

Use of Amplatzer Vascular Plug to Embolize Errant Chest Tube Tract in Liver

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We have read the case report of Hamanaka et al. [1] with great interest, prompting us to share a similar account in which a 70-year-old man presented with dyspnea.

During subsequent clinical diagnostics, computed tomography (CT) revealed a right apical lung mass that appeared to invade chest wall. In addition, the entire right upper lobe was collapsed, causing upward hemidiaphragmatic shift, and a right pleural effusion was detected. Insertion of a 14-Fr chest tube to collect fluid instead brought an immediate surge of blood (~ 550 mL), the dire effects then precipitating cardiopulmonary resuscitation. Upon return of spontaneous circulation, plain radiographs and CT images demonstrated tubal penetration of the liver. The tip of the chest tube had arrived at right ventricle (Figs. 1 and 2), traveling via right hepatic vein. Fortunately, hemodynamic stabilization was soon achieved.

Two days later, the patient was referred to interventional radiology for chest tube removal and embolization of the

liver tract. Under fluoroscopic guidance, we carefully withdrew the chest tube to inferior vena cava (IVC), using vertebral contours as landmarks. After an uneventful declamping trial, we passed a 0.035-inch hydrophilic guidewire (Radifocus; Terumo, Tokyo, Japan) and a 5-Fr catheter (Kumpe; Cook Medical, Bloomington, IN, USA) through the chest tube to IVC and pulled both tube and catheter into hepatic vein. Next, we advanced a 6-mm Amplatzer vascular plug (AVP) IV (St. Jude Medical [Abbott], St. Paul, MN, USA) through the 5-Fr catheter for tract embolization [2]. Initially placed in hepatic vein, the AVP was pulled back to hepatic parenchyma. A nearby nodular liver calcification and a degree of patient discomfort helped in estimating the vein–tract junction. Having established a lack of bleeding along the tract, we detached the AVP and removed the chest tube/catheter together (Fig. 3). The patient recovered well, undergoing lung cancer treatment for more than a year.

Level of Evidence: Level 4, Case Series.

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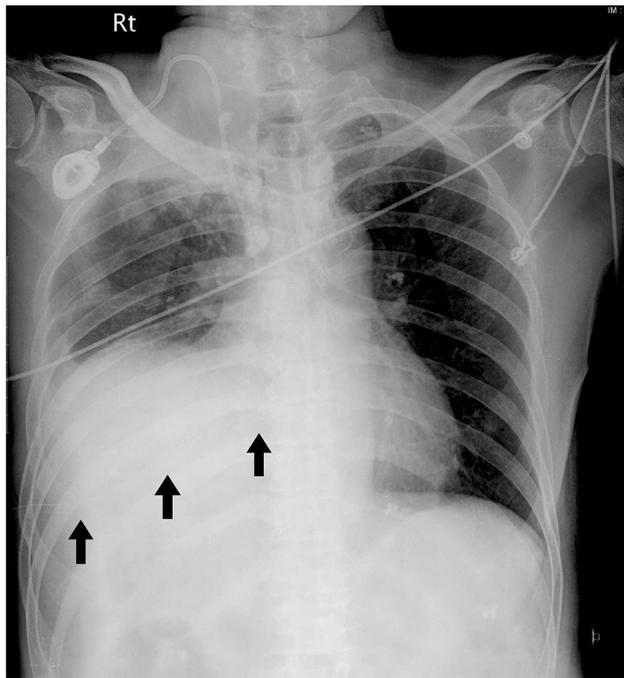


Fig. 1 Plain radiograph of chest disclosing elevated right hemidiaphragm and tip of chest tube (black arrows) in right ventricle

As stated, Hamanaka et al. used a balloon catheter to minimize blood loss, which is a commendable safety measure. Although flow volumes within hepatic vein are substantial, estimated at 17 mL/kg/min [3], the pressure is ≤ 8 mmHg and the right atrium-to-hepatic vein pressure gradient is only ~ 1 to 2 mmHg [4]. Furthermore, the flow is directed toward the heart. Thus, the massive bleeding we encountered is readily explained by the right ventricular location of tubal tip. We also presumed that bleeding risks are mitigated by reduced procedural times. In our patient, there was not much tubal blood loss after repositioning the tip. Furthermore, AVP placement is a less time-consuming process, with less potential for inadvertent migration than multiple coil insertions. Exact placement of an AVP may be challenging, but adjacent bony structures and their contours may be used as landmarks, and discomfort of the patient helped us in determining the vein-tract junction. Even though we fail exact placement, the AVP can easily be re-sheathed which allows to correct a malposition. Exceptionally, massive bleeding may occur in patients with hepatic congestion as a consequence of elevated hepatic venous pressure and treatment may need an additional caution.

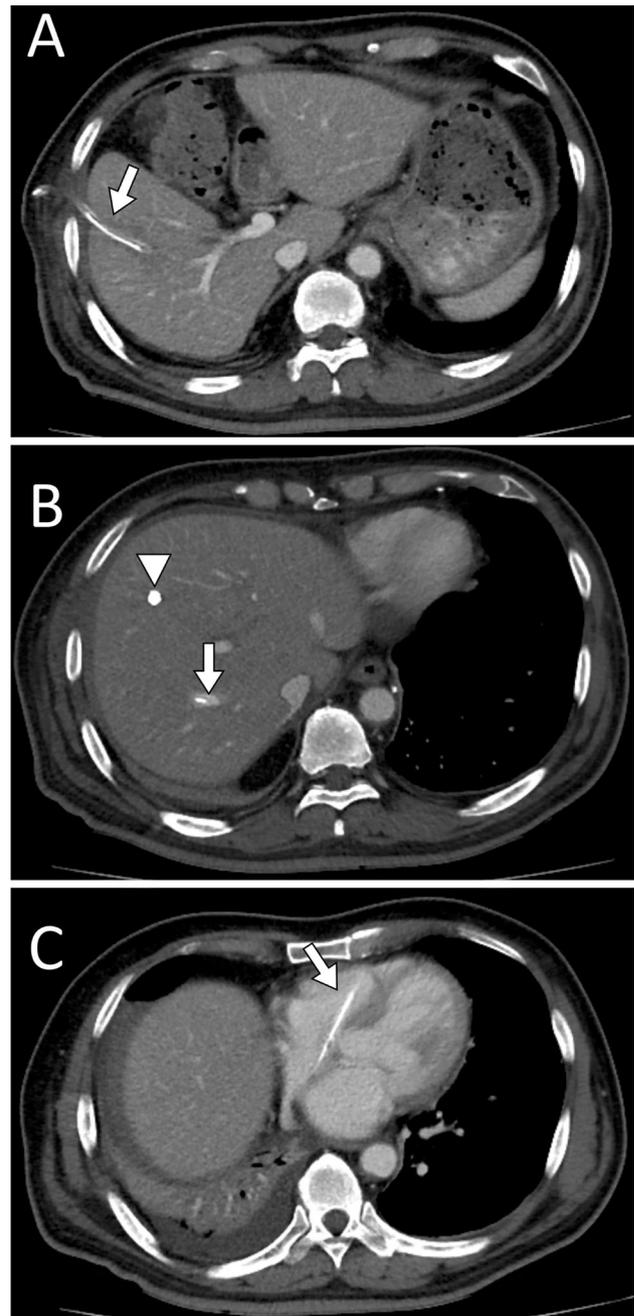


Fig. 2 **A** Axial computed tomography (CT) showing malpositioned tube within right hemihepatic segment 5 (arrow); **B** alternate view of chest tube entering right hepatic vein (arrow), with nodular parenchymal calcification (arrowhead) marking vein-tract junction; and **C** tip of chest tube confirmed in right ventricle (arrow)

In summary, AVP use appears safe and effective in embolizing the errant tracts of malpositioned chest tubes. However, patients with hepatic congestion may instead benefit from an occlusive balloon.

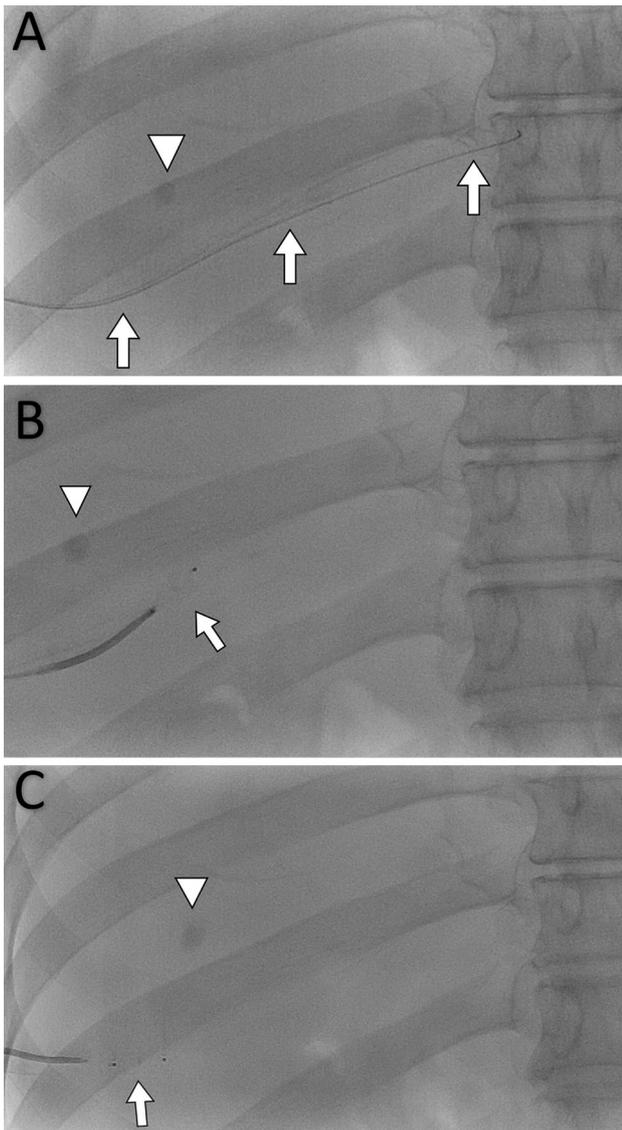


Fig. 3 Use of Amplatzer vascular plug (AVP) for transhepatic tract embolization under fluoroscopic guidance: **A** passage of guidewire and 5-Fr catheter (arrows) through chest tube, relying on nodular parenchymal calcification (arrowhead) as repositioning landmark; **B** type IV AVP (arrow) advanced via catheter to deploy within hepatic vein; and **C** AVP (arrow) pulled to vein–parenchymal tract junction, marked by nodular calcification (arrowhead)

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflict of interest.

Consent for Publication For this type of study consent for publication is not required.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

Informed Consent This study has obtained approval from our institutional review board, and the need for informed consent was waived.

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