MEDICAL FORUM

CEMENT LEAKAGE INTO THE INFERIOR VENA CAVA WITH PULMONARY CEMENT EMBOLISM: A CASE REPORT

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SUMMARY

Cement leakage into the venous system is a rare but potentially serious complication of vertebral augmentation procedures. We present what is, to our knowledge, the first reported case in Vietnam of cement leakage into the inferior vena cava (IVC) with pulmonary cement embolism (PCE). A 55-year-old male, after successful treatment of spondylodiscitis, underwent vertebral augmentation with cement at L4–L5 because of residual vertebral deformity and refractory pain. On follow-up imaging, extravasated cement was detected within the IVC and pulmonary arteries. Interestingly, the patient was admitted for lumbar pain without any respiratory symptoms, and the embolism was identified incidentally on CT. This case highlights the crucial role of imaging in detecting silent embolic complications and emphasizes the need for careful procedural technique and routine follow-up after vertebral augmentation.

Keywords: *cement leakage, inferior vena cava, pulmonary cement embolism, vertebral augmentation, spondylodiscitis.*

I. INTRODUCTION

Percutaneous vertebral augmentation procedures, including vertebroplasty and kyphoplasty, are widely used in the management of painful vertebral fractures due to osteoporosis, trauma, or neoplastic disease. In selected cases, they may also be considered after adequate treatment of infectious spondylodiscitis, when infection has resolved but residual vertebral collapse and refractory pain persist. Although generally considered safe, complications may occur, with cement leakage being one of the most common. Most leakages are clinically silent and limited to adjacent soft tissues or intervertebral discs, but intravascular leakage may cause potentially life-threatening embolic events [2].

Pulmonary cement embolism (PCE) has been reported in up to 23% of patients undergoing vertebral augmentation, the majority being asymptomatic [7]. Cement migration into the IVC is particularly rare but represents a direct route to the pulmonary arteries [5,6,11]. Severe consequences such as IVC thrombosis, cement entrapment in IVC filters [1], or embolization to the right heart chambers [5] have been documented.

We present a rare case of cement leakage into the IVC with pulmonary embolism, incidentally detected on imaging in a patient without respiratory symptoms, to highlight the importance of follow-up imaging and awareness of this complication.

II. CASE REPORT

A 55-year-old male with no significant past medical history was admitted to our hospital for lumbar pain. He was diagnosed with spondylodiscitis due to Staphylococcus aureus and received prolonged antibiotic therapy until clinical symptoms improved and laboratory inflammatory markers normalized. After infection control, the patient was discharged but continued to experience persistent lumbar pain and progressive vertebral deformity.

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He later sought care at a secondary hospital, where a multidisciplinary team evaluated his condition and, given the severe vertebral collapse and refractory pain despite medical treatment, vertebral augmentation with bone cement at the L4–L5 levels was indicated and performed. The procedure was technically successful, and the patient was discharged in stable condition.

At routine follow-up, the patient reported persistent lumbar pain but denied any respiratory symptoms such as dyspnea, chest pain, or hemoptysis. Laboratory values were within normal limits.

Lumbar radiographs revealed hyperdense foci within the right aspect of the L4 and L5 vertebral bodies, consistent with bone cement. A linear hyperdense tract extending anteriorly and superiorly from the cemented area was also observed, raising suspicion of venous extravasation (Figure 1). Subsequent non-contrast CT of the lumbar spine confirmed cement leakage from the paravertebral venous plexus into the inferior vena cava (IVC), extending cranially up to the level of the L1 vertebral body (Figure 2). Chest CT further demonstrated multiple linear and nodular hyperdense opacities distributed along the pulmonary vascular branches, predominantly in the basal regions of the right lung, consistent with pulmonary cement embolism (Figure 3).

Given the absence of cardiopulmonary symptoms, the patient was managed conservatively with close clinical monitoring and medical therapy. The patient remained stable during follow-up without evidence of further complications.

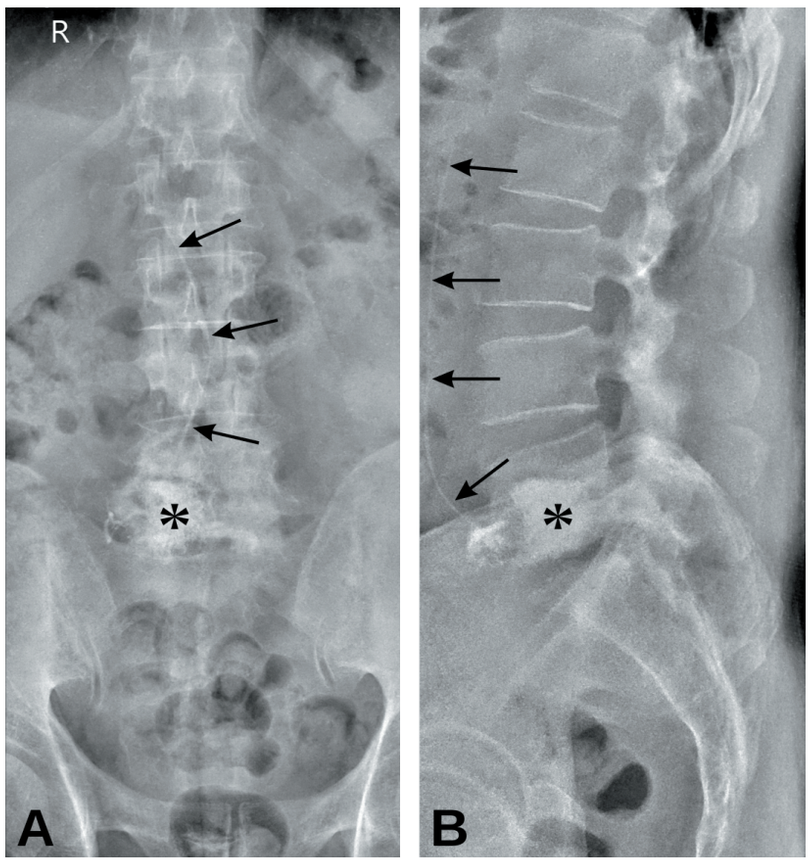

Figure 1. Anteroposterior (A) and lateral (B) lumbar spine radiographs. Hyperdense foci are observed in the right aspect of the L4 and L5 vertebral bodies, corresponding to bone cement following vertebroplasty (asterisks). A linear hyperdense tract extends anteriorly and superiorly from the cemented region, indicating cement leakage into the inferior vena cava (arrows).

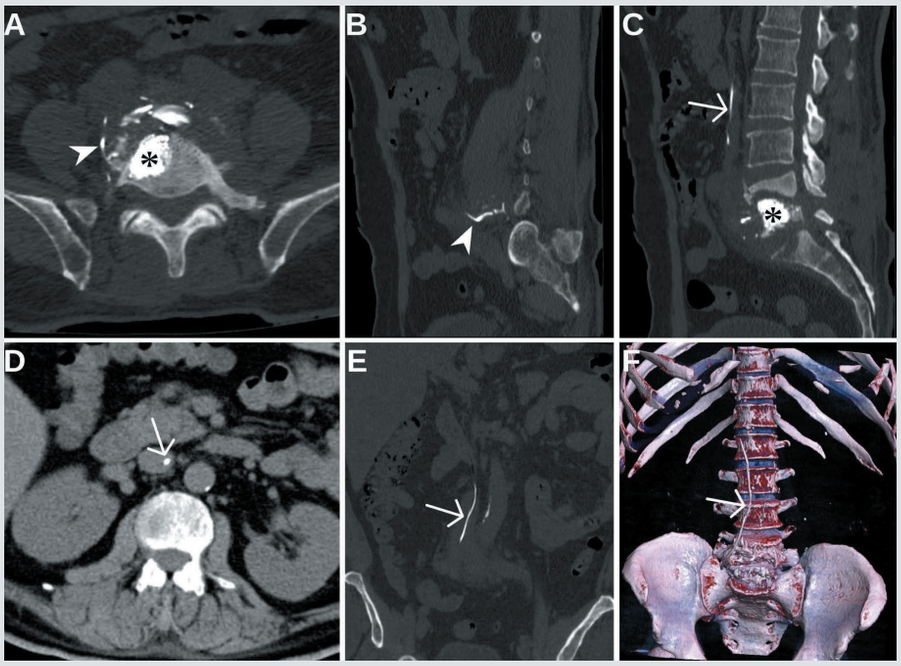

Figure 2. Non-contrast CT images of the lumbar spine in axial (A, D), sagittal (B, C), and coronal (E) planes, along with 3D reconstruction (F). Findings demonstrate status post right-sided vertebral augmentation of the L5 body using bone cement, with associated degenerative changes at the L4, L5, and S1 levels (asterisks). Hyperdense cement material is seen within the inferior vena cava (white arrows). A cement leakage tract extends from the paravertebral venous plexus into the inferior vena cava, ascending cranially up to the level of the L1 vertebral body (arrowheads).

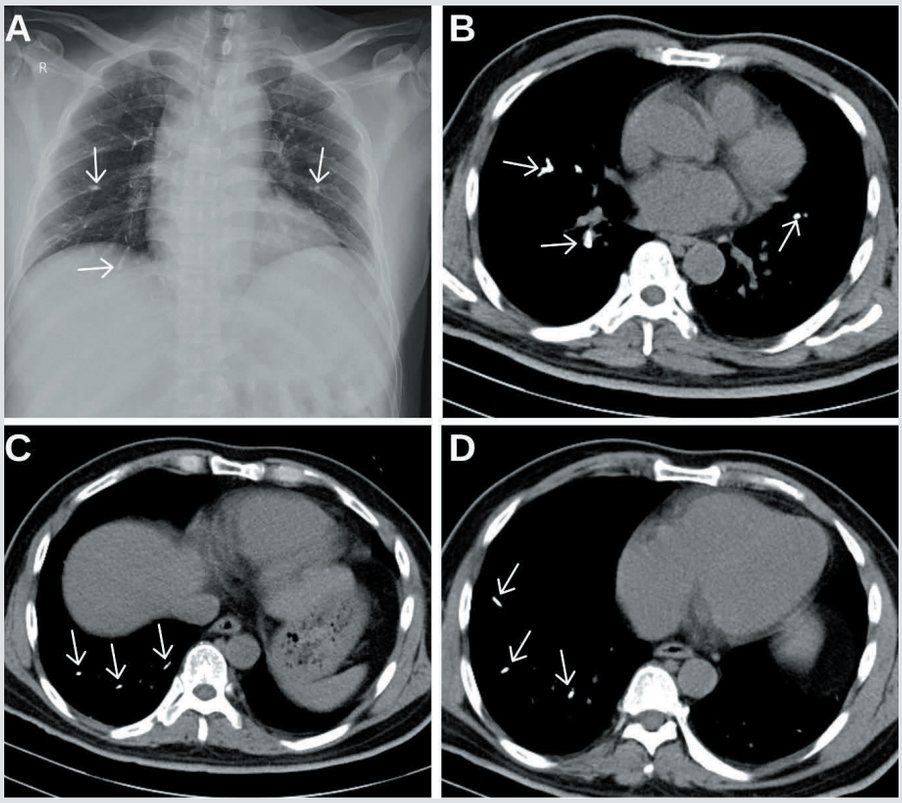

Figure 3. (A) Chest radiograph demonstrates multiple linear and nodular hyperdense opacities distributed along the pulmonary vasculature, predominantly on the right side (arrows). (B–D) Axial CT images of the chest reveal increased nodular and linear hyperdensities along the pulmonary vascular branches in the basal regions of both lungs, with right-sided predominance, consistent with pulmonary cement embolism (arrows).

III. DISCUSSION

Cement leakage is a well-recognized complication of vertebral augmentation procedures. Leakage usually occurs through cortical breaches or venous channels. Once cement enters the paravertebral venous plexus, it may migrate into the inferior vena cava (IVC) and subsequently to the pulmonary arteries [5]. On CT, embolized cement is typically seen as linear or nodular hyperdensities within pulmonary arteries, most commonly in the lower lobes [3]. While many cases of pulmonary cement embolism (PCE) are detected incidentally and remain asymptomatic [2,7], some patients may develop respiratory symptoms such as dyspnea and chest pain, and in severe cases even cardiopulmonary collapse [4,9].

Cement leakage into the IVC is rare but can be associated with significant complications. Cases of IVC thrombosis have been described, sometimes requiring advanced diagnostic modalities such as multidetector CT or intravascular ultrasound for accurate evaluation [6,11]. Other reports highlight unusual presentations such as cement entrapment within IVC filters [1] or migration into the right heart chambers, which may cause severe or even fatal outcomes [5]. These cases emphasize that once cement gains access to major venous conduits, the potential for systemic complications becomes considerable.

Management strategies for intravascular cement leakage and PCE depend on the patient's symptoms and the extent of embolism. Asymptomatic patients are often managed conservatively with close clinical and imaging follow-up [2,9]. Symptomatic or extensive embolism may require anticoagulation [7], endovascular interventions such as stent graft placement [10], or in selected severe cases, surgical removal of cement fragments [5]. In the present case, despite cement migration into the IVC and pulmonary arteries, the patient remained asymptomatic, and conservative management was considered appropriate.

Our case has several notable features. First, cement leakage into the IVC with subsequent PCE is exceptionally rare and, to our knowledge, has not been previously reported in Vietnam. Second, the patient presented without any respiratory symptoms, and the diagnosis was made incidentally on follow-up CT. Third, the underlying condition was a history of spondylodiscitis. Vertebral augmentation in this context is only considered after adequate infection control, and is far less common compared with procedures performed for osteoporosis or metastatic disease. These aspects make the case distinctive and provide valuable clinical insight into the silent but potentially serious nature of cement embolism.

The mechanism of cement leakage into the inferior vena cava (IVC) is believed to involve early entry of low-viscosity cement into the paravertebral venous plexus, which communicates directly with the IVC, especially when the injection pressure exceeds the intravertebral venous pressure or when cortical defects are present [5,6,11]. Factors such as high injection pressure, low cement viscosity, large injected volume, and premature injection before adequate cement polymerization have been identified as major risk contributors [5,6].

Several technical measures have been recommended to minimize this complication, including using higher-viscosity cement, applying slow and intermittent injection under continuous fluoroscopic monitoring, limiting the total cement volume, and stopping the procedure immediately if early venous leakage is detected [5,10,11]. Strict adherence to these procedural precautions is essential to reduce the risk of cement migration into the venous system and subsequent pulmonary embolism.

IV. CONCLUSION

Cement leakage into the IVC with subsequent pulmonary embolism is a rare complication of vertebral augmentation. Although many patients remain asymptomatic, timely recognition on imaging is crucial for appropriate management. This case is particularly notable as it may represent the first report in Vietnam, was discovered incidentally in a patient without respiratory symptoms, and occurred in a patient with a history of treated spondylodiscitis. These findings highlight the critical role of post-procedural imaging and raise awareness of this potentially life-threatening but often silent complication.

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