Thorned heart. Description of a near-fatal cardiac embolism after percutaneous Vertebroplasty

Federica Pigna,1 Simone Calamai,2 Francesco Scioscioli,1 Lorenzo Buttarelli,3 Francesco Nicolini,4 Gianfranco Cervellin5

1Emergency Department, University Hospital of Parma; 2Postgraduate Emergency Medicine School, University of Parma; 3Department of Radiology, University Hospital of Parma; 4Cardiac Surgery Unit, University Hospital of Parma, Parma; 5Academy of Emergency Medicine and Care (AcEMC), Pavia, Italy

Abstract

Cement extravasation is a rather common complication of vertebroplasty, which can be observed in up to 30-40% of patients undergoing this procedure, further associated with venous leakage occurring in up to 24% of cases. Pulmonary embolism may eventually develop once the cement migrates within the pulmonary artery, and is the most common complication of cement extravasation (involving ~4.6% of patients). Intra-cardiac cement embolism is considerably less frequent, but is a potentially fatal complication, mostly managed with cardiac surgery. We describe here a rare case of near-fatal cardiac cement embolism, with a large fragment perforating the right ventricle and reaching the pericardium, who presented to the Emergency Department (ED) for syncope. The patient, who displayed this severe complication after a vertebroplasty procedure performed for osteoporotic compression fracture, needed cardiac surgery.

Introduction

Percutaneous Vertebroplasty (PVP), a minimally invasive procedure introduced by Galibert et al. in 1987, is aimed at treating vertebral compression fractures.1 This procedure consists in injection of a type of acrylic cement (generally polymethylmethacrylate) into the vertebral body through its pedicles, for partially restoring the vertebral height and stabilizing the trabeculae, thus alleviating pain and discomfort.2,3 Originally developed for neoplastic fractures, PVP has been then extended to management of osteoporotic fractures and has achieved worldwide diffusion after publication of some case series, despite lack of substantial evidence4-8 and with only one randomized trial proving some benefits.9 These findings have also raised some ongoing ethical and organizational issues,10,11 since several adverse events associated with PVP have been described, mainly encompassing osteomyelitis, cord compression, thecal sac injury, respiratory failure due to pulmonary cement emboli, and cardiac emboli, less frequently.8,12-14

We describe here a rare case of near-fatal cardiac cement embolism, needing cardiac surgery, after a vertebroplasty procedure performed for osteoporotic compression fracture.

Case Description

An 85-year-old woman presented to the Emergency Department (ED) for syncope developed few hours after she underwent percutaneous vertebroplasty on the fourth lumbar vertebra (L4) for osteoporotic compression fracture associated with pain resistant to conservative treatment. After the syncopal episode, the patient complained for headache and chest pain radiated to the neck.

The medical history was positive for hypothyroidism and mild Alzheimer’s disease. The patient was an active smoker, was taking low dose aspirin, as primary cardiovascular prevention, without any recorded event in his history. She was also taking thyroxine and donepezil, whilst no allergies were reported.

Blood pressure upon ED admission was 110/60 mmHg, heart rate 80 bpm, respiratory rate 14 breaths per minute and peripheral oxygen saturation 97%. No fever and no other clinically meaningful findings could be recorded.

During the ED visit the patient had an additional syncope associated with hypotension (i.e., 90/50 mmHg), accompanied with cape cyanosis and bladder and fecal incontinence. Urgent blood testing revealed some abnormal results, as follows: White Blood Cells (WBC) 17.480/µL, glucose 220 mg/dL, cardiac troponin I 1137 ng/L (upper reference limit, 10.5 ng/L in women). The Electrocardiogram (ECG) showed mild sinus tachycardia (105 bpm), without ischemic modifications. Due to the clinical worsening, persistence of chest pain and observation of pericardial effusion with bed-side ultrasonography, the patient was suspected as having aortic dissection, so that she underwent computed angiog-
raphy (Angio-CT). This investigation confirmed the presence of pericardial effusion (maximal width, 19 mm) and linear hyperdense material into the inferior vena cava and within the Right Ventricle (RV). Based on these findings, a Cardiac Computed Tomography (cCT) was scheduled, which confirmed the presence of a radiopaque needle-like body lodged inside the RV, just 10 mm below the valvular plane. This abnormal finding was identified as likely being a fragment of cement embolized during the PVP. Briefly, the “needle” passed through the basal-inferior wall of RV, reaching the pericardium (Figure 1; Figure 2) and causing hemo-pericardium thus promoting cardiac tamponade. A cardiac surgeon was immediately alerted, and the patient underwent cardiac surgery for removing the cement fragment and repairing the RV (Figure 3). Aspirin was stopped before surgery. After being removed, the ‘needle’ was found to be 3.5 cm-long, with a ~2-3 mm width, as shown in Figure 4. The post-operative course was complicated by anemia, requiring blood transfusions (3 Units of concentrated red blood cells), and by an episode of delirium, needing neuroleptics (i.e., quetiapine). On the 10th day after surgery, the patient was then transferred to the rehabilitation clinic, where the ensuing clinical course was clinically favorable.

Discussion

Bone cement leakage is of particular concern among the various possible complications of PVP, since it can lead to canal stenosis, as well as cord\textsuperscript{15,16} and nerve root\textsuperscript{17} compressions.

Cement extravasation is indeed a rather frequent common complication of vertebroplasty, which can be observed in up to 30-40\% of patients undergoing this procedure,\textsuperscript{18} further associated with venous leakage occurring in up to 24\% of cases.\textsuperscript{12} It usually develops when the injected acrylic cement is not sufficiently polymerized, so that it may leak into the external vertebral venous...
plexuses, then migrating into the Inferior Vena Cava (IVC). Pulmonary embolism may eventually develop once the cement migrates within the pulmonary artery, and can hence be considered the most frequent complication of cement extravasation (involving ~4.6% of patients), often being asymptomatic (due to the small size of the emboli), but occasionally hemodynamically compromising.\textsuperscript{12,13} Intra-cardiac cement embolism is considerably less frequent, but is a potentially fatal complication, mostly managed with cardiac surgery.\textsuperscript{14} Only rarely cardiac cement embolism has been successfully managed with endovascular procedure.\textsuperscript{19} Surprisingly, late clinical manifestations of cardiac injury due to cement embolism have even been described.\textsuperscript{20}

Although reliable studies addressing the potential risk factors of cement embolism are almost lacking, intravertebral cleft, cortical disruption, low cement viscosity and high volume of injected cement have been implicated, whilst age, gender, fracture type, operation level do not appear to be significant determinants.\textsuperscript{21,22}

**Conclusions**

In line with a recent Cochrane Review,\textsuperscript{4} we endorse the concept that patients should be informed on the evidence failing to support substantial benefits of vertebroplasty but highlighting its potential complications and side effects. Emergency physicians should also acknowledge the risk of cardiac or pulmonary complications of PVP whenever facing patients with syncope, chest pain, hypotension or dyspnea after being managed with this procedure for vertebral compression fractures.

**References**