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ORTHOPAEDICS
Case Report

Pulmonary Cement Embolism in a Multiple Myeloma Patient Following Vertebroplasty: A Case Report

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Abstract

The standart treatment of refractory and painful primary or metastatic lytic tumoral lessions and osteoporotic vertebral compression fractures in the elderly population is considered to be percutaneous transpedicular polymethylmethacrylate injection to the fracture, referred as vertebroplasty. Although, cement leakage into the spinal canal and perivertebral venous system have been reported in the literature with this technique, the true incidence of pulmonary embolism, especially in tumor patients is still unclear. This case report describes a pulmonary cement embolism due to cement extravastion following vertebroplasty in a multiple myeloma patient. Early postoperative symptoms such as dyspnea, tachypnea and productive coughing should arise suspicion for a possible pulmonary embolism. Surgeons may consider vertebrography prior the procedure to assess the risk of cement leakage and can prefer postoperative chest radiographs in both symptomatic and asymptomatic patients as a routine screening modality especially in lytic tumoral lessions revealing higher risk of embolism.

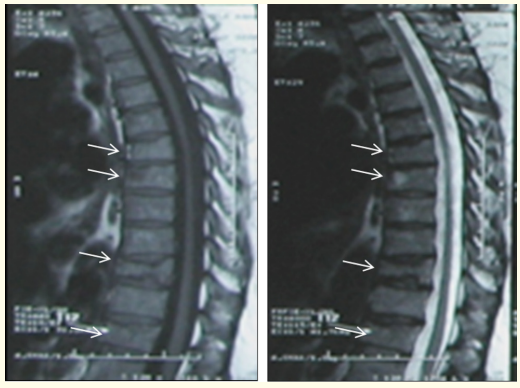
Keywords: *Vertebroplasty; Cement embolism; Multiple myeloma, vertebrography; Lytic tumoral lession*

Introduction

Despite accurate diagnosis techniques and effective medical treatment modalities, osteoporotic vertebral compression fractures in the elderly population still remains to be a substantial burden for physicians and health systems. For its non-medical treatment several surgical techniques have been described in the treatment of refractory vertebral body fractures secondary to osteoporosis [1-3]. These percutaneous vertebral augmentation techniques gained popularity among orthopedic surgeons and was accepted to be safe and effective. Galibert et al. first introduced the technique of percutaneous reduction of the vertebral body assisted by injecting transpedicular polymethylmethacrylate (PMMA) into the cavity known as vertebroplasty [4]. Vertebroplasty is nowadays also indicated in the treatment of hemangiomas, multiple myeloma (MM) and painful osteolytic vertebral tumors [5,6]. The majority of the complications consist of local complications such as infection or cement leakage into the spinal canal or perivertebral venous system. Paraplegia due to spinal cord compression extravasation is the most devastating complication but fortunately is reported to be extremely rare. This article describes a rare but major complication pulmonary cement embolization following vertebroplasty for the treatment of a lytic tumoral lession. The purpose of the report is to inform clinicians to consider vertebrography prior vertebroplasty to detect the potential risk of cement extravasation and prefer chest X-rays and computerized tomography scans as imaging studies to make the diagnosis of pulmonary embolism accurately in order to take preventive measures in patients with respiratory distress.

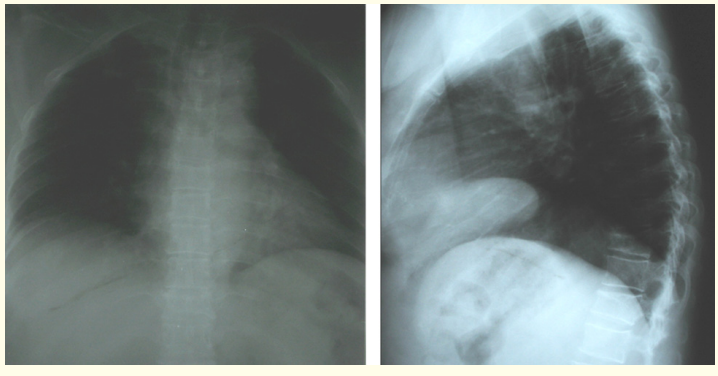
Case Report

A 70 year old woman presented with a 1-2 months of atraumatic back pain. Her medical history consisted only of MM and hypertension. Pain was exacerbated by weight bearing and mainly localized to the upper lumbar spine. Physical examination revealed tenderness during palpation over the thoracolumbar region. Conventional radiographs and Magnetic Resonanse Imaging revealed multiple compression fractures at T6, T7, T10, T11 and T12. Anterior column of T7 vertebral body shows decreased signal intensity on T1 weighted image and increased signal intensity on T2 weighted image (Figure 1a-1b). Although the patient was ambulatory, pain was intolerable despite the use of narcotic analgesics. After discussing the medical condition of the patient with anesthesiology and cardiology, the patient was advised to undergo the vertebroplasty procedure. The patient was placed in the prone position and by fluoroscopy guidance, the pedicles were canulated under local anesthesia. A non-ionic radiopaque (Omnipaque) administration via Jam Sheede needle, so called vertebrography was conducted in order to detect possible extravasation under fluoroscopy as described by Senkoylu et al. [7]. Hence the lession was hypervascular and the radiopaque immediately entered the vascular system, vertebrography could not be achieved. Because of this observation, PMMA was then hardened to an optimal viscosity in order to avoid potential leakage and later injected into the vertebral body. The same procedure was applied subsequently to each vertebrae. The patient tolareted the procedure well and no evidence of cement extravasation was detected via fluoroscopy during and immediately after the procedure (Figure 2a-2b).



1A **1B**

Figure 1a-1b: *Sagital T1 (a) and T2 (b) weighted images show compression fractures of T6, T7, T10 and T12 vertebral bodies (arrows). T11 vertebral body shows a mild compression deformity. Anterior column of T7 vertebral body shows decreased signal intensity on T1 weighted image and increased signal intensity on T2 weighted image (arrow).*



2A **2B**

Figure 2A-2B: *Anteroposterior flouroscopic image and b. Lateral chest graphy show normal findings.*

Postoperative the same day, the patient presented with respiratory distress symptoms such as, mild dyspnea, chest discomfort, shortness of breath and productive cough. The patient was consulted to a pulmonary and cardiology specialist and underwent computerized tomography scan (CT) and echocardiogram. Thorax CT showed multiple nodular and linear hyperdensities in bilateral lobar and segmental pulmonar artery branches. (Figure 3a-3b). CT findings were concordant with multiple cement embolism within segmental branches and an increased 50 mm Hg pulmonary arterial pressure was detected during echocardiogram and supported the initial diagnosis with near normal ejection fraction. The patient was treated with supplemental oxygen inhalation and anticoagulants. At day 5, her dyspnea regressed, coughing subsided, the patient was comfortable and discharged home without supplemental oxygen.

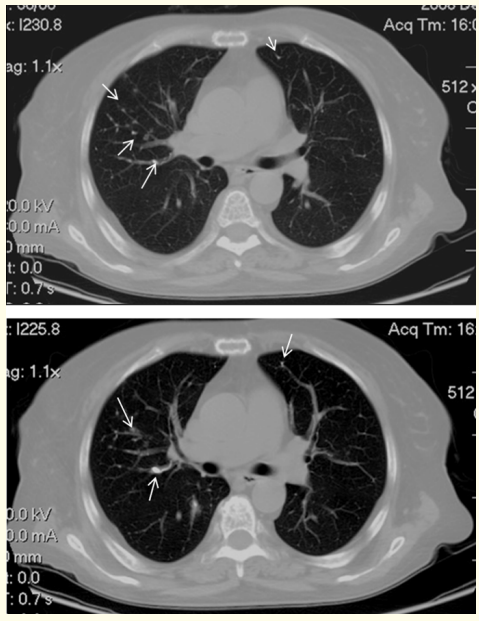


Figure 3A-3B: *Axial thorax CT shows multiple linear and nodular hiperdensities in bilateral lobar and segmental pulmonary artery branches(arrows).*

Discussion

This report describes a rare entity a pulmonary embolism due to cement extravasation following a vertrebroplasty procedure. The risk of cement extravasation intravascularly and into the spinal canal, foramen is related with several variables. Pressure, volume and the viscosity of the cement used [8,9]. As these properties differ between the two techniques, the rate of cement leakage is reported to be different between vertebroplasty and kyphoplasty. Biomechanical data demonstrate a decreased risk of cement migration with kyphoplasty compared to vertebroplasty [10,11]. Injecting more viscous cement under relatively lower pressure reduces the risk of cement leakage. Although studies reveal high percentages (%24-%39) of cement leakage into the paraspinal vasculature following vertebroplasty, pulmonary embolism is estimated to occur rare because PMMA rapidly polymerizes, which prevents it from reaching the vena cava [12].

In a study conducted by Phillipsb., *et al*. Intraoperative venograms were performed with fluoroscopy in 20 patients before and after the procedure and no cases of extravasation was stated [13]. Contrary to these findings, the literature also compromises some catastrophic results. Up to date, six deaths have been reported after vertebroplasty. Farahvar et al. reported perforation of the right cardiac ventricular wall by PMMA after lumbar kyphoplasty [14]. Rothermich., et al. has reported open pulmonary wedge resection and embolectomy as a result of massive cement embolization to the pulmoner arterial circulation in a 29 year old patient following vertebroplasty [15].

In the case we presented, even after 2 years there was evidence of cement embolism in chest radiographs (Figure 4). Although our patient was asymptomatic, chronic and persistent respiratory symptoms have been defined in patients after cement embolism. This may be an important issue in patients especially with chronic pulmonary and cardiac disease. Although vertebroplasty is considered to be a safe method in the treatment of osteoporotic vertebral fractures, in patients with multiple myeloma, hypervascular lessions such as hemangiomas, renal cell CA metastazis and lytic tumoral lessions have increased risk of embolism. Recently, leakage of cement into the azygous vein and pulmonary embolism after vertebrolpasty is described in a 58 year old woman diagnosed with multiple myeloma [16]. Although Duran et al. have described the incidence of pulmonary embolism as %6.8 after vertebroplasty, the true incidence of pulmonary embolism is still unknown, since up to date there are no prospective studies using computed tomography scan to study pulmonary vessels after vertebroplasty [17]. Standart guidelines, including vertebrography has to be described to assess the intraoperative risk of cement leakage and treatment of pulmonary embolism after vertebroplasty.

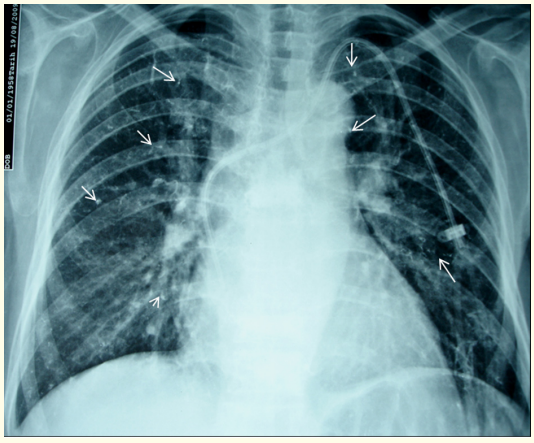


Figure 4: *PA chest graphy shows linear densities in the bilateral upper and middle zones (arrows).*

Conclusion

We believe that the rate of pulmonary embolism after vertebroplasty is more than estimated since patients usually have mild symptoms that are undiagnosed and postoperative visualization is only focused on the lumbar spine. Surgeons may consider intraoperative vertebrography and postoperative chest radiographs as a routine screening modality to evaluate cement extravasation risk and pulmonary embolism. It has to be kept in mind that although vertebrography is effective and safe to assess the risk of cement extravasation prior cement injection, the image obtained may be suboptimal in hypervascular lessions due to rapid radiopaque extravasation into the circulatory system. Postoperative symptoms such as dyspnea, tachypnea and productive coughing should arise suspicion for a possible pulmonary embolism due to cement extravasation and computed tomography scans should be considered in its early diagnosis. To reduce embolization rates, we recommend cement to be injected in a more viscous state under low pressure and the volume should not exceed 5 ml. Following vertebrography, patients with high risk can be candidates for thrombotic agent injection before vertebroplasty to close venous channels and reduce the potential risk of pulmonary embolism. The authors declare that they have no conflict of interest.

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