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CASE REPORT
Cardiac Imaging

A spear to the heart—the accidental discovery of a giant cement embolism in the right heart: a case report

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Background The incidence of recognized cardiopulmonary cement embolism in the context of percutaneous vertebroplasty varies between 0% and 23%. In most cases, only small fragments embolize in the pulmonary arteries or the right heart cavities. The latter can cause potential harm by right ventricular perforation.

Case summary A 57-year-old patient was admitted to our department of cardiology due to exertional dyspnoea and chest pain. In the course of further diagnostic tests, a huge cement embolus was accidentally discovered in the right ventricle. The unusual size and length and the threat of ventricular perforation make this case so unique.

Discussion Large cement embolisms in kyphoplasty settings are possible and associated with the risk of fulminant complications.

Keywords Case report • Heart • Cement embolism • Kyphoplasty • Ventricular perforation

Learning points

- Intra-cardiac cement embolization is a recognized complication of vertebral kyphoplasty.
- Rarely, large embolic fragments seem to occur, which can cause life-threatening complications.

Introduction

Percutaneous vertebroplasties are today one of the widespread standard procedures in the context of vertebral compression fractures or osteolytic metastases.[1] Potential complications include bone cement embolism into the spinal canal, spondylitis, and cement vascular embolism. The latter occurs in up to 5% of percutaneous vertebral interventions and rare cases can lead to life-threatening complications.[2] During the embolization, the cement migrates through the paravertebral or epidural veins into the venous system and embolizes in the direction of the right heart or pulmonary arteries.[3] Even if cement embolization is often asymptomatic, there is a risk of a fulminant course. Several risk factors have been identified for the occurrence of a cement embolism. These include high injection pressure, pathological fractures, and large amounts of injected methyl methacrylate.[4] In the present case, we report a female patient

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who suffered from a large, more than 10 cm long cement embolism in the right heart.

Timeline

2 years before admission	Percutaneous vertebroplasty
Day 0	Day of admission
Day 0	Echocardiography and chest X-ray
Day 1	Pulmonary angiography by computed tomography (CT), detection of foreign body in right ventricle
Day 2	Coronary angiography, no Coronary Artery Disease (CAD)
Day 5	Cardiac multidetector CT scan, evaluation of foreign body
Day 9	Transfer to the Department of Cardiac surgery
Day 18	Cardiac surgery and removal of foreign body
Day 27	Discharge from hospital

Case presentation

A 57-year-old female patient presented with exertional dyspnoea at New York Heart Association levels II–III and atypical pectanginous chest pain. The patient had an unremarkable cardiac history apart from mild arterial hypertension. Pre-existing medical conditions included iron deficiency anaemia. In addition, cement augmented dorsal stabilization had been performed in the lumbar spine two years before due to osteoporotic fracturing. In the clinical examination, the patient's general condition was slightly reduced with regular vital signs (blood pressure 131/82 mmHg, heart rate 85/min, and peripheral oxygen saturation 99%). Auscultation showed no heart murmurs.

Laboratory tests revealed a reduced Hb 10.1 g/dL (normal range 13.5–16.9 g/dL) and D-dimer elevation (2319 ng/mL; normal range <500 ng/mL) in the setting of iron deficiency anaemia. Due to the dyspnoea and the elevated D-dimer, a chest X-ray and computed tomography (CT) pulmonary angiography were performed, which ruled out pulmonary artery embolism. However, the images showed an elongated radiopaque structure in the right heart cavities, approximately 10 cm in length (*Figure 1*). Transthoracic 2D echocardiography showed a preserved left ventricular function without relevant heart valve dysfunction and particularly no signs of right heart strain. In addition, a hyperechogenic linear structure of almost 10 cm in length, running from the apical lateral wall of the right ventricle through the tricuspid valve to the roof of the right atrium could be observed. As the foreign body appeared to be rigid with the tip drilled into the lateral ventricular myocardium a cement obstruction resulting from dorsal cement augmentation was suspected. Coronary angiography was performed to clarify the symptoms further and did not show significant stenosis of the coronary artery disease. For further workup and evaluation of the right ventricular foreign body, cardiac multidetector CT was performed. Here, the suspicion of foreign body entrainment was confirmed by 3D reconstruction. In addition, the apically located portion of the foreign body appeared to penetrate the myocardium in the region of the right ventricular lateral wall (*Figures 2 and 3*). Therefore, with the threat of ventricular perforation, surgical removal of the foreign body was performed by median sternotomy. Macroscopically, the picture of a cement embolization was confirmed (*Figure 4*).

Discussion

Since percutaneous vertebroplasty is a standard procedure in vertebral compression fractures or osteolytic metastases, this surgical procedure has potential hazards such as bone cement embolism to the spinal canal, spondylitis, and vascular cement embolism.[5] During this procedure, the patient is in prone position and a dorsomedial skin incision is performed. Once the vertebral bodies have been exposed, the pedicle screws are implanted and cemented under radiological control. Due to the frequency with which the procedure is carried out, the

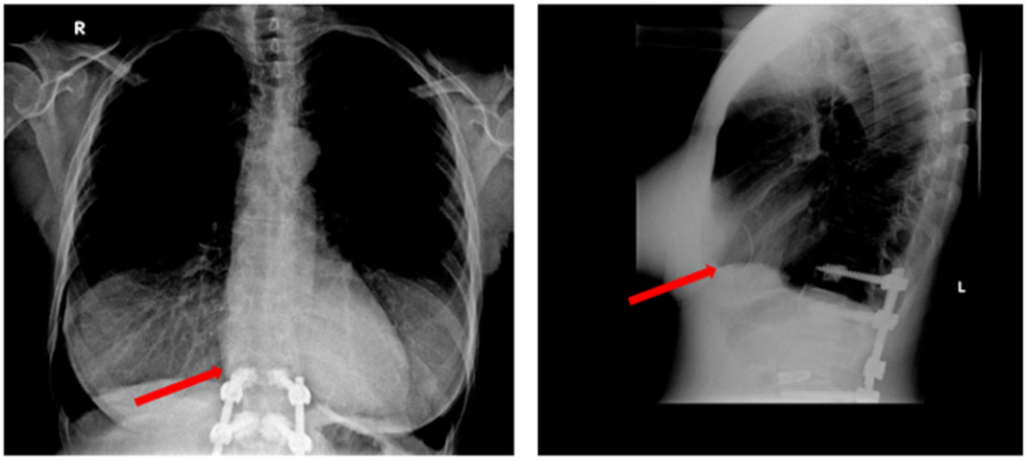

Figure 1 Chest X-ray in Angina pectoris (AP) and lateral showing the foreign body in the right heart.

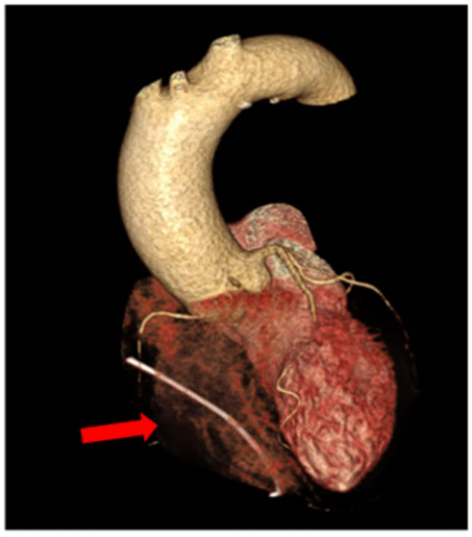

Figure 2 3D reconstruction of right ventricular foreign body.

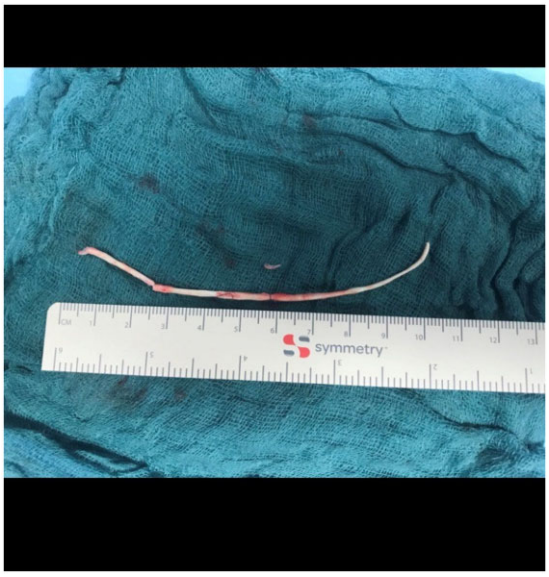

Figure 4 Macroscopic findings show the cement embolus.

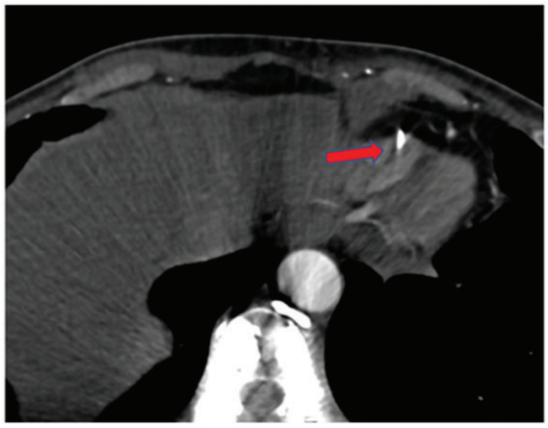

Figure 3 The tip of the foreign body penetrates the ventricle wall (arrow).

complications keep recurring. As mentioned earlier, cement embolization is often asymptomatic and does not cause clinical problems. The Vertos II study showed that subclinical emboli are often caused by small fragments that end diffusely in the sub-segments of the pulmonary arteries.[6] In these cases, oral anticoagulation therapy is sufficient and immediate surgery is not required. However, surgical excision is the gold standard in patients with right ventricular involvement and risk of ventricular perforation even if percutaneous removal is possible.[7]

In the present case, we decide to send our patient to the cardiac surgeon because of the threat of ventricular perforation. Interestingly, cardiac enzymes were not elevated in the patient. Retrospectively, this may argue against the presence of acute or prolonged myocardial damage. Moreover, the time of this accidental finding, almost two years after initial vertebroplasty, strengthens the benign character of cement embolism. The dyspnoea could not be explained by echocardiography, coronary angiography, or pulmonary angiography. Whether the impressive findings shown here are causative remains speculative. However, it can be postulated that pulmonary microemboli occurred in addition to cardiac emboli, which could not be visualized angiographically in the pulmonary artery CT sub-segments.

Today, surgical excision is the gold standard in comparable cases. Interestingly, Shamekhi *et al.* recently described a successful percutaneous extraction. Therefore, an exact patient selection is obligatory here.

In conclusion, it can be stated that cement embolisms can occur during percutaneous vertebroplasty. Predisposing factors are partly known and we can detect the embolism well using CT. To increase patient safety, the cement should be applied under fluoroscopic control.

Written informed consent was obtained from the patient presented here before publication.

Lead author biography

Dr Lambers graduated in Medicine from the Radboud University Nijmegen, the Netherlands in 2012. He completed his residency at the Department of Cardiology at the University Hospital in Bonn and the Department of Cardiology at the University Hospital of Schleswig-Holstein, Kiel, both in Germany. In 2018, his path brought him to the Elisabeth Hospital in Essen, Germany where he works as a senior consultant.

Supplementary material

Supplementary material is available at *European Heart Journal—Case Reports* online.

Slide sets: A fully edited slide set detailing these cases and suitable for local presentation is available online as Supplementary data.

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Consent

The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient's family in line with COPE guidance.

Conflict of interest: None declared.

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