

Percutaneous Endovascular Retrieval of Large Cement Leakage into the Right Atrium Following Cement-Augmented Pedicle Screw Instrumentation

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Spinal deformities in patients with osteoporosis are difficult to treat because of their debilitating and progressive nature¹⁾. Such cases often necessitate spinal instrumentation to reduce the back pain or neurological deficit. However, a pedicle screw in the osteoporotic spine poses an increased risk of screw loosening, pullout, and fixation failure. A cement-augmented fenestrated pedicle screw (CAPS) overcomes these problems by improving the initial fixation strength and fatigue strength of instrumentation in osteoporotic vertebrae and offers significant pullout strength²⁾. However, there are several reports of intravascular cement leakage³⁾. We encountered a case of intravascular long cement leakage following CAPS.

Vertebral column resection (VCR) was planned for a 78-year-old female with osteoporotic vertebral fracture at T12 (Fig. 1). The use of CAPS was considered because pedicle screw loosening before surgery was a concern. Pedicle screws were inserted at the T10, T11, L1, and L2 pedicles under fluoroscopy. Expedium Verse[®] spinal system and Vertecem V+[®] cement (DePuy Synthes Products, Inc., Raynham, MA, USA) were used. After 4 minutes of mixing, the bone cement was inserted into T10 pedicle screws. A couple of minutes later, the bone cement was inserted into L2. At this point, we observed long bone cement leakage from the L2 pedicle in fluoroscopy (Fig. 2A), into the vein (Fig. 2B). The cement gradually moved to the cranial side and stopped

at the level of the heart, requiring stoppage of the surgery. At this time, there was no change in blood pressure, heart rate, and electrocardiogram. We consulted a radiologist responsible for the endovascular therapy. Simultaneously, heparin was administered to prevent the formation of thrombosis around the foreign body and subsequent pulmonary artery embolization. Transesophageal echocardiography showed that the migrated cement reached into the right atrium and touched the interatrial septum (Fig. 2C). We planned to remove the free cement fragment using a catheter immediately after VCR to avoid the risk of heart wall perforation. The postoperative x-ray showed the migrated cement (Fig. 2D, 2E).

The patient was moved from the prone position to the supine position. First, a 16F sheath (Gore[®] DrySeal, 33 cm) was positioned in the inferior vena cava via the right femoral vein under ultrasound guidance. The retrieval catheter (Merit Medical[™] EnSnare[®] system, 6F) was introduced into the right atrium under fluoroscopic guidance with general anesthesia continued. We successfully captured the migrated cement linear fragment using a triple-loop snare (Fig. 3A, B). The object was long (6.5 cm) and had a needle-like appearance (Fig. 3C). Contrast-enhanced CT taken after surgery revealed no evidence of pulmonary embolism and cardiac perforation. The patient's back pain was relieved after surgery, and no further complications occurred.

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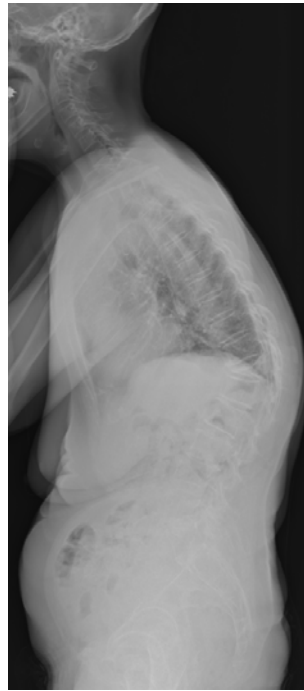


Figure 1. A 78-year-old female with an osteoporotic vertebral fracture at T12 presented severe back pain.

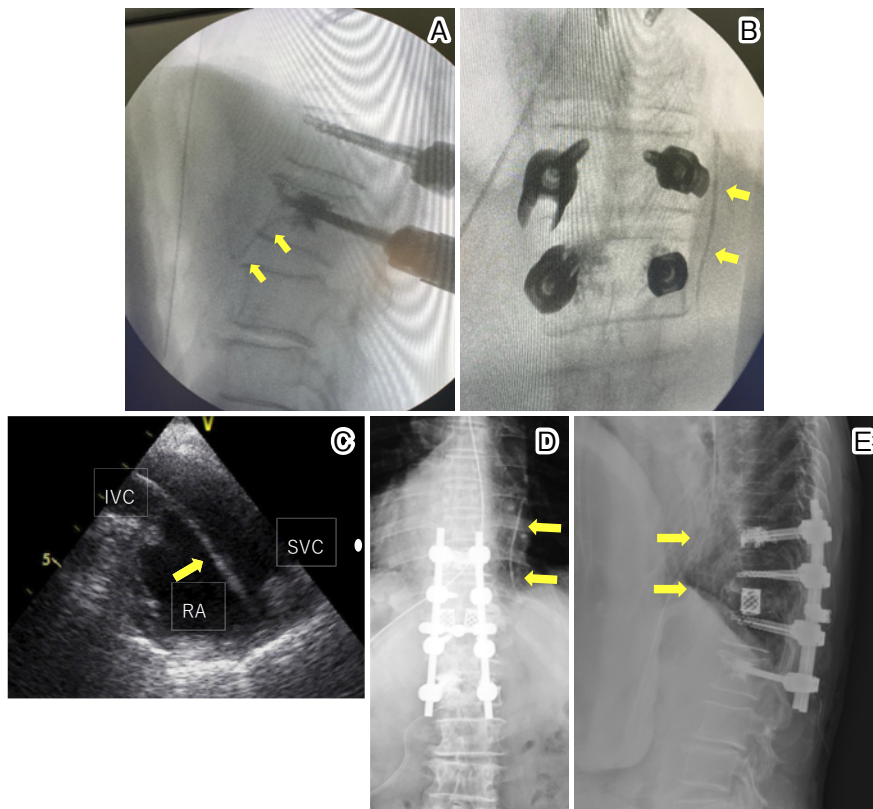


Figure 2. Bone cement leakage (yellow arrow) from the L2 pedicle was observed in the lateral view of fluoroscopy (A). Cement leakage (on the right side) into the inferior vena cava (B). Transesophageal echocardiography showed that the migrated cement reached into the right atrium and touched the interatrial septum (C). The post-VCR x-ray showed the migrated cement at heart level (D, E).

Abbreviations: IVC, inferior vena cava; RA, right atrium; SVC, superior vena cava

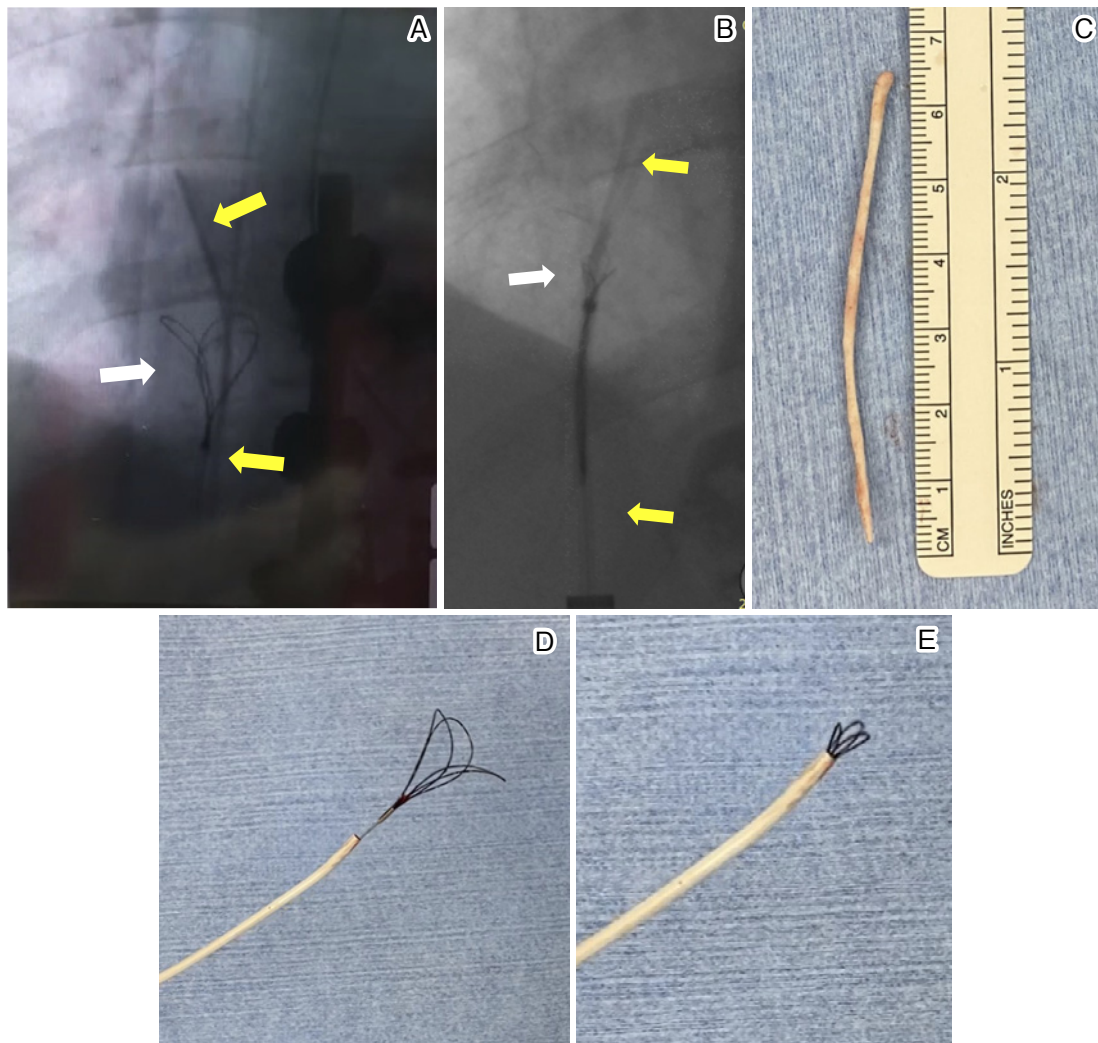


Figure 3. The migrated cement body (yellow arrow) was captured using a triple-loop snare (white arrow) (A, B). The retrieved object was large (6.5 cm) and had a needle-like appearance (C). Triple-loop retrieval kits, which were designed with the rigor of inferior vena cava filter retrieval, were used (D, E).

When used at low viscosity of the bone cement for CAPS, the cement poses a risk of leakage into the venous system⁴. Janssen et al.⁵ investigated 165 patients who underwent spine surgery with CAPS. They identified 68 cases with cement leakage into paravertebral veins or the ascending vena cava and 13 patients with pulmonary cement embolism (7.9%), of whom five (3.0%) were symptomatic. In addition, a case of cardiac perforation caused by bone cement, closely resembling our situation, was reported as a complication of CAPS⁶, wherein the authors reported the presence of a sharp and large fragment (4.5-cm-sized and needle-shaped). In their case, the authors detected cement leakage 7 days after spine surgery and performed antero-lateral thoracotomy under one-lung ventilation for its removal. In our case, the leakage was spotted during the VCR, and therefore an immediate retrieval procedure using a percutaneous endovascular approach could be planned. Since a linear-shaped cement fragment was fragile to catch by endovascular devices, it was useful to introduce a large bore sheath and use of triple-loop retrieval kits, which were designed with the rigor of inferior vena cava filter retrieval

(Fig. 3D, 3E). To our knowledge, there have been no studies to reveal an effective way for the prevention or prediction of cement leakage. A strict indication for CAPS should be necessary to minimize the risk. In addition, CAPS should be used carefully, especially in patients with contraindications for anticoagulation and endovascular treatment.

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Ethical Approval: This study was approved by the Institutional Review Board of Osaka City University (No. 3170).

Informed Consent: The patient provided informed consent for the publication of their case.

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