Removing pericardial drainage tube for acute cardiac tamponade associated with catheter ablation of atrial fibrillation can trigger hemoperitoneum from severe liver bleeding

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Introduction

Cryoballoon-based pulmonary vein (PV) isolation is a highly effective method for the treatment of atrial fibrillation (AF).[1] Nonetheless, catheter ablation can result in serious procedural complications, the mostly likely of which is acute cardiac tamponade.[2] Life-saving emergency pericardiocentesis for the aspiration of pericardial fluid and restoration of hemodynamics is required for acute cardiac tamponade. However, the life-saving procedure of pericardiocentesis can result in serious complications, such as liver bleeding, ventricular puncture, and pneumothorax.[3] Previous studies have reported that 6.2% of patients who have pericardiocentesis performed have complications, the most frequent of which is liver puncture.[4]

KEY TEACHING POINTS

- Hemoperitoneum from liver bleeding can be triggered not just during subxiphoid pericardiocentesis but also right after removal of the pericardial drainage tube.
- Great care must be taken even a couple of days after pericardiocentesis when the drainage tube is removed.
- It is thus recommended that clinicians perform a computed tomography scan after subxiphoid pericardiocentesis and examine whether there is liver puncture even if the patient shows a normal laboratory workup and normal liver enzyme levels.

Case report

A 76-year-old woman with a several-month history of palpitations and progressive dyspnea on exertion was referred to our hospital. A 12-lead electrocardiogram from 1 year before referral showed a normal sinus rhythm. At the time of the referral, AF was found in the 12-lead electrocardiogram. We attempted rhythm control with antiarrhythmic drugs of bepridil and flecainide but could not maintain sinus rhythm. Upon receiving the patient's consent, we subsequently performed catheter ablation for the AF. Cardiac computed tomography (CT) (Figure 1) showed no anatomical variation. PV isolation using a cryoballoon was performed under conscious sedation. Specifically, our ablation procedure was as follows. A second-generation cryoballoon catheter (28 mm, Arctic Front Advance; Medtronic, Minneapolis, MN) with a circular mapping catheter (20 mm, Achieve; Medtronic) was advanced into the left atrium and the PV ostium via a 15F steerable sheath (FlexCath Advance; Medtronic). The cryoballoon was then inflated. Contrast medium was used to confirm PV occlusion, and cryoenergy was applied to each PV for 180 seconds (Figure 2). During freezing of the left PVs, a 20-electrode catheter (BeeAT; Japan Lifeline Co, Ltd, Tokyo, Japan) was positioned in the right ventricle to obtain backup pacing in case of transient sinus arrest or atrioventricular block (Figure 2A and 2B). Before engagement of the right PVs with the cryoballoon, the BeeAT position was adjusted to obtain constant right phrenic nerve pacing and to record the diaphragmatic compound motor action potential (Figure 2C and 2D). After PV isolation, we performed high-dose isoproterenol provocation of non-PV foci. Non-PV foci were not provoked, and the session ended accordingly. The postcatheter blood pressure was 135/70 mm Hg.

KEYWORDS Acute cardiac tamponade; Pericardiocentesis; Subxiphoid approach; Hemoperitoneum; Liver bleeding; Catheter ablation
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Figure 1 Cardiac computed tomography of the patient before catheter ablation. No pulmonary venous variation was found.

Six minutes later in our catheter lab, the blood pressure decreased to 65/40 mm Hg, and we immediately performed a transthoracic echocardiogram (TTE). Only a portable echo was available (hand-held Vscan; GE Vingmed Ultrasound, Horten, Norway) because of the emergency situation. The TTE showed circular pericardial effusion (PE) and diastolic collapse of the right-sided heart chambers. We diagnosed the patient with acute cardiac tamponade associated with catheter ablation and prepared for pericardiocentesis. The systolic blood pressure immediately decreased to 40 mm Hg. From the poor views from the echo, we suspected that the parasternal and apical approaches were not applicable; there was no surgeon available for a surgical approach. Because of the seriousness of the situation, subxiphoid pericardiocentesis was performed with radiographic guidance at the inferior cardiac border by inserting a needle (Aspiration Seldinger Kit; Medtronic Inc, Minneapolis, MN) through the skin below the xiphoid process and the left costal margin at a 45-degree angle and advancing it toward the left shoulder. We were able to remove 550 mL of bloody effusion and attached a drainage tube. A TTE showed that the cardiac pendular movement had improved owing to a substantial reduction of the PE. The patient was then moved from the catheter lab to the intensive care unit. The next day, she had a normal laboratory workup and normal liver enzyme levels (hemoglobin concentration: 11.8 g/dL; aspartate aminotransferase 28 mg/dL; aminotransferase 21 mg/dL) and no PE in the TTE. The total amount of blood effusion removed by the pericardial drainage tube was 25 mL during the 48 hours. On the basis of these observations, we transferred the patient from the intensive care unit to the general ward and removed the pericardial drainage tube. However, 3 hours after this removal, she felt faint after getting up. The blood pressure was decreased again to 68/40 mm Hg.

Possible causes of presyncope and low blood pressure were the following: vasovagal reaction, femoral vascular complications, recurrence of cardiac tamponade, and hemoperitoneum from liver bleeding. We did not identify a vasovagal reaction (heart rate increased to approximately 100 beats/min) or femoral vascular complications. Hemoperitoneum was suspected because the urgent subxiphoid pericardiocentesis could have caused liver bleeding, and such a risk is a disadvantage of the subxiphoid approach.[3] A TTE showed no PE, which ruled out the recurrence of cardiac tamponade. Blood laboratory testing showed progressive anemia (hemoglobin concentrations decreased from 11.8 to 8.7 g/dL). A CT scan clearly indicated hemoperitoneum and liver puncture from the drainage tube (Figure 3). Therefore, we diagnosed the patient with hemorrhagic shock due to hemoperitoneum from liver bleeding.

The patient was then moved to the intensive care unit, where transfusion of red blood cells and fresh frozen plasma was required. We regularly conducted blood laboratory testing and checked her blood pressure. We consulted an interventional radiologist and a professional liver surgeon, concluding that we will perform invasive treatment if hemoperitoneum becomes severe and anemia progresses. Note also that the patient and her family refused invasive treatment except for emergencies. We performed a CT scan 2 weeks later and confirmed that the blood had absorbed and there was no recurrence of PE. Therefore, we concluded that no surgery was necessary. After 6 months of follow-up, the patient remained free of hemoperitoneum and PE.

Discussion

Cardiac tamponade is defined as PE resulting in hypotension. The incidence of cardiac tamponade associated with catheter ablation for AF has been reported to be 1.0%–2.0%.[2,5] In the case of an unstable hemodynamic state, the life-saving procedure of pericardiocentesis should be performed as soon as possible. Emergency pericardiocentesis is traditionally performed using anatomical landmarks under fluoroscopic guidance by the subxiphoid approach.[6] Canonical emergency medicine guidelines recommend that medical practitioners choose the method that they are the most familiar with among the 3 major methods of subxiphoid, parasternal, and apical approaches. Among these, the subxiphoid approach is most commonly chosen because of the convention.[7] However, the subxiphoid approach has potential risks, including right ventricular puncture, liver puncture, and life-threatening hemorrhage. The subxiphoid approach has the longest distance from the skin to the pericardial fluid.[8] In contrast, the increasing use of the TTE has enabled the other 2 methods to be safer than the subxiphoid approach. In fact, previous studies have suggested that the parasternal approach is safest if guided by a TTE.[9] However, despite these recent findings, the subxiphoid approach is particularly useful in cases of emergency, such as in our case.[3]

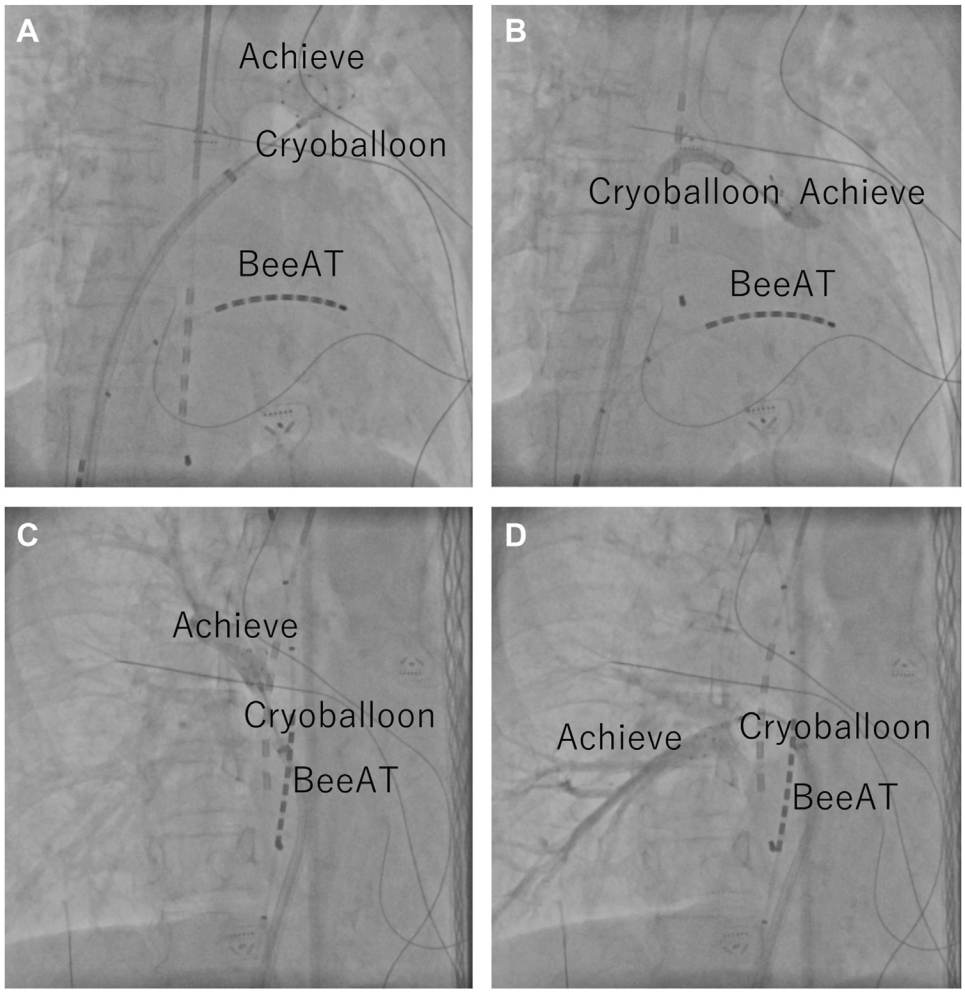

Figure 2 Pulmonary vein angiography during cryoballoon ablation (anteroposterior view). **A:** Left superior pulmonary vein (LSPV). Diameter: 22 mm. Achieve: Octapolar Achieve mapping catheter (Medtronic, Minneapolis, MN). BeeAT: 20-electrode atrial cardioversion (BeeAT; Japan Lifeline Co, Ltd, Tokyo, Japan). **B:** Left inferior pulmonary vein (LIPV). Diameter: 16 mm. **C:** Right superior pulmonary vein (RSPV). Diameter: 21 mm. **D:** Right inferior pulmonary vein (RIPV). Diameter: 14 mm.

Our patient presented with a normal blood laboratory workup, normal liver enzyme levels, and no PE as shown by a TTE 1 day after the pericardiocentesis procedure. These findings indicated no serious bleeding from the liver. Therefore, we transferred her from the intensive care unit to the general ward. On postprocedure day 2, we removed the drainage tube, which triggered hemoperitoneum. We suspect that the drainage tube had temporarily blocked the bleeding. Our case is a rare, educational example that suggests that intensive care is necessary even after drainage

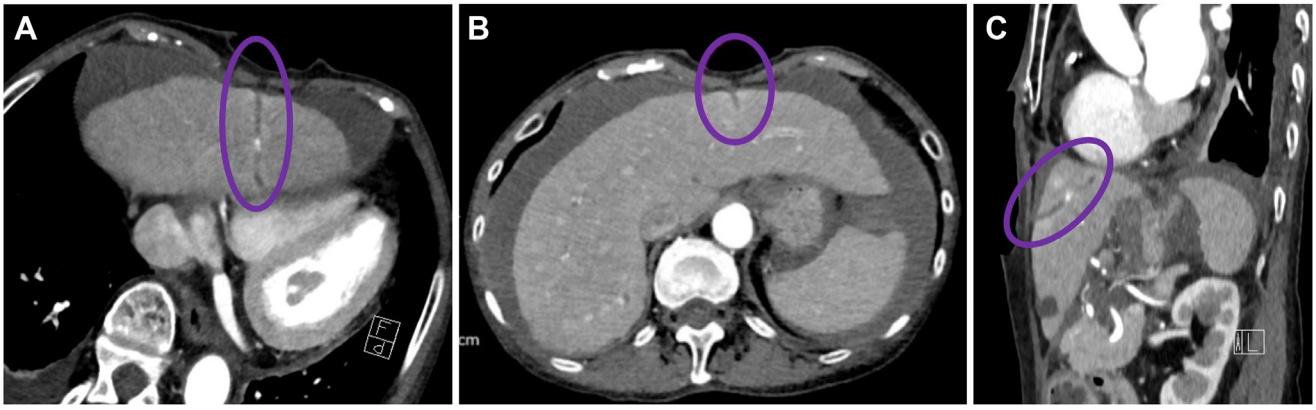

Figure 3 Chest and abdominal computed tomography after removing the drainage tube. **A:** Axial view (higher slice). The purple circle indicates the hole from penetration of the drainage tube. **B:** Axial view (lower slice). **C:** Sagittal view.

tube removal. Concretely, we have several recommendations based on our clinical case. Even if the patient has a normal laboratory workup and normal liver enzyme levels, as in our case, we recommend clinicians to perform a CT scan after subxiphoid pericardiocentesis and examine whether there is liver puncture. If liver puncture is found or suspected in the CT scan, we recommend that (1) cardiologists consult surgeons to consider the possibility of surgical removal and (2) if surgical removal is not pursued, cardiologists perform drainage tube removal in the intensive care unit to prevent further complications from pericardiocentesis.

Conclusion

We present an unusual, but important, case that shows that urgent pericardiocentesis for acute cardiac tamponade associated with catheter ablation can result in hemoperitoneum after drainage tube removal. CT scans can clearly visualize liver puncture from the subxiphoid approach. Pericardiocentesis is a potentially life-saving procedure that carries a high risk of complications, such as liver bleeding, as observed in our case. Great care must be taken for the patient's safety during and after such procedures.

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