



## Case Report

# Cement leakage and pulmonary embolism by bone cement-augmented pedicle screw fixation of the thoracolumbar spine – A case report

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## ABSTRACT

**Background:** Few studies discuss the complication of pulmonary cement embolism (PCE) due to cement augmented pedicle screw instrumentation (CAPSI) of the thoracolumbar spine.

**Case Description:** A 62 female with a history of multiple myeloma and Sjogren's syndrome on chronic steroids developed an osteoporotic L1 compression fracture and underwent posterior stabilization with a T10–L4 CAPSI. However, postoperatively, the patient developed a surgical site infection and a PCE, resulting in severe respiratory compromise and death 1 month later.

**Conclusion:** When performing a T10–L4 thoracolumbar CAPSI (i.e., augmented pedicle screw instrumentation of the thoracolumbar spine) to address an L1 osteoporotic compression fracture, a 62 year old patient developed a life ending multi organ deficiency due to sepsis together with a PCE.

**Keywords:** Cement-augmented pedicle screw instrumentation, Pulmonary cement embolism, Thoracolumbar spine

## INTRODUCTION

Patients with thoracolumbar osteopenic/osteoporotic compression fractures with/without neural compromise may undergo injection of cement into the collapsed vertebra. This may be further accompanied by cement augmented pedicle screw instrumentation (CAPSI) (i.e., cement increase the pull-out strength 2–5 times of screws vs. traditional screws).<sup>[1,6,12]</sup> However, bone cement may leak into the spinal canal (i.e., intradural or extradural), causing cord/root compression and intravascular embolization (i.e., especially to the right heart and/or pulmonary arteries).<sup>[7,9,11]</sup> Risk factors for cement embolization (i.e. incidence 2.1–26.0%) include; impaired viscosity of the cement/polymethylmethacrylate, use of high injection pressures, the presence of pathological fractures especially involving the dorsal vertebral wall, and using overly large volumes of injectate [Table 1].<sup>[4,3,8]</sup>

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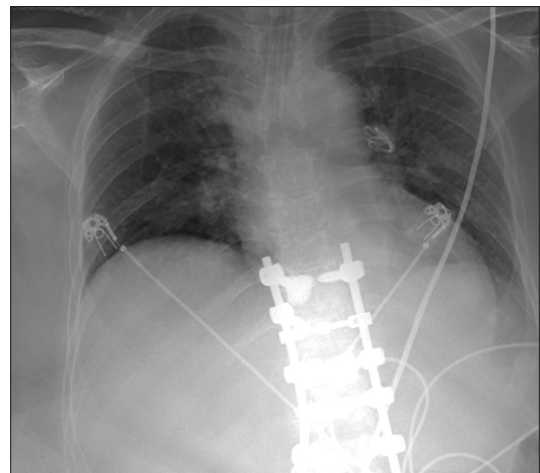
**Table 1:** Current literature regarding the evidence of PCE in Spine Surgery.

Author [Reference], Journal, Year	Study design, No. of patients (n)	Pathology	Diagnostic studies	Surgery	Outcome
Gomez <i>et al.</i> , <sup>[1]</sup> Surg Neurol Int., 2021	1 CR	T11 Fx PE.	CTA	PS	Postop Mech Vent
Goost <i>et al.</i> , <sup>[2]</sup> Z Orthop Unfall, 2012	Survey	-	-	Aug SI	80% Used Cement Aug
Huang, <sup>[3]</sup> J Int Med Res., 2022	1 CR	Os Fx	CTA Echo e	Balloon Kyph	Death of cardiac and respiratory failure
Janssen <i>et al.</i> , <sup>[4]</sup> Spine J, 2017	Retro 165	Os Fx (n=40), Mets (n=57), LDD (n=49), SSI (n=5), Tr Fx Os (n=14) w	CTA X-rays	Cement-Aug PS	29 Cement Leakage (4 life-threatening)
Kim <i>et al.</i> , <sup>[5]</sup> Clin Orthop Surg, 2020	Retro 170	Os Fx	CT	Cement-Aug PS	7 Cement leakage
Krueger <i>et al.</i> , <sup>[6]</sup> Spine J, 2009	Review	Os Fx	CXR, CT	Perc Vert	PE 3.5–3%
Lambers <i>et al.</i> , <sup>[7]</sup> Eur Heart J Case Rep., 2021	1 CR	Os Fx	CXR, CT	Per Vert	Symptomatic Cement Embolus
Mueller <i>et al.</i> , <sup>[8]</sup> J Neurosurg Spine, 2016	Prosp 98	Ox	CXR, CT	Aug PS	Cement Leak 88 patients
Song <i>et al.</i> , <sup>[9]</sup> Medicine (Baltimore), 2020	1 CR	Os Fx	CXR, CT	Perc Kyph	Emergency Cardiac surgery
Tang <i>et al.</i> , <sup>[10]</sup> BMC Musculoskelet Disord., 2020	Retro 93	Os	X-ray CT	Aug PS	Cement Leakage in 116 Screws
Ulusoy <i>et al.</i> , <sup>[11]</sup> Eur Spine J., 2018	Retro=93	LDD+Os	CXR, CT	Aug PS	Cement Leakage 46 patients
Zhang <i>et al.</i> , <sup>[12]</sup> Orthop Traumatol Surg Res., 2021	Meta 1277	Os	CXR, CT	Aug SI	Risk Cement Leakage 21.8% (6–43.1%)

CR: Case report, Retro: Retrospective study, Meta: Meta-analysis, Fx: Fracture, PE: PE: Pulmonary embolism, LDD: Lumbar degenerative disease, SSI: Surgical site infection, CXR: Chest X-ray, Echo: Echocardiogram, CT: Chest CT, PS: Pedicle screw fixation, SI: Spinal instrumentation, Kyph: Kyphoplasty, Vert: Vertebroplasty, Aug: Augmented, Perc: Percutaneous, Postop: Postoperative, Mech: Mechanical, Vent: Ventilation, CTA: Computed tomography angiography, Prosp: Prospective, Os: Osteoporotic or Osteoporosis

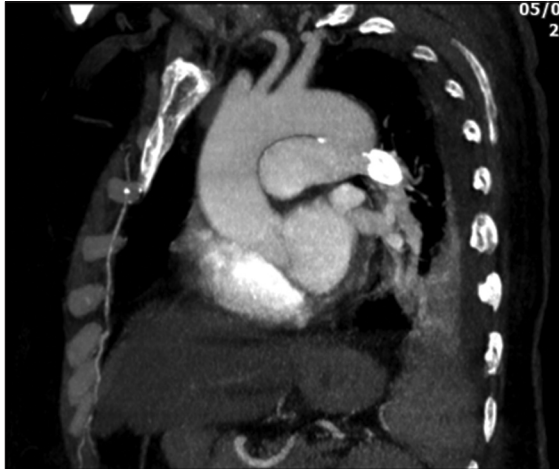
## CASE PRESENTATION

A 62-year-old female with multiple myeloma and Sjogren syndrome on long-term corticosteroids fell; this resulted in an L1 osteoporotic compression fracture. About a year later, after SARS-COVID pneumonia, she developed a pulmonary embolism (PE) and a right pubic area infected fistula/abscess. Within a few months, she presented with a progressive paraparesis attributed to an L1 osteoporotic fracture and underwent a T10–L4 CAPSI to stabilize her progressive thoracolumbar kyphosis. Postoperatively, she developed a surgical site infection requiring debridement and partial removal of the spinal implants. She was treated with cloxacillin and rifampicin; cultures initially grew *Staphylococcus aureus* methicillin-susceptible *S. aureus* but later also were positive for *Acinetobacter baumannii* and *Enterococcus faecalis*. When she acutely developed increased respiratory compromise, a computed tomography angiography-PE protocol documented a left pulmonary artery cement embolism within the lung parenchyma, that is, (see on chest X-ray) [Figures 1-3].

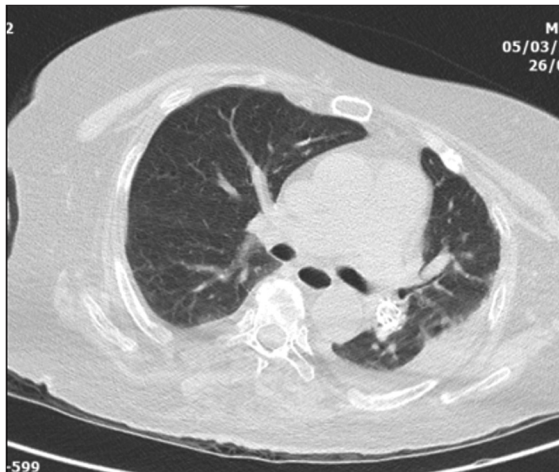


**Figure 1:** Postoperative anteroposterior chest X-ray of the patient with the visible cement emboli on the left pulmonary artery.

Respiratory decompensation, including the need for intubation and septic shock, resulted in her death 1 month later.



**Figure 2:** Coronal view of postoperative computed tomography pulmonary angiogram depicting the cement construct on the left pulmonary artery.



**Figure 3:** Sagittal view of postoperative computed tomography pulmonary angiogram depicting the cement construct on the left pulmonary artery.

## DISCUSSION

Bone cement augmentation is used to increase the pull-out strength for pedicle screw instrumentation (CAPSI) applied in patients undergoing stabilization of osteoporotic compression fractures of the thoracolumbar spine. However, risks of cement leakage include embolization into the spine (i.e., extradural/intradural), epidural veins, inferior vena cava, pulmonary artery (i.e., range 3.5–23%), right atrium, pulmonary artery, lungs, and heart causing right heart and/or respiratory failure.<sup>[8,10]</sup> Although a certain number of pulmonary cement embolisms (PCE) may be conservatively and effectively managed with heparin, other patients may require surgical removal.<sup>[5,9,11]</sup> In our case, cement embolized the left pulmonary artery and caused fatal respiratory decompensation and cardiac failure. Other authors discuss

the following different measures used to decrease the risk of cement embolization; Goost *et al.* used incompletely cannulated pedicle screws with a closed tip, while Kim *et al.* emphasized using a bipedicular approach and having these procedures only performed by spine surgeons (i.e., not a radiologist) utilizing intraoperative C-arm fluoroscopy.<sup>[2,5]</sup>

## CONCLUSION

A 62-year-old female underwent a thoracolumbar CAPSI (pedicle screws T10–L4) to stabilize an L1 osteoporotic compression fracture and subsequently succumbed to multi-organ deficiency due to a septic shock together with a large PCE.

## Ethical approval

The Institutional Review Board approval is not required.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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