

# Asymptomatic Cement Emboli to the Heart: A Case Report

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**Abstract** Percutaneous vertebroplasty is a well-established procedure for treating vertebral compression fractures caused by osteoporosis and malignant metastases. This technique involves injecting polymethyl methacrylate (PMMA), commonly known as bone cement, into the affected vertebral body. Cement embolism, where PMMA migrates to other organs, can occur but is often asymptomatic and may be discovered incidentally during imaging for unrelated issues. This report describes a 38-year-old asymptomatic female who was found to have cement emboli in the right ventricle following percutaneous vertebroplasty.

**Keywords:** Vertebroplasty, Kyphoplasty, cement embolism, CXR, CT

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## 1. Introduction

Percutaneous vertebroplasty (PVP) and balloon kyphoplasty (BKP) are relatively recent techniques used to manage painful vertebral fractures, particularly those resulting from osteoporosis. The considerable volume of case reports and clinical studies published in the literature underscores the widespread adoption of both techniques since their initial introduction by Galibert et al. for percutaneous vertebroplasty and Reiley et al. for percutaneous kyphoplasty. [1]

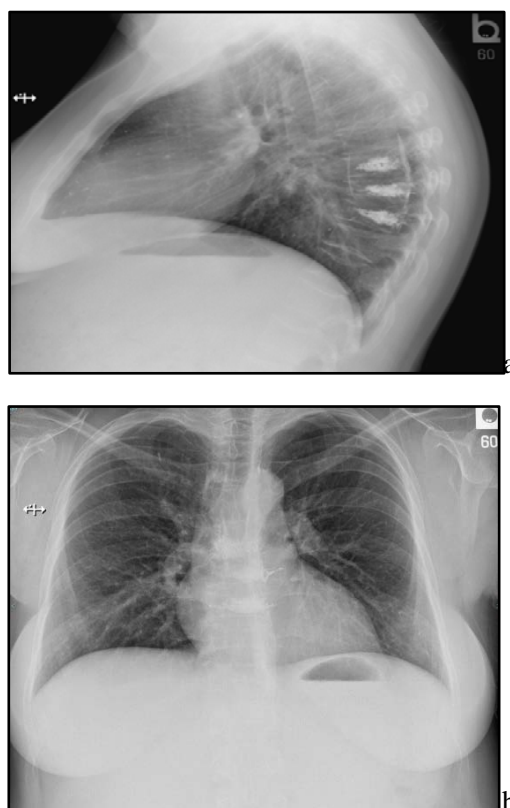
Extravertebral Cement leakage into the surrounding venous plexus following vertebroplasty represents the most common complication. [2] These leaks can vary from asymptomatic tissue damage to compression of nerve roots leading to nerve irritation, and in severe cases, pulmonary cement embolisms (PCE). It is presumed that many embolisms may go undetected. [1]

## 2. Case Report

A 38-year-old female with a history of low bone density secondary to hyperparathyroidism had been receiving antiosteoporotic injections for two years. Then she underwent percutaneous vertebroplasty (PVP) at the T7-T9 vertebral levels for osteoporotic fractures (Figure 1a and Figure 1b).

During a routine CT scan of the abdomen and pelvis, performed to evaluate a renal stone, incidental findings included linear and nodular hyperdensities along the right ventricular free wall in the lower portions of the chest images. To further investigate these findings, a cardiac CT angiography (CTA) with calcium scoring was conducted. The CTA confirmed the presence of linear and nodular

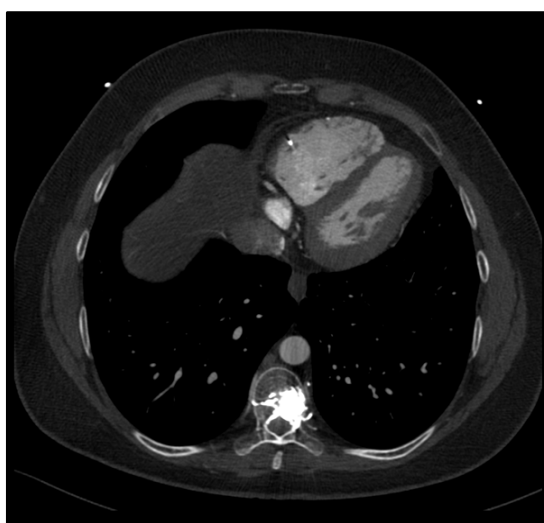
hyperdensities along the right ventricular free wall, unchanged compared to the CT scan of the abdomen (Figure 2a and Figure 2b). The Hounsfield density of those lesions is more than adjacent bones, and contrast similar to the cement density of the vertebroplasty (Figure 3), (Figure 4). this further supported cardiac cement emboli.



**Figure 1.** (a) Posteroanterior and (b) lateral chest radiographs showed vertebroplasty at the level of T7-T9 vertebral body

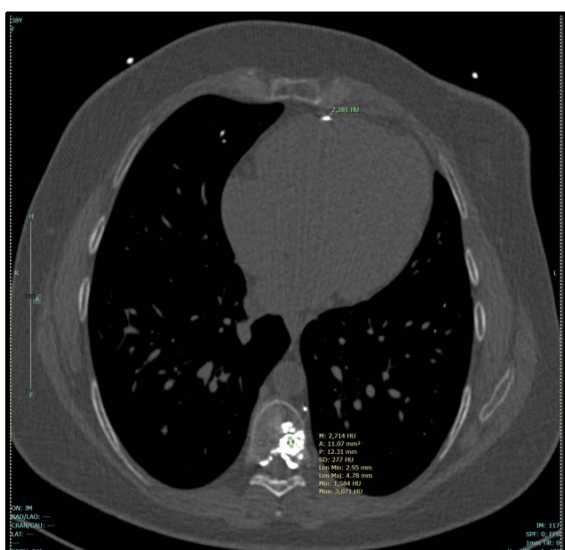


a



b

**Figure 2.** (a, b) axial CT images of the heart illustrate scattered small nodular and linear hyperdense cement emboli attached to the right ventricular free wall



**Figure 3.** Axial CT image in bone window demonstrates similar densities of the cement embolism in the right ventricle and cement in vertebroplasty



**Figure 4.** Sagittal view of computed tomography angiogram cardiac showing dense paravertebral veins due to leaked cement

### 3. Discussion

Percutaneous vertebroplasty (PVP) is a minimally invasive procedure introduced in 1987, primarily for pain relief in patients with vertebral compression fractures due to osteoporosis, multiple myeloma, metastatic tumors, or hemangioma. The procedure involves the injection of polymethylmethacrylate (PMMA), a rapidly setting bone cement, into the vertebral body under imaging guidance. [3]

Although PVP is minimally invasive, it can lead to various local and systemic complications. The most common complication is the leakage of PMMA into the spinal canal or perivertebral venous system. This occurs when the PMMA mixture (approximately 90% methyl methacrylate (MMA) and 10% barium sulfate) is injected while still in a relatively liquid state, or due to excessive injection pressure. [1] Other factors contributing to the risk of cement extravasation include inadequate polymerization of the cement, cement type and viscosity, injected volume (as leakage correlates with dosage), or the number of augmented levels. Cement leakage typically starts from segmental or paravertebral veins, traveling through the azygos or hemiazygos system or directly via the inferior vena cava, potentially leading to embolism in the lungs and other organs. To minimize these risks, it is recommended to use high-viscosity cement, adhere to appropriate setting times, and perform frequent fluoroscopy during the procedure to mitigate risks. [4]

Cement extravasation can occur following both kyphoplasty and vertebroplasty, with a higher incidence reported after vertebroplasty. [5] Observational studies have reported rates of cement leakage ranging from 0% to 23%. [6] However, symptomatic intracardiac cement embolism is relatively rare, with an incidence of approximately 0.3%. [7] To the best of our knowledge there are only 2 case report of cardiac cement emboli in the literature, Pan et al. (2021) and Oshinsky et al. (2018).

The clinical manifestations of cement embolism can vary widely, from asymptomatic cases to severe outcomes such as cardiac tamponade or perforation. [5] Symptoms

may appear weeks or even years post-procedure, highlighting the importance of routine imaging, including chest radiography, echocardiography, and chest CT scans, to detect asymptomatic embolisms and prevent complications. [4] Small-volume cement embolisms are often asymptomatic and detected through chest CT scans, while large-volume embolisms can cause refractory hypoxemia, intraoperative mortality, or right ventricular perforation leading to pericardial tamponade. Immediate percutaneous retrieval or open-heart surgery may be necessary in such cases. In the absence of life-threatening symptoms, conservative management is often recommended. Additionally, PMMA cement embolism may lead to tricuspid regurgitation and heart failure. [8]

Management strategies for cement embolism remain controversial due to limited evidence available in the literature. Treatment may range from conservative management with oxygen and anticoagulants to more invasive procedures for embolus removal, depending on the patient's hemodynamic stability and the embolus's mobility. [4]

#### 4. Conclusion

This case highlights the potential risks associated with percutaneous vertebroplasty (PVP), specifically the risk of polymethylmethacrylate (PMMA) cement embolism. Despite being a minimally invasive procedure, the leakage of cement into the venous system poses significant systemic risks, including cardiac embolism. The patient's history of osteopenia and prior bisphosphonate treatment

further complicates the clinical scenario. Prompt recognition and intervention are crucial to mitigate the adverse outcomes associated with cement embolism.

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