Letter to the Editor

Intracardiac and intrapulmonary cement embolisms after percutaneous vertebroplasty

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Introduction

Percutaneous vertebroplasty (PVP) is a minimally invasive surgical technique primarily employed for the treatment of vertebral fractures, compression fractures, and pain management in vertebral tumors. This procedure involves the percutaneous injection of polymethylmethacrylate (PMMA) or similar substances to reinforce the vertebral body, thereby stabilizing its structure and alleviating pain symptoms. Cement extravasation is a common complication of PVP. Around 23% of patients experience cement extravasation into central veins (1). Intracardiac cement embolism is a relatively rare but potentially fatal complication, where cement initially enters the cardiac ventricle and may further migrate into the pulmonary artery, posing a life-threatening risk. We herein report a case of intracardiac and intrapulmonary cement embolisms after PVP.

Case presentation

A 73-year-old female reported having experienced chest pain, dyspnea, and fatigue for 3 months. The patient had undergone PVP with PMMA for L2 and L4 vertebral compression fractures 6 months prior to the current presentation.

Lab tests showed an elevated plasma D-dimer level, but other laboratory values were within normal ranges. Electrocardiogram monitoring revealed bradycardia (60 beats/minute) and chest X-ray examination showed multiple high-density tubular opacities corresponding to the course of pulmonary vessels and linear high-density substances in the cardiac shadow (*Figure 1A*,*1B*). Lumbar spine X-ray examination revealed continuous linear bone cement residue visible from L2 centrum to the inferior vena cava (IVC) (*Figure 1C*,*1D*, white arrows). A subsequent computed tomography (CT) scan revealed bone cement extending from the IVC through the liver to the right atrium (*Figure 1E*, white arrow), passing through the tricuspid valve, extending into the right ventricle, forming a large rod-like foreign body in the right heart (*Figure 1F*, blue arrows), and finally entering the pulmonary artery (*Figure 1G*, blue arrows). Echocardiography showed an 87 mm long rod-shaped strong echoic substance in the right atrium and right ventricle, causing moderate elevation of pulmonary artery pressure and moderate tricuspid regurgitation.

We opted for conservative treatment in this case for several reasons. Firstly, the extent of bone cement leakage in this patient was more extensive, involving the IVC, heart, and lungs. Although the continuous, rod-shaped bone cement residue is firmly fixed and unlikely to easily fracture or be carried away by blood flow, any external interference

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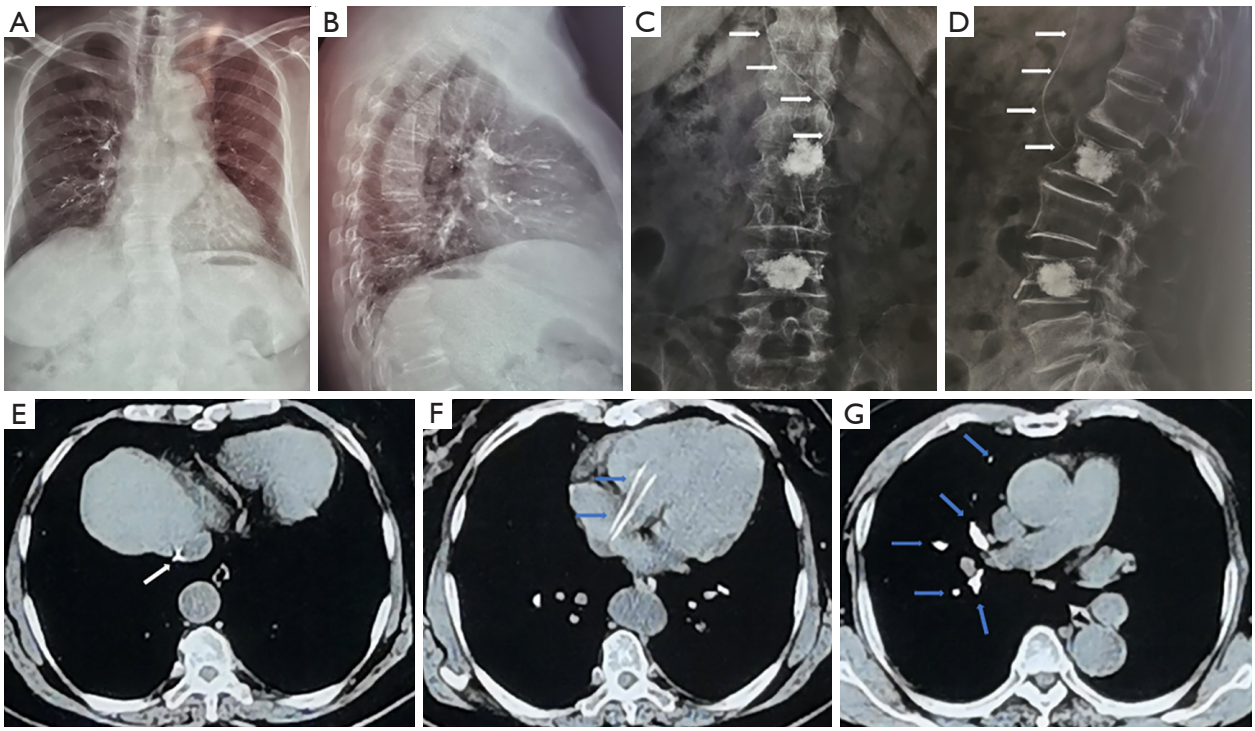

Figure 1 X-ray and CT findings of the patient. (A) Anteroposterior chest X-ray image. (B) Lateral chest X-ray image. (C) Anteroposterior lumbar spine X-ray image. (D) Lateral lumbar spine X-ray image. (E-G) Chest CT images. The white arrows indicate residual bone cement within the inferior vena cava. The blue arrows indicate residual bone cement within the heart and lung. CT, computed tomography.

could result in fragmentation and potentially severe damage to the heart and lungs. Secondly, percutaneous surgery may not have been feasible due to the size of the foreign body. Open surgical intervention would be required, but considering the patient's advanced age and the significant burden of such a procedure, the potential benefits did not outweigh the potential harm. Lastly, the patient's preference for conservative treatment was respected.

Currently, the patient's condition involves the regular monitoring of international normalized ratio (INR) levels and adjustment of warfarin or rivaroxaban dosages accordingly. The daily dosage ranges from 2.5 to 5 mg of warfarin or 15 to 30 mg of rivaroxaban, aiming for a target INR range of 2 to 3. Monthly follow-up assessments indicate that long-term anticoagulant treatment has led to a significant reduction in dyspnea, enabling the patient to independently perform most activities of daily living, including walking and climbing stairs. She no longer reports any chest pain, however, mild dyspnea and significant fatigue after sustained activity still require attention.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Discussion

PMMA bone cement is commonly used in PVP, but it can cause leakage into the venous system (1). Factors such as intravertebral cleft, cortical disruption, low cement viscosity, and high volume of injected cement have been associated with cement leakage in previous studies (2). Intra-cardiac cement embolism is a rare but potentially fatal complication of PVP, and can cause symptoms such as chest pain, dyspnea, and shock (3). Prompt recognition and treatment are crucial due to the risk of perforation, pericardial tamponade, and pericardial perforation. However, there may be no postoperative chest symptoms despite the presence of a large cement embolism in some cases (4). Early diagnosis is challenging without early symptoms; it is essential to identify any cement leakage during surgery

and closely monitor patients for postoperative symptoms. Therefore, we recommend that clinicians perform transthoracic echocardiography and chest CT scans after each PVP procedure to detect asymptomatic intracardiac and intrapulmonary cement embolism, and take appropriate measures to prevent the occurrence of severe delayed cardiopulmonary functional failure.

For the treatment of symptomatic intracardiac cement embolism, open surgery has been the preferred approach, particularly in cases involving tricuspid valve injury or cardiac perforation (5). However, percutaneous retrieval is a less invasive alternative for cement removal. It is important to note the potential complications associated with percutaneous retrieval, such as further fragmentation of thrombus and distal embolization (6). The choice between percutaneous retrieval and open surgery should consider various clinical factors, including the size and precise location of the embolism and the presence of cardiac complications (6). In cases where patients exhibit mild clinical symptoms and stable hemodynamics, conservative management is recommended. This may involve anticoagulation, continuous low-flow oxygen therapy, and administration of antibiotics, with close monitoring of the patient's condition (7).

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-23-606/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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