, 4, 6-8, 11, 13, 15-17).

Based on the presented case and review of previous reports (Table 1), hemorrhagic shock can be caused by deep liver laceration (> 3 cm) in abdominal blunt trauma patients. If during an emergency surgery, this hypothesis is proved, it is advised to find the real source of bleeding. The fibrosis around hematoma showed a long-lasting HAP in our patient. Angioembolization, as a reliable nonoperative method, requires both sufficient equipment and a trained radiologist. When the exact bleeding vessels are not found during initial laparotomy among liver blunt trauma candidates, delayed HAP formation is a probability and regular follow-up by CT scan or Doppler US is advised to provide the opportunity of using an elective noninvasive management before catastrophic fatal outcomes occur.

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Footnotes

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References

1. Sun L, Guan YS, Wu H, Pan WM, Li X, He Q, et al. Post-traumatic hepatic artery pseudo-aneurysm combined with subphrenic liver abscess treated with embolization. *World J Gastroenterol.* 2006;12(17):2798-9. [PubMed: 16718774].
2. Luo X, Tan S, Wang J, Qian C. Upper gastrointestinal hemorrhage from hepatic artery pseudoaneurysm secondary to trauma: a case report. *Med Princ Pract.* 2010;19(6):493-5. doi: 10.1159/000320311. [PubMed: 20881420].
3. Tsurukiri J, Ueno M. Early multiple intrahepatic artery pseudoaneurysm formation after liver trauma. *Clin Gastroenterol Hepatol.* 2011;9(10):e106-7. doi: 10.1016/j.cgh.2011.06.001. [PubMed: 21699812].
4. Mate AD, Surnare KR, Deolekar SS, Gvalani AK. Lower gastrointestinal bleeding due to hepatic artery pseudoaneurysm following laparoscopic cholecystectomy. *J Minim Access Surg.* 2013;9(1):31-3. doi: 10.4103/0972-9941.107135. [PubMed: 23626418].
5. Cambj-Sapunar L, Piplovic-Vukovic T, Simunic M, Ardalic Z, Tonkic A, Perkovic N, et al. Posttraumatic hepatic artery pseudoaneurysm presenting as gastrointestinal bleeding. *J Intens Care Emerg Med.* 2014;9(1):57-9. doi: 10.22514/sv91.042014.11.
6. Batur A, Yavuz A, Toktas O, Bora A, Bulut MD. Hepatic Artery Pseudoaneurysm: Delayed Presentation after a Blunt Trauma. *Pol J Radiol.* 2015;80:334-6. doi: 10.12659/PJR.894177. [PubMed: 26171087].
7. Osterballe L, Helgstrand F, Axelsen T, Hillingsø J, Svendsen LB. Hepatic pseudoaneurysm after traumatic liver injury; is CT follow-up warranted? *J Trauma Manag Outcomes.* 2014;8:18. doi: 10.1186/1752-2897-8-18. [PubMed: 25780384].
8. Bashiri K, Roushan N, Hamidian SM. Hepatic Artery Pseudoaneurysm; Simple or Difficult to Diagnose? *Arch Iran Med.* 2016;19(7):521-2. [PubMed: 27362248].
9. Brandt AH, Ewertsen C, Hansen KL. The Impact of Transient Hepatic Attenuation Differences in the Diagnosis of Pseudoaneurysm and Arteriovenous Fistula on Follow-Up CT Scans after Blunt Liver Trauma. *Diagnostics (Basel).* 2014;4(3):129-39. doi: 10.3390/diagnostics4030129. [PubMed: 26852681].
10. Iswanto S, Nussbaum ML. Hepatic artery pseudoaneurysm after surgical treatment for pancreatic cancer: minimally invasive angiographic techniques as the preferred treatment. *N Am J Med Sci.* 2014;6(6):287-90. doi: 10.4103/1947-2714.134377. [PubMed: 25006566].
11. Kumar A, Ahuja CK, Vyas S, Kalra N, Khandelwal N, Chawla Y. Hepatic arteriovenous fistulae: role of interventional radiology. *Digest Dis Sci.* 2012;57(10):2703-12.
12. Karangelis D, Daskalopoulos M, Giamouzis G, Koufakis T, Fragoulis S, Papadakis E, et al. Acute aortic dissection is independent of weather conditions but statistically correlates with day of the week. *J Emerg Trauma Shock.* 2014;7(3):244-6. doi: 10.4103/0974-2700.136877. [PubMed: 25114440].
13. Francisco LE, Asuncion LC, Antonio CA, Ricardo RC, Manuel RP, Caridad MH. Post-traumatic hepatic artery pseudoaneurysm treated with endovascular embolization and thrombin injection. *World J Hepatol.* 2010;2(2):87-90. doi: 10.4254/wjh.v2.i2.87. [PubMed: 21160978].
14. Aboujaoude M, Noel B, Beaudoin M, Ghattas G, Lalonde L, The Bao B, et al. Pseudoaneurysm of the proper hepatic artery with duodenal fistula appearing as a late complication of blunt abdominal trauma. *J Trauma.* 1996;40(1):123-5. [PubMed: 8576975].

15. Zhang X, Li X. Successful Embolization of a Huge Hepatic Artery Pseudoaneurysm after Blunt Abdominal Trauma. *J Pediatr*. 2016;**168**:252–e1. doi: [10.1016/j.jpeds.2015.09.052](https://doi.org/10.1016/j.jpeds.2015.09.052). [PubMed: [26490131](https://pubmed.ncbi.nlm.nih.gov/26490131/)].
16. Yi IK, Miao FL, Wong J, Narasimhan KL, Lo RH, Yee L, et al. Prophylactic embolization of hepatic artery pseudoaneurysm after blunt abdominal trauma in a child. *J Pediatr Surg*. 2010;**45**(4):837–9. doi: [10.1016/j.jpedsurg.2010.01.021](https://doi.org/10.1016/j.jpedsurg.2010.01.021). [PubMed: [20385298](https://pubmed.ncbi.nlm.nih.gov/20385298/)].
17. Gondolesi GE, Matsumoto C, Wayne M, Schwartz ME. Post-traumatic pseudoaneurysm of the common hepatic artery with duodenal fistula. *HPB (Oxford)*. 2002;**4**(4):183–6. doi: [10.1080/13651820260503855](https://doi.org/10.1080/13651820260503855). [PubMed: [18332952](https://pubmed.ncbi.nlm.nih.gov/18332952/)].
18. Baha B, Meyer PG, Brunelle F, Orliaguet G, Michel JL, Carli P. [A case of hepatic pseudoaneurysm treated with percutaneous embolization in a child with multiple trauma]. *Ann Fr Anesth Reanim*. 2001;**20**(9):786–90. [PubMed: [11759319](https://pubmed.ncbi.nlm.nih.gov/11759319/)].
19. Jones PM, Subbarao G. Hemobilia caused by hepatic artery pseudoaneurysm following abdominal trauma. *J Pediatr Gastroenterol Nutr*. 2015;**60**(5):ee40. doi: [10.1097/MPG.0b013e31829ce596](https://doi.org/10.1097/MPG.0b013e31829ce596). [PubMed: [23752076](https://pubmed.ncbi.nlm.nih.gov/23752076/)].

Table 1. Review of Hepatic Artery Pseudoaneurysm Reports After Blunt Abdominal Trauma (1, 3, 5, 6, 12-19)

Num	Year	Age, y	Gender	Case Presentation/Diagnosis	Management	Final Outcome
1	1996	-	-	Upper GI bleeding 3 years after trauma/Proper HAP with duodenal fistulization	Ligation of hepatic artery and fistula repair	Success
2	2001	8	-	Hemobilia 15 days after multiple trauma/Left HAP	Direct percutaneous embolization	Success
3	2002	29	Male	Upper GI bleeding 3 months after multiple trauma/common HAP with duodenal fistula	Ligation of hepatic artery and fistula repair	Success
4	2006	23	Male	Subphrenic abscess 10 days after car accident/complex subphrenic abscess and right HAP	Transcatheter embolization and collection drainage	Success
5	2010	11	Male	Hematemesis and melena 1 year after hepatorrhexis/right HAP	Transcatheter arterial embolization	Success
6	2010	10	Male	Hypovolemia and tachycardia 4 days after bicycle handle bar abdominal trauma/left HAP	Arterial embolization	Success
7	2010	18	Male	Choluria, pruritus, vomiting, nausea, and abdominal pain 6 months after motorcycle accident/common HAP and dilated intrahepatic bile ducts	Arterial embolization and direct injection of thrombin after embolization failure	Success
8	2011	84	Male	RUQ abdominal pain 3 days after 5 m-falling/multiple intra-HAP	Transcatheter coil embolization	Success
9	2014	46	Male	Melena and dizziness 5 months after a bicycle accident/right HAP	Transcatheter embolization	Success
10	2014	21	Male	Bleeding from laparotomy incision 23 days after blunt trauma to chest and RUQ/right HAP and distal hepatic artery-portal vein fistula	Coil embolization	Success
11	2015	34	Male	Epigastric tenderness and hematemesis 1.5 months after trauma/left HAP and duodenal ulcer	Distal gastrectomy, cholecystectomy, and removal of pseudoaneurysm	Died of hypovolemia 9 h after admission
12	2015	11	Female	Abdominal pain, hematochezia, and hematemesis 2 weeks after falling down of stairs/right HAP and biliary ductal dilatation	Coil embolization	Success
13	2016	7	Female	Fever and abdominal pain 2 days after trauma/common HAP	Coil embolization	Success

Abbreviations: GI, gastrointestinal; HAP, hepatic artery pseudoaneurysm; RUQ, right upper quadrant.