MINI-FOCUS ISSUE: PROCEDURAL COMPLICATIONS

CASE REPORT: CLINICAL CASE

Near-Fatal Hepatic Complication After Cardiac Catheter Ablation

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ABSTRACT

Radiofrequency cardiac ablation is increasingly performed for the management of dysrhythmias. Bleeding is a well-known complication of this procedure. We present a rare case of a near-fatal iatrogenic hepatic hemorrhage after cardiac catheter ablation. (Level of Difficulty: Advanced.) (J Am Coll Cardiol Case Rep 2022;4:545–548)

HISTORY OF PRESENTATION

A 75-year old man presented to the emergency department with dyspnea and nonspecific abdominal pain 5 days after cardiac ablation for supraventricular tachycardia. Cardiac ablation was performed in a quaternary cardiac hospital by an experienced electrophysiologist and a fellow, with no reported procedural difficulty or complication. Advancement of catheters from the right femoral vein (3 quadripolar catheters to the right atrium, tricuspid annulus, and right ventricle and 1 decapolar catheter to the coronary sinus) is not routinely performed with fluoroscopy, and no resistance or difficulty was documented. Atrioventricular nodal re-entry tachycardia was inducible. A long sheath (Swartz SRO) was advanced over a guidewire to the right atrium, and a 4-mm radiofrequency catheter (Biosense Webster; J&J) was passed by the sheath to the midseptum, where radiofrequency energy was applied to the slow pathway area. Atrioventricular nodal re-entry tachycardia was rendered noninducible. The patient was taking apixaban for paroxysmal atrial fibrillation, which he continued taking after the procedure. On examination the patient was tachypneic and tachycardic but in a hemodynamically stable condition.

LEARNING OBJECTIVES

- To recognize potential hepatic complications of RFCA with the use of femoral access.
- To recognize potential hepatic complications associated with anticoagulation.
- Important reminder to maintain a broad range of differential diagnoses even during pursuit of the likely or common diagnosis.
condition. There was mild tenderness on palpation of the right upper quadrant without overt peritonism.

**MEDICAL HISTORY**

His medical history was significant for chronic obstructive pulmonary disease (COPD). He had no history of bleeding, clotting disorders, or any abdominal trauma. He was a current smoker with a 60 pack-year history. He did not describe harmful alcohol intake or illicit drug use. He led an active lifestyle and lived alone on a rural property.

**DIFFERENTIAL DIAGNOSIS**

In the emergency department, the focus was on dyspnea with tachycardia in a patient with COPD. The initial differential diagnoses were of pulmonary embolism, pericardial effusion, and infective exacerbation of COPD.

**INVESTIGATIONS**

A CT pulmonary angiogram (CTPA) was performed (Figure 1). The scan was negative for pulmonary embolism and pericardial effusion and showed no chest infection. He received analgesia and antibiotics and was observed overnight. In the morning, his pain had improved though not resolved with opioid analgesia. A diagnosis of infective exacerbation of COPD was made, and he was discharged home with antibiotics.

**MANAGEMENT**

Over the next 12 hours, the patient’s pain worsened, and he returned to the hospital. On re-presentation, he was in a hemodynamically unstable condition, with a systolic blood pressure of 60 mm Hg. Repeated imaging revealed an extensive subcapsular hepatic hematoma. His hemoglobin dropped from 11.3 g/dL to 7.8 g/dL. He was resuscitated with crystalloid and packed red blood cells, and his coagulopathy was managed with tranexamic acid, prothrombin complex concentrate, fresh frozen plasma, and factor VII. No focal hepatic bleeding point was identified radiologically to allow embolization; however, the liver capsule was effectively “deroofed” by an extensive subcapsular hematoma. The patient remained hemodynamically compromised and underwent emergency laparotomy. A large volume of free intraperitoneal blood was found with rupture of the liver capsule anteriorly and an active bleeding point subcapsularly in segment III. He experienced an on-table cardiac arrest. To attain hemostasis, his liver was surgically packed, and he was transferred to the intensive care unit. He returned the after day for a re-look laparotomy, which found ongoing low-volume bleeding with multiple bleeding points across the liver, which were controlled surgically. After a 5-week period of rehabilitation, he could function independently and was discharged from the hospital.

A retrospective review of his initial CTPA demonstrated a small subcapsular hematoma (Figure 1). Cross-sectional imaging including magnetic resonance imaging with Primovist demonstrated residual subcapsular hematoma and no underlying focal liver lesion.

**DISCUSSION**

Radiofrequency catheter ablation (RFCA) is increasingly performed in the United States, and many patients are prescribed anticoagulation to prevent embolic stroke from their underlying dysrythmia. Bleeding is a recognized risk of RFCA, but subcapsular liver hematoma after endovenous cardiac ablation has not previously been reported, to our knowledge, although direct hepatic injury from the use of an epicardial approach has been reported previously.

Subcapsular liver hematomas typically occur in blunt trauma but can arise in pregnancy and rarely can be spontaneous.

In this case, we postulate that liver injury was caused by inadvertent right hepatic vein catheterization during cardiac ablation. Injury from radiofrequency is unlikely because no radiofrequency was delivered to the myocardial tissue adjacent to the liver. The initial injury was subclinical; however, with recommencement of anticoagulation, bleeding progressed to a life-threatening subcapsular hematoma.

The CTPA performed on the patient’s initial presentation to the emergency department demonstrated a lobulated appearance of the lower right lobe (Figure 1); however, as a dedicated venous phase was not performed, this was not recognized. Over the next 24 hours, this subcapsular hematoma then extended, shearing the liver capsule and causing multiple subcapsular bleeds, most pronounced in the left hemiliver where the hematoma was largest (Figure 2). With resuscitation, surgical intervention, and cessation of anticoagulation, a fatal outcome was narrowly avoided.

RFCA is a widely used, safe, and effective treatment for patients with arrhythmias. A large multicenter study concluded that the rate of major complications, which included all complications that
required intervention, was 4%. One in 4 occurred after discharge from the hospital and within 30 days of the RFCA. Vascular access complications, which include the development of a puncture site hematoma, arteriovenous fistula, or pseudoaneurysm, account for >50% of complications. Other complications are isolated to the thoracic cavity or coronary vessels or are secondary to emboli formation. The hepatic venous circulation may be inadvertently catheterized in RFA. Presumably in this case 1 of the catheters, possibly the stiffer decapolar catheter, was inadvertently advanced into the hepatic vein, with subsequent endovascular intrahepatic injury. If fluoroscopy is not used, catheterization of the hepatic veins may not be recognized until resistance is noted.

**FIGURE 1 Initial Computed Tomography Scan**

(A) 2015 scan for comparison. No contour bulge of posterior liver edge along segment 6 (blue arrow). (B) Inferior images of a computed tomography pulmonary angiogram performed on initial acute presentation in 2018: note new contour bulge (orange arrow) and subtle hypodensity (**) along segment 6, indicating an early subcapsular hematoma.

**DIAGNOSIS OF SUBCAPSULAR HEPATIC HEMATOMA**

Subcapsular hepatic hematoma is a challenging clinical diagnosis. The signs and symptoms are nonspecific, and a history of recent cardiac procedure may not prompt a hepatic differential diagnosis when a patient presents with dyspnea (presumably from diaphragmatic irritation in this case). The absence of radiologic findings to support the initial pulmonary differential diagnoses and the ongoing severe pain may have provided a cue to the consideration of a broader differential diagnosis.

Imaging of the liver with CT or ultrasound is vital in making the diagnosis. Although it is not the ideal imaging modality, a noncontrast CT scan can demonstrate acute hematomas in the immediate 24 to 72 hours after bleeding. This case demonstrates

**FIGURE 2 Repeated Computed Tomography Scan 1 Day Later**

(A, B) Significant acute extravasation/bleeding of contrast material in the subcapsular space from several bleeding points (solid arrows), the largest overlies the left lobe. Expansion of the subcapsular hematoma (dashed arrows) compressing the liver (**).
evolution of the hepatic subcapsular hematoma on serial imaging, initially depicted as a subtle new bulge in the contour of segment VI of the liver. Hepatic contour abnormalities can occur with distortion of the hepatic parenchyma, focal expansion of the liver, capsular pathologic changes, or perihepatic processes. They may also occur physiologically adjacent to diaphragmatic slips. Although this finding is not specific, it is important to be aware of its potential significance.

Despite initial observation overnight, the patient remained in hemodynamically stable condition. Not until a further 12 hours later did his condition become hemodynamically unstable after substantial hemorrhage. The current consensus for management of liver trauma is that close clinical monitoring and regular examination has lower mortality rates compared with routine laparotomy in patients whose conditions are hemodynamically stable. It is hypothesized that this is because the liver often stops bleeding spontaneously. Sixty percent to 70% of high-grade liver injuries are now successfully managed nonoperatively. The combination of anticoagulation here was permissive of progressive hematoma, making operative management necessary.

FOLLOW-UP

The patient was well with no further hepatic issues on review 9 months after discharge from the hospital.

CONCLUSIONS

RFCA is commonly performed and is rarely complicated by hepatic subcapsular hematomas, which may be life threatening, particularly in the setting of anticoagulation. Awareness of the potential for hepatic bleeding complications, and early recognition and intervention, are critical to prevent morbidity and mortality.

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REFERENCES

1. Kneeland PP, Fang MC. Trends in catheter ablation for atrial fibrillation in the United States. J Hosp Med. 2009;4:E1-5.
2. Callens H, Hindricks G, Capato R, et al. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation: executive summary. J Arrhythm. 2017;33:369-409.
3. Koruth JS, Aryana A, Dukkipati SR, et al. Unusual complications of percutaneous epicardial access and epicardial mapping and ablation of cardiac arrhythmias. Circ Arrhythm Electrophysiol. 2011;4:882-888.
4. Lumley S, Slessor AA, Saunders M, et al. Golfer’s swing leads to a spontaneous subcapsular liver haematoma. BMJ Case Rep. 2013;Jun;19:2013.
5. Ndizenge A, Hammoudé F, Brutus P, et al. An obscure case of hepatic subcapsular hematoma. Case Rep Gastroenterol. 2011;5:223-226.
6. Bertaglia E, Stabile G, Pappone A, et al. Updated national multicenter registry on procedural safety of catheter ablation for atrial fibrillation. J Cardiovasc Electrophysiol. 2013;24:1069-1074.
7. Lipson JA, Qayyum A, Avrin DE, et al. CT and MRI of hepatic contour abnormalities. AJR Am J Roentgenol. 2005;184:75-81.
8. Suen K, Skandarajah AR, Knowles B, et al. Changes in the management of liver trauma leading to reduced mortality: 15-year experience in a major trauma centre. ANZ J Surg. 2016;86:894-899.

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