Scientific letters

Multiple Fatal Pulmonary Embolism During Polymethyl-Methacrylate Vertebroplasty With Successful Percutaneous Retrieval of a Large Cement Fragment

Embolia pulmonar múltiple tras vertebroplastia con polimetilmetacrilato, con evolución fatal a pesar de la extracción percutánea de un microfragmento

To the Editor,

A 74-year-old man with high blood pressure, dyslipidemia, and diabetes, who had been evaluated in our unit 13 months earlier for atrial fibrillation, underwent cardioversion with no apparent structural heart disease. One month later he was diagnosed with T4N3M0-stage adenocarcinoma of the lung and received chemotherapy and radiation therapy. In February 2011, the patient was hospitalized for intense lumbar pain of 10 days' duration. Computerized tomography identified a compression fracture of the second lumbar vertebra (L2) due to metastasis.

The neuroradiology team opted for vertebroplasty. With the patient under general anesthesia and prone decubitus, the procedure began with diagnostic vertebrography, immediately followed by bilateral transpedicular vertebroplasty in L2 introducing radiopaque bone cement (Biomet Bone Cement V, BIOMET®). This is prepared by dissolving a powder containing methyl methacrylate (MMA), zirconium dioxide, and benzoyl peroxide in a 10 ml flask with MMA solution and dimethyl toluidine, which is then cooled. We obtained good results in the vertebra (Fig. 1A). However, we identified millimetric MMA fragments in both lungs and one larger, round fragment in a segmental branch of the inferior left lobule (Fig. 1B).

We requested that the cardiac catheterization laboratory remove these. After positioning the patient in supine decubitus and using right femoral vein access, a 30 cm 20 Fr XLCFW 20.0-38-30 Endostent (COOK®) delivery catheter–with 2 cuts made in the distal end–was deployed. With a multipurpose catheter, we accessed the pulmonary artery and performed selective angiography, enabling us to locate the cement fragment in the

Figure 1. A: transpedicular vertebroplasty; introducing cement in L2. B: selective pulmonary arteriography; inferior left lobule segmental branch occlusion; scattered microembolisms (arrows). C: cement embolus in right lung segmental branch. D: snare catheter capture and passage of catheter+fragment through tricuspid valve.

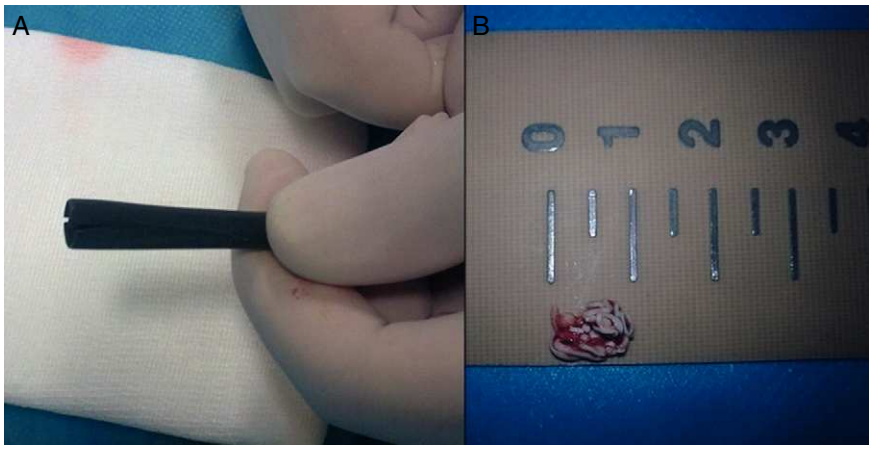

Figure 2. A: 20 Fr sheath; detail of longitudinal cuts. B: rounded, 1 cm diameter morphology of cement.

segmental branch (Fig. 1B). We deployed a straight guidewire distally, followed by the catheter. This was replaced by a 15 mm Amplatz Goose-Neck (ev3®) snare catheter, opened and retracted over the cement, closing the snare to fix the fragment. While keeping a hold on this, we slowly retrieved the catheter and fragment but at the level of the tricuspid valve it embolized and impacted in an inferior right branch lobule (Fig. 1C). We repeated the capture maneuver in this lobule and at the second attempt passed the tricuspid valve without difficulty (Fig. 1D) and drew the cement into the sheath with no resistance thanks to the 2 cuts we had previously made (Fig. 2A). With the cement fixed in the interior, we withdrew the entire sheath and, once on the table, extracted the MMA fragment by cutting the sheath lengthwise (Fig. 2B).

The patient was admitted to intensive care and underwent thoracic computerized tomography which confirmed millimetric fragments remained in the inferior and suprahepatic vena cavae and segmental branches of both lungs.

Despite several attempts to disconnect the ventilator, this was not possible. The patient presented pneumonia for *Staphylococcus aureus,* which was treated with antibiotics initially leading to improvement. In the following days his condition worsened with severe respiratory insufficiency with hypoxemia and respiratory acidosis; he was labeled as having acute respiratory distress. Clinical course was bad, with low blood pressure and oligoanuria, and the patient died 12 days after the procedure.

Vertebroplasty and kyphoplasty with MMA are well-known techniques and one of the complications is loss of material, which occurs in up to 70% of cases. How MMA accesses the venous system is unclear although direct injection into iliolumbar or epidural veins may be the cause. Vertebra are highly vascularized by intraosseous veins with a network that connects to paravertebral and extradural plexuses. Moreover, osteoporotic compression destroys the vertebral body, permitting direct shunting of MMA fragments to the venous system and pulmonary circulation.[1] Hence, pulmonary embolisms appear in 23% of computerized tomography studies.[2]

Treatment of this complication ranges from anticoagulation therapy to surgical embolectomy in severe cases.[3] Our review of the literature revealed a recent case of pulmonary embolism of MMA following vertebroplasty with percutaneous retrieval.[4] Bose et al.[4] captured the fragment with a snare catheter and surgically retrieved it from the femoral vein.

In our patient, as well as the major accumulation, percutaneously retrieved, multiple pulmonary embolizations occurred. These, together with the patient's lung condition, influenced the outcome.

In addition to the embolism-occlusion process, we describe a fatal outcome to respiratory distress following surgical embolectomy.[3] The MMA microparticles activate the inflammatory-anaphylactic cascade and endothelial permeability is altered with activation of the complement system and liberation of histamine.[5,6]

Faced with vertebroplasty complicated by a pulmonary event, this type of embolism should be expected. The process may be severe and the outcome fatal, as in the present case. Accumulations of a certain size can be retrieved percutaneously.

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REFERENCES

1. Laredo JD, Hamze B. Complications of percuteneous vertebroplasty and their prevention. Semin Ultrasound CT MRI. 2005;26:65–80.
2. Kim YJ, Lee JW, Park KW, Yeom HS, Park JM, Kang HS. Pulmonary cement embolism after percutaneous vertebroplasty in ostioporotic vertebral compression fractures: incidence, characteristics and risk factors. Radiology. 2009; 251:250–9.
3. Yoo KY, Jeong SW, Yoon W, Lee J. Acute respiratory distress syundrome associated with pulmonary cement embolism following percutaneous vertebroplasty with polimethylmethacrylate. Spine. 2004;29:E294–7.
4. Bose R, Choi JW. Successful percutaneous retrieval of methyl metacrylate orthopedic cement embolism from the pulmonary artery. Catheter Cardiovasc Interv. 2010;76:198–201.
5. Bengtson A, Larsson M, Gammer W, Heidman M. Anaphylatoxin release in association with methylmethacrylate fixacion of hip prosstheses. J Bone Joint Surg Am. 1987;69A:46–9.
6. Robbins RA, Russ WD, Rasmussen JK, Clayton MM. Activation of the complement system in the adult respiratory distress syndrome. Am Rev Resp Dis. 1987; 135:651–8.

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