Cardiac Perforation and Multiple Emboli After Percutaneous Vertebroplasty

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abstract

Percutaneous vertebroplasty is a minimally invasive technique for treating vertebral compression fractures and tumors. Although percutaneous vertebroplasty is considered a relatively safe and technically simple procedure, it is also associated with life-threatening complications as a result of cement leakage, including cardiac perforation and pulmonary embolism. A 63-year-old woman underwent percutaneous vertebroplasty for an L3 vertebral fracture and had cement leaks into the inferior vena cava, pulmonary arteries, and right heart chambers, with a free wall perforation. Surgical removal of the cement emboli was recommended as a result of apparent penetration of the ventricle and the fragile nature of polymethyl methacrylate. A cardiopulmonary bypass was immediately performed via a right atriotomy. A foreign body 10 cm in length was removed from the right atrium and ventricle. Arteriotomies were then performed, and 4 cement filaments were retrieved from the pulmonary arteries. The inferior vena cava was also surgically opened, allowing extraction of a cement fragment that was 12 cm long. The postoperative course was uneventful, and the patient fully recovered. This is the first report of the migration of a cement fragment larger than 10 cm that had migrated and embedded in the heart chamber. This report showed that imaging analysis is valuable when cement leakage is detected during percutaneous vertebroplasty and can be used to avoid serious complications and improve patient outcomes. [Orthopedics. 2015; 38(10):e947-e950.]
In recent years, percutaneous vertebroplasty has become a widely used treatment for vertebral compression fractures and tumors. Although this procedure is considered relatively safe and technically simple, it is also associated with life-threatening complications as a result of cement leakage, including cardiac perforation and pulmonary embolism. The authors report a case of cement embolization after percutaneous vertebroplasty that involved the inferior vena cava, pulmonary arteries, and right heart, with free wall perforation.

**Case Report**

A 63-year-old woman presented to the authors’ hospital with dyspnea and chest pain. The history showed a previous diagnosis of osteoporosis, but no previous cardiac events or other potentially relevant medical conditions. Two weeks earlier, the patient underwent percutaneous vertebroplasty at another institution with polymethyl methacrylate (PMMA) cement for repair of a compression fracture of L3. One day later, the patient had light dyspnea and chest pain and underwent treatment with oxygen. The patient was considered stable, with complete resolution of the symptoms, and was discharged. However, 12 days after the procedure, she had progressive chest pain and dyspnea and presented to the authors’ hospital for urgent care.

Electrocardiogram on admission showed increased sinus tachycardia at 124 beats/min (normal range, 60-100 beats/min). Radiography and computed tomography scans showed multiple hyperdense foreign objects in the inferior vena cava, left main pulmonary artery, right pulmonary artery branch, right atrium, and right ventricle, with a free wall perforation (Figures 1A-C). Transthoracic echocardiography showed a hyperechoic linear structure that was embedded in the right atrium and right ventricle and was accompanied by moderate pericardial effusion (Figure 1D).

Surgical removal of the foreign body structures was recommended because of apparent penetration of the ventricle and the fragile nature of PMMA. Cardiopulmonary bypass was immediately performed with a right atriotomy. A 10-cm-long foreign body was removed from the right atrium and ventricle. Arteriotomies were then performed, and 4 cement filaments were retrieved from the pulmonary arteries (Figure 2). The inferior vena cava was also surgically opened, allowing extraction of a 12-cm–long cement fragment (Figure 3). The postoperative course was uneventful, and the patient recovered fully.

**Discussion**

Percutaneous and transpedicular injection of PMMA during percutaneous vertebroplasty provides mechanical stability to partially collapsed vertebral bodies. This procedure offers rapid pain relief and fortification for bone structure remodeling. Despite these benefits, there is a risk that PMMA will enter the vertebral venous plexus through the iliolumbar or epidural veins and subsequently migrate to the inferior vena cava, right heart chambers, and pulmonary arterial system. Pulmonary cement emboli after vertebroplasty are not uncommon, although incidence rates vary from 1% to 23%. Most cases are...
asymptomatic, with fewer than 1% presenting with dyspnea,\(^1\) and require only observation without treatment. However, for symptomatic cases or patients with a central embolism, standard treatment guidelines for pulmonary thromboembolism, such as anticoagulation, should be followed.\(^6\) For patients with large cement fragments in the inferior vena cava, fragment removal is recommended to prevent further migration to the pulmonary arteries, even if the patient is asymptomatic.\(^7\) Endovascular fragment retrieval is suggested for patients with a cement fragment embolus in the pulmonary artery.\(^8\) Cardiopulmonary bypass and surgical removal of the emboli are recommended for those with a massive embolism leading to cardiac perforation.\(^2\)

The current patient had cement embolization into the inferior vena cava and pulmonary arteries as well as cardiac perforation, all of which required surgery. To the current authors' knowledge, this is the only case report of this type. Furthermore, this is the first report of migration of a cement fragment larger than 10 cm that had migrated and embedded in the heart chamber. Previous reports of similar cement-related cardiac perforation and pulmonary emboli involved smaller fragments (range, 1-9 cm).\(^2,9\)

To minimize the risk of cement emboli, some authors suggest injection of no more than 4 to 6 mL into the vertebral body and the use of bilateral injections.\(^6,7\) Additionally, the cementing material should be highly viscous at the time of injection, and injection pressure should be minimized.

The current authors reported a 63-year-old woman who had cardiac perforation and multiple large emboli after percutaneous vertebroplasty. Imaging is therefore advised when cement leakage is detected during the procedure because of the risk of serious complications.

### References

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