Case Report

Hepatic Artery Embolization to Control Liver Hemorrhages by Interventional Radiologists: Experiences from Khon Kaen University

Vallop Laopaiboon MD*, Chalida Aphinives MD*,
Pongdej Pongsuwan MD**, Ake Pugkem MD***,
Jureerat Thammaroj MD*, Warinthorn Puttharuk MD*

** Department of Radiology, Faculty of Medicine, Khon Kaen University, Khon Kaen*
*** Department of Radiology, Bhumipol Adulyadej Hospital, Bangkok*
**** Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen*

Between 2001 and 2005, nine patients with liver hemorrhage underwent non-surgical embolotherapy. There were six males and three females, ranging in age from 9 to 58 years. All patients were symptomatic with hypotension and decreasing hematocrit. Causes of liver hemorrhage included liver laceration following blunt abdominal injury (2 patients), pseudoaneurysms of hepatic artery following blunt abdominal trauma (4 patients), post-traumatic hepatic artery and portal vein pseudoaneurysm (1 patient), hemobilia following liver resection for cholangiocarcinoma (1 patient) and hepatic artery aneurysm with fistula to the common bile duct (1 patient). All patients had successful embolization of artery to control liver hemorrhage. No acute complication occurred. In conclusion, embolotherapy is an effective treatment with a low complication rate to stop liver hemorrhage, especially from an artery.

Keywords: *Embolotherapy, Embolization, Liver, Hemorrhage, Bleeding*

J Med Assoc Thai 2006; 89 (3): 384-9
Full text. e-Journal: *http://www.medassocthai.org/journal*

The liver is the organ most frequently injured by abdominal blunt trauma[1]. Both delayed hemorrhage and intrahepatic pseudoaneurysm after blunt liver trauma are rare but can be the causes of late complication. The most common cause of hepatic arterial bleeding is abdominal trauma, accounting for 85% of all cases. Presently, it is believed that nearly 40% of these bleedings are due to iatrogenic injuries such as percutaneous transhepatic procedures or liver biopsies. Gall stone-related diseases, systemic infections, aneurysm, tumors or pre-eclampsia are other rare causes of hemobilia[2-7]. In the present report, the authors present their experience embolotherapy to control liver hemorrhage in 9 patients.

Correspondence to : Laopaiboon V, Department of Radiology, Faculty of Medicine, Khon Kaen University, 123 Group 16, Mittraparp Rd, Muang district, Khon Kaen 40002, Thailand. Phone: 0-4334-8389, Fax: 0-4334-8389; E-mail: laopaiboonv @yahoo.co.uk

Material and Method

Between 2001 and 2005, 9 patients with liver hemorrhage underwent non-surgical embolotherapy. There were 6 males and 3 females, ranging in age from 9 to 58 years. All patients were symptomatic with hypotension and decreasing hematocrit. Causes of liver hemorrhage included liver laceration following blunt abdominal injury (2 patients), pseudoaneurysms of hepatic artery following blunt abdominal trauma (4 patients), post-traumatic hepatic artery and portal vein pseudoaneurysm (1 patient), hemobilia following liver resection for cholangiocarcinoma (1 patient) and hepatic artery aneurysm with fistula to common bile duct (1 patient) (Table 1). Of these, 1 case was due to iatrogenic etiology.

In all patients, diagnostic angiography was performed prior to embolization to clarify the type and site of blood loss. Selective hepatic angiography was performed, using a standard 4-F or 5-F cobra or 4-F simple curve or 5-F sidewinder catheter. The catheter

Table 1. Patient characteristics and details of management

Patient	Pathology	Embolization materials
1. M, 23 yrs	Post-traumatic hepatic artery pseudo-aneurysm	Gelfoam + coil
2. M, 20 yrs	Post-traumatic hepatic artery pseudo-aneurysm	Coil
3. M, 31 yrs	Liver laceration and hematoma	Gelfoam
4. F, 27 yrs	Liver laceration and hematoma	Coil
5. F, 9 yrs	1) Hepatic artery pseudo-aneurysm 2) Portal vein pseudo-aneurysm	1) Gelfoam + coil 2) Coil
6. M, 44 yrs	DSA shows extravastion of contrast medium following liver resection for cholangiocarcinoma	Gelfoam + coil + glue
7. M, 58 yrs	Hepatic aneurysm with fistula to common bile duct	Gelfoam + coil + glue
8. M, 30 yrs	Hepatic aneurysm	Gelfoam + coil
9. F, 28 yrs	Hepatic artery pseudoaneurysm	PVA (Polyvinyl acetates)

was inserted as deep as possible near the site of blood loss. The authors used a coaxial microcatheter in the patient who had hepatic artery aneurysm with fistula to the common bile duct in order to perform superselective catheterization into the aneurysm. Most patients (6/9) were embolized by Gelfoam particles with or without coils (Cook, Bloomington).

Results

All patients had successful embolization to control liver hemorrhage. Diagnosis, clinical and radiological findings, and treatment are summarized in Table 1. Four patients (case I, II, VIII, IX) with post-traumatic hepatic artery pseudoaneurysms (Fig. 1A, B) presented hemobilia. The hemorrhage was controlled within 48 hours after embolization. No acute complication was occurred. One to two weeks after the procedure, follow up color Doppler sonogram and contrast enhanced CT were performed and showed no remaining flow within the pseudoaneurysms.

Two patients (case III, IV) with liver laceration and hematoma (Fig. 2) developed hypotension, decreasing hematocrit and shock, so the authors had to embolize them urgently.

One patient (case V) presented with post-traumatic hepatic artery and portal vein pseudoaneurysms (Fig. 3A, B). Two weeks after hepatic artery embolization, transileocecal vein portography was performed in the operating room demonstrating large portal vein pseudoaneurysm arising from a branch of

Fig. 1A Selective right hepatic artery; demonstrating a large pseudoaneurysm arising from the right hepatic arterial branch

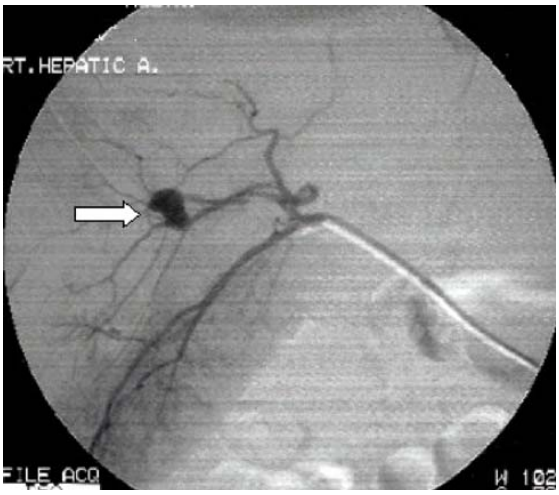

Fig. 1B Selective right common hepatic artery; demonstrating a pseudoaneurysm arising from the right hepatic arterial branch (arrow)

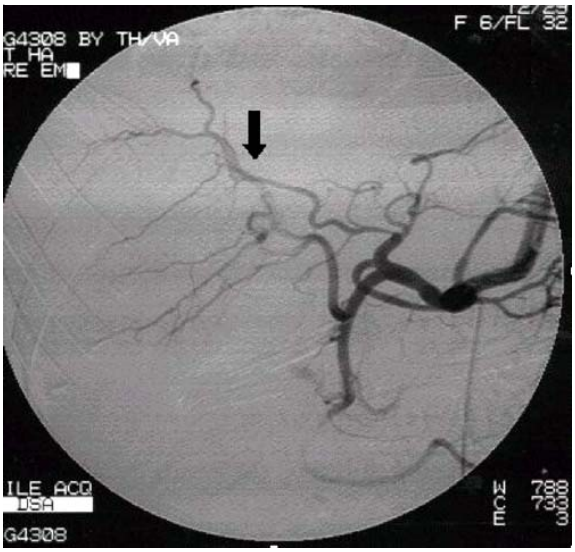

Fig. 2 Selective right common hepatic artery; demonstrating irregularity of the right hepatic arterial branch (arrow)

the right portal vein, and subsequent embolization was successfully done.

The earliest bleeding was observed in a case of hepatic aneurysm with fistula to the common bile duct (case VII) (Fig. 4A, B), 2 weeks after the procedure. This aneurysm was firstly embolized by glue, unfortunately, the glue refluxed and blocked the right hepatic artery, massive bleeding via fistula to common bile duct occurred. The patient developed hypotension, dyspnea and impending shock, so the authors had to occlude the proper hepatic artery by using glue, Gelfoam and coils to obtain immediately control of the bleeding. Repeated diagnostic angiography showed total occlusion of the hepatic artery with no evidence of arterial bleeding. CT scan showed small liver abscesses. Gastroscopy revealed mucosal bleeding which would be treated conservatively. The patient was finally discharged 1 month later.

Another patient with post-operative hemobilia (case VI) presented obstructive jaundice because of recurrent cholangiocarcinoma, 2 and a half years after embolization, he was treated by percutaneous transhepatic biliary drainage (PTBD).

Discussion

Hemorrhage from the hepatic arteries due to liver injuries is an uncommon but serious problem with significant morbidity and mortality. Selective arterial embolization is the treatment of choice for initial management with a substantial rate of success and a low incidence of serious complications[8]. Complications associated with technique of the transcatheter embolization include inadvertent occlusion of the wrong vessel with subsequent infarction of the normal structure, abscess formation, dislodgment and migration of the occluding device and hematoma or pseudoaneurysm at the catheter entry site. The authors presented cases of transarterial embolization and transiliocecal portal vein embolization. Only one case developed

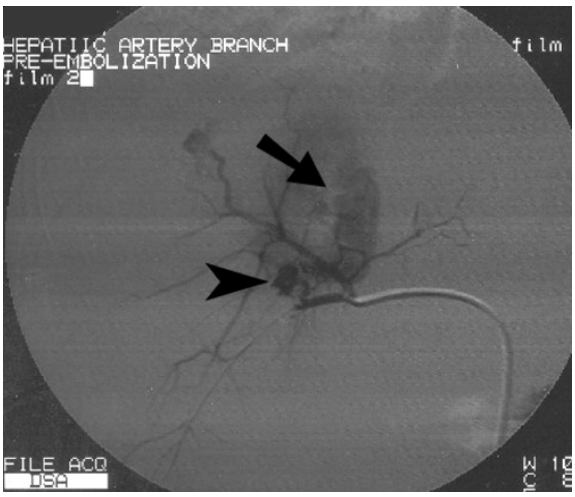

Fig. 3A DSA, selective right hepatic artery demonstrated two pseudoaneurysms arising from a branch of the right hepatic artery (arrowhead and back arrow)

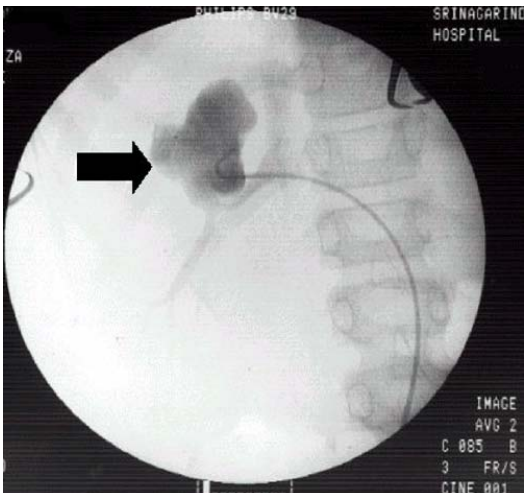

Fig. 3B Selective portogram demonstrated the large pseudoaneurysm (black arrow) arising from a branch of the right portal vein with associated shunt to the hepatic vein and opacified IVC

Fig. 4A Contrast-enhanced computed tomography (CT), demonstrating a 2-cm pseudoaneurysm in the common hepatic artery with surrounding hematoma

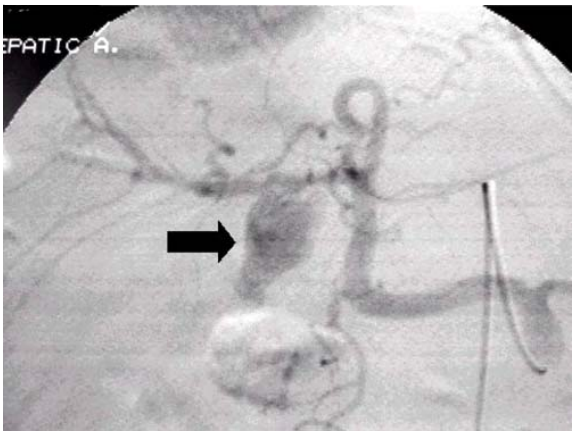

Fig. 4B Selective angiography of the common hepatic artery, demonstrating a pseudoaneurysm (arrow)

liver abscesses, which was resolved by conservative treatment.

Hepatic aneurysms are true aneurysm, pseudoaneurysm or, rarely, of the dissecting type aneurysm. True hepatic aneurysms are usually related to atherosclerosis, whereas extrahepatic pseudoaneurysms generally results from intra-abdominal inflammation, trauma and surgical procedure[9].

Hepatic artery pseudoaneurysms following blunt liver injury originate from a disruption of arterial continuity with extravasation of blood into the surrounding tissue. A fibrous capsule then enlarges the surrounding tissues due to the unrelenting arterial pressure. This has a reported prevalence of about 1%[10], and while rupture into the common bile duct may be very rare[11], which is shown in one of the presented patients. This lesion can be diagnosed by contrast enhanced CT scan, dynamic CT scan, CT angiography, color Doppler sonogram and MRI[12-14]. Because Doppler sonogram and CT scan are non-invasive investigations, they may also be useful in follow up of embolized aneurysms to ensure their continued regression. However, the most sensitive and valuable investigation modality is still selective angiography, which has a sensitivity of 100%[10,15-17].

Hemorrhage from the hepatic artery can be accurately diagnosed by angiography. Angiographic findings are extravasation of contrast medium, pseudoaneurysms, arterioportal fistula, or irregularities of lacerated arteries. The most common angiographic findings in cases of percutaneous biliary drainage are irregularities of the segmental arteries[18,19].

Conventional surgical management of this type of bleeding is difficult. Surgical ligation of hepatic artery may be ineffective because there is intrahepatic collateral circulation or extrahepatic feeding arteries arising from capsular branches or arterial branch in hepatoduodenal ligament. This type of bleeding is best controlled by hepatic resection, followed by hepatic ligation and packing[18,20]. The surgical treatments of hepatic aneurysm or pseudoaneurysms are aneurysmal exclusion, aneurysmectomy with arterial reconstruction and liver resection depending on the anatomic location of aneurysm. Although surgical management is appropriate in patients with stable conditions, (surgery) in high-risk patients or patients in shock, associated mortality rates are as high as 50%. Non-operative management was established in the pediatric patients, especially these who are hemodynamically stable[19].

Conclusion

The authors present 9 cases of liver hemorrhage with different etiology. All patients were successfully treated by embolotherapy. Hepatic artery embolization is an effective treatment with low complication rate to stop liver hemorrhage.

References

1. Ivatury RR, Stal WM. Liver trauma. In: Maull KI, editor. Advances in trauma. Vol. 4. Chicago: Yearbook Medical Publishers; 1989: 193-210.
2. Sandblom P. Hemobilia. Surg Clin North Am 1973; 53: 1191-201.
3. Michell SE, Shunman LS, Kaufman SL, Chang R,

Kadir S, Kinnison ML, et al. Biliary catheter drainage complicated by hemobilia: treated by balloon embolotherapy. Radiology 1985; 157: 645-52.
4. Mandel SR, Jacques PF, Sanofsky S, Mauro MA. Nonoperative management of peripancreatic arterial aneurysms. A 10-year experience. Ann Surg 1987; 205: 126-8.
5. Hubloue I, Keymeulen B, Delvaux G, Somers G. Hepatic artery aneurysm. Case reports with review of the literature. Acta Clin Belg 1993; 48: 246-52.
6. Terasaki KK, Quinn MF, Lundell CJ, Finck EJ, Pentecost MJ. Spontaneous hepatic hemorrhage in preeclampsia: treatment with hepatic arterial embolization. Radiology 1990; 174: 1039-41.
7. Stain SC, Woodburn DA, Stemphens AL, Katz M, Wagner WH, Donovan AJ. Spontanous hemorrhage associated with pregnancy. Treatment by hepatic arterial interruption. Ann Surg 1996; 224: 72-8.
8. Mirvis SE, Whitley NO, Vainwright JR, Gens DR. Blunt hepatic trauma in adults: CT-based classification and correlation with prognosis and treatment. Radiology 1989; 171: 27-32.
9. Stanley JC, Messina LM, Zelenock GB. Splanchnic and renal artery aneurysms. In: Moore WS, editor. Vascular surgery: a comprehensive review. 4th ed. Philadelphia: WB Saunders; 1993: 580-8.
10. Croce MA, Fabian TC, Spiers JP, Kudsk KA. Traumatic hepatic artery pseudoaneurysm with hemobilia. Am J Surg 1994; 168: 235-8.
11. Akatsu T, Hayashi S, Egawa T, Doi M, Nagashima A, Kitano M, et al. Hepatic artery pseudoaneurysm associated with cholecystitis that ruptured into the gallbladder. J Gastroenterol 2004; 39: 900-3.
12. Zalcman M, Matos C, Van Gansbeke D, Engelholm L, de Toeuf J, Struyven J. Hepatic artery aneurysm; CT and MR features. Gastrointest Radiol 1987; 12: 203-7.
13. Rokke O, Sondenaa K, Amundsen S, Bjerke-Larssen T, Jensen D. The diagnosis and management of splanchnic artery aneurysms. Scand J Gastroenterol 1996; 31: 737-43.
14. Warshauer DM, Keefe B, Mauro MA. Intrahepatic hepatic artery aneurysm: computed tomography and color-flow Doppler ultrasound findings. Gastrointest Radiol 1991; 16: 175-7.
15. Salam TA, Lumsden AB, Marthin LG, Smith RB III. Nonoperative management of visceral aneurysms and pseudoaneurysms. Am J Surg 1992; 164: 215-9.
16. Lumsden AB, Mattar SG, Allen RC, Bacha EA. Hepatic artery aneurysms: the management of 22 patients. J Surg Res 1996; 60: 345-50.
17. Baker KS, Tsiando J, Cho SR, Beachley MC. Splanchinic artery aneurysms and pseudoaneurysm: transcatheter embolisation. Radiology 1987; 163: 135-9.
18. Gorich J, Rilinger N, Brado M, Huppert P, Vogel J, Siech M, et al. Non-operative management of arterial liver hemorrhages. Eur Radiology 1999; 9: 85-8.
19. Meyer AA, Crass RA, Lim RC Jr, Jeffrey RB, Trunkey DD. Selective nonoperative management of blunt liver injury using computed tomography. Arch Surg 1985; 120: 550-4.
20. McGehee RN, Towsend CM Jr, Thompson JC, Fish JC. Traumatic hemobilia. Ann Surg 1974; 179: 311-5.

การรักษาภาวะเลือดออกในตับด้วยรังสีร่วมรักษา: ประสบการณ์จากมหาวิทยาลัยขอนแก่น

วัลลภ เหล่าไพบูลย์, ชลิดา อภินิเวศ, พงษ์เดช พงษ์สุวรรณ, เอก ปักเข็ม, จุรีรัตน์ ธรรมโรจน์, วรินทร์ธร พุทธรักษ์

คณะผู้วิจัยได้ทำการศึกษาผู้ป่วย 9 ราย ที่ได้รับการวินิจฉัยว่ามีภาวะเลือดออกในตับ ระหว่างปี พ.ศ. 2544 ถึง พ.ศ. 2548 ผู้ป่วยมีอายุระหว่าง 9-58 ปี เป็นเพศชาย 6 และเพศหญิง 3 ราย ผู้ป่วยทุกรายมีความดันโลหิตต่ำร่วมกับภาวะเลือดจาง สาเหตุของภาวะเลือดออกดังกล่าวในการศึกษานี้ ได้แก่ ตับฉีกขาดจากอุบัติเหตุที่ช่องท้อง 2 ราย ภาวะเส้นเลือดแดงเฮปาติกโป่งพอง จากอุบัติเหตุที่ช่องท้อง 4 ราย ภาวะเส้นเลือดแดงเฮปาติกร่วมกับเส้นเลือดดำพอร์ทัลโป่งพอง 1 ราย ภาวะเลือดออกในท่อน้ำดีจากการผ่าตัดตับ 1 ราย และภาวะเส้นเลือดแดงเฮปาติกโป่งพองร่วมกับ fistula ไปที่ common bile duct อีก 1 ราย ผู้ป่วยทั้งหมดได้รับการ รักษาด้วยรังสีร่วมรักษาโดยวิธีการอุดกั้นหลอดเลือดแดงเฮปาติก เพื่อหยุดภาวะเลือดออกในตับ คณะผู้วิจัย พบว่าการรักษาด้วยวิธีนี้เป็นวิธีการที่มีประสิทธิภาพ และภาวะแทรกซ้อนต่ำ