Bone cement embolism attached to central venous catheter

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Editor’s key points
- This case highlights the possibility of a leak of bone cement into the venous system during vertebroplasty.
- The cement leak was noted at the time of surgery.
- Routine postoperative chest X-ray showed the presence of a mass attached to the CVP catheter.
- The mass was removed surgically.

We report on a rare complication of poly(methyl methacrylate) (PMMA), injected into the spine, which then inadvertently leaked into the venous system. This resulted in an embolism of PMMA and produced a mass surrounding a triple lumen central venous catheter located in the superior vena cava. The catheter as well as the attached mass of PMMA was retrieved safely by cardiothoracic surgery. This case emphasizes the importance of prompt diagnosis and treatment and illustrates the need for close monitoring of patients undergoing any spinal surgery that includes vertebroplasty.

Keywords: bone cements; central venous catheters; complication; pulmonary embolism; shock; vertebroplasty

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Vertebroplasty is a fairly common, invasive procedure for the treatment of osteoporotic vertebral compression fractures. Although relatively safe, the procedure is not without risks. When poly(methyl methacrylate) (PMMA) leaks into the surrounding venous circulation, serious complications can occur, including cement embolization into the venous system with consecutive pulmonary embolism and spinal cord compression.1,2 The true incidence of systemic embolization is likely to be underestimated as clinical presentations range from dramatic (e.g. massive pulmonary embolism resulting in death) to incidental findings on imaging, to asymptomatic.2,3 Optimal treatment for leaks is controversial and depends on the location of the cement and the severity of symptoms. Exactly how the body reacts to undetected, non-massing leaks is unknown.

Case report
The indication for spondylodesis and vertebroplasty in this 64-yr-old female was osteoporosis with compression fractures and severe pain lasting several years. She consented to publication of the report.

During surgery on the thoracic spine, the pedical screw holes of vertebral bodies 10 and 12 were filled with PMMA. This was done under continuous fluoroscopy. When leakage into vertebral veins was noted, the application was stopped. In total, ≏ 4 ml PMMA (1 ml per screw hole) had been released. Although PMMA application normally requires high pressure, surgical records in this case indicate that higher than normal pressure was exerted.

After operation, the patient was transferred to the intensive care unit. Although the patient remained asymptomatic, according to our standards we performed a chest radiograph. This image (Fig. 1), as well as the computed tomography (CT) images (Figs 2 and 3) which were subsequently performed, revealed a mass at the confluence of the azygous vein and superior vena cava (SVC). Although we had never seen anything like this previously, we assumed that the mass was likely to be PMMA which had embolized into the systemic circulation. The mass appeared to be attached to the central venous pressure (CVP) catheter and we were uncertain whether the SVC was involved as well.

Although the team discussed several options to remove the central venous catheter (CVC) and the mass, all options included a risk of mass embolism, with either consecutive obstruction of blood inflow into the heart or pulmonary embolism. We decided that the safest option was to transfer the patient to a cardiovascular surgery department with cardiopulmonary bypass availability.

In cardiovascular surgery, the SVC was partially clamped and then incised to immobilize the CVC. Fortunately, the mass was not attached to the vessel wall. The CVC was then cut above the mass, and both the CVC and the attached mass were retrieved completely (Fig. 4). A bypass was not necessary and the patient made an uneventful recovery.

Discussion
PMMA, when used as a cementing agent in arthroplasty for hip and knee replacement, has been associated with hypotension, hypoxia, and intraoperative cardiac arrest in 0.6–1.0% of patients.4,5 PMMA has also been used for vertebroplasty, which is a relatively safe, simple, and commonly performed procedure for the management of vertebral compression fractures. The procedure involves injection of acrylic cement (PMMA) into a partially collapsed vertebral body. This provides mechanical stability.

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The procedure is typically performed under CT or fluoroscopic guidance.

Paravertebral venous leakage and pulmonary embolization of PMMA occurs frequently, but is clinically silent in most cases.²

On rare occasions, extravasation of PMMA cement into the vertebral venous circulation may result in devastating complications such as spinal cord compression resulting in paraplegia, cerebral embolism, penetration of the right ventricle, renal artery embolism, and acute respiratory distress syndrome.² 6–8

In our case, it appears that cement passed from vertebral venous plexuses via paravertebral veins, into the azygos system. At the junction of the SVC and the azygos system, the cement started to solidify and the majority attached to the catheter. Presumably, some cement also passed into the right atrium and pulmonary circulation, although the CT scans did not show any evidence of this.

In order to prevent embolization into the central circulation, it is first important to understand the basic requirements for PMMA use.

Three mechanisms responsible for cement embolism leading to cement migration into the venous system are:
Various approaches to eliminating the foreign material have been described in the literature. The method of choice largely depends on the location of the cement and the severity of symptoms, which include anticoagulation, interventional procedures, and open heart surgery.

This case emphasizes the importance of prompt diagnosis and treatment and illustrates the need for close monitoring of patients undergoing any spinal surgery that includes vertebroplasty. In the event of circulatory collapse, PMMA embolism is an important differential diagnosis.

Declaration of interest
None declared.

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