Asymptomatic cement embolism in the right atrium after vertebroplasty using high-viscosity cement: a case report

Vinodhkumar Pannirselvam, Hwan Tak Hee
Department of Orthopedic Surgery, National University Hospital, Singapore

ABSTRACT

A 52-year-old woman underwent vertebroplasty for fractures of the T10, T11, and L2 vertebrae secondary to multiple myeloma. She was discharged uneventfully within a week. Nine months later, she was readmitted for syncope. Echocardiography revealed a mass in the right atrium. Magnetic resonance imaging (MRI) revealed a low signal intensity irregular mass (8x7 mm) and a comma-shaped mass (12 mm) in the right atrium. She was prophylactically anticoagulated for the probable emboli. Repeat cardiac MRI performed 2 weeks later showed that the size of the masses remained unchanged. Surgical intervention was not suggested by the cardiothoracic surgeons. Three months later, the patient remained uneventful.

Key words: bone cements; embolism; heart atria; vertebroplasty

INTRODUCTION

Vertebroplasty is a relatively safe procedure for the management of vertebral compression fractures refractory to conservative treatment. Nonetheless, leakage of polymethylmethacrylate (PMMA) into the spinal canal or perivertebral veins can lead to devastating complications such as spinal cord compression or pulmonary embolism. Complications after vertebroplasty are rare (1 to 10%) and generally minor, asymptomatic, and transient.1-3 The complication rate is higher in patients with metastatic lesions.1 The rate of venous cement leakage can be up to 24%.4 We report a case of asymptomatic cement embolism in the right atrium after vertebroplasty using high viscosity cement.

CASE REPORT

In March 2009, a 52-year-old woman presented with severe low back pain and was diagnosed to have
multiple myeloma. Magnetic resonance imaging (MRI) showed compression fractures at the T10, T11, and L2 vertebrae. In view of persistent pain and failure of conservative management, she underwent vertebroplasty of T10, T11, and L2 (Fig. 1) using high-viscosity cement (Confidence, Depuy Spine, Raynham [MA], USA). She was discharged uneventfully after a week of observation by the haematologist after chemotherapy.

Nine months later, she was readmitted for syncope. Her full blood count, renal panel, endoscopy for investigation of anaemia, chest radiography, and venous Doppler ultrasonography of the legs were unremarkable. However, transoesophageal echocardiography showed an elongated mass measuring 2.8 cm in length in the right atrium exiting from the inferior vena cava. MRI of the heart revealed a low signal intensity irregular mass (8x7 mm) and a comma-shaped mass (12 mm in length) at the right atrium attached to the tip of central line catheter (Fig. 2). She was prophylactically anticoagulated for the probable emboli. Repeat cardiac MRI after 2 weeks revealed that the size of the masses remained unchanged (Fig. 2). As the masses did not reduce after anticoagulation or progress at follow-up, they were considered cement emboli owing to the recent history of vertebroplasty. Surgical intervention was not suggested by the cardiothoracic surgeons. Three months later, the patient remained uneventful, and no further follow-up was needed.

**DISCUSSION**

Most patients with minor cement venous extravasation and even pulmonary emboli detected by chest radiographs remain asymptomatic.
Nonetheless, such complications can cause fatal consequences including pulmonary embolism,\textsuperscript{3–8} paradoxical cerebral embolism,\textsuperscript{9} penetration of the right ventricle,\textsuperscript{10} renal artery embolism,\textsuperscript{11} and acute respiratory distress syndrome.\textsuperscript{12}

The incidence of cement leakage decreases significantly when high-viscosity (rather than low-viscosity) cement is used.\textsuperscript{13} A paste-like consistency is preferred to a liquid consistency, particularly when the lesion is a highly vascular or extensive osteolytic tumour.\textsuperscript{14} The uniformity of the filling pattern and the elapsed time from cement mixing affect the viscosity.\textsuperscript{15} In a fractured vertebral body model, the total injected cement leakage reduces from 50\% to <10\% when the cement viscosity increases from low to medium.\textsuperscript{15} In 56 vertebroplasties with 4 different viscosity levels and 2 different injection speeds for artificial vertebrae of 3 different porosities, viscosity is the key factor for reducing the risk of PMMA leakage.\textsuperscript{16} Compared with low-viscosity PMMA, high-viscosity PMMA (Confidence, Disc-O-Tech, Israel) is safe and effective for clinical use and significantly reduces extravasation rate and leakage-related complications (p<0.001).\textsuperscript{17} Cement embolism can also be caused by insufficient polymerisation of PMMA at the time of injection. An adequate amount of the injected PMMA is recommended. Pain relief is not proportional to the degree of lesion filling by the PMMA.\textsuperscript{14} Complications are mainly related to excessive PMMA injection.\textsuperscript{18}

Fluoroscopy enables early detection of cement leakage into the perivertebral veins. Computed tomographic guidance increases precision, improves results, and reduces complications, but lacks real-time visualisation of cement leak.\textsuperscript{19}

The role of vertebral venography before PMMA injection is contentious. The use of antecedent venography is advocated to decrease complications associated with needle placement within the basivertebral venous plexus and to delineate the route of cement egress.\textsuperscript{2} However, the injected contrast media may stain the spinal tumours, which interrupts the early venous leakage.\textsuperscript{20} Different flow characteristics of the contrast material and PMMA may hamper the predictive value of venography.\textsuperscript{20} Venography is routinely performed in our centre. In our patient, the PMMA leaked outside the fractured vertebral body, and could have migrated via the anterior external vertebral venous plexus. The possible causes include viscosity and volume of cement injected and venous anomaly of the vertebral plexus.

**CONCLUSION**

Surgeons should be aware of the fracture pattern and anatomy of the vertebral venous system. Careful fluoroscopic monitoring is essential to minimise cement leakage during vertebroplasty, especially when multiple levels of vertebrae are involved.

**DISCLOSURE**

No conflicts of interest were declared by the authors.

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