Case report

Cement pulmonary embolism after balloon kyphoplasty

Pretty Sara Idiculla, Kartikeya Rajdev, Sami Pervaz, Michael Cinelli, Saad Habib, Abdul Siddiqui, Sara Ahmed

ABSTRACT

Osteoporotic vertebral fractures are common among the geriatric population and are managed by vertebral augmentation procedures. Pulmonary cement embolism is a relatively rare complication of these procedures and can range from mild, transient respiratory sequelae to a more severe pulmonary infarction. We discuss the case of a 75-year-old woman, identified with osteoporotic thoracolumbar vertebral fractures, found to have pulmonary cement embolism four days following multi-level balloon kyphoplasty. We attempt to highlight, pulmonary cement embolism as a potential complication following a vertebral augmentation procedure and that systematic pulmonary imaging after surgery may be helpful to facilitate its detection and further management.

1. Background

Osteoporotic vertebral fractures have become a growing problem among the geriatric population, due to an increased prevalence of osteoporosis and cancer. In addition to hospital admission and parenteral opioids for pain, they can cause neurological deficits, height loss and restrictive lung disease, secondary to spinal deformity [1]. Vertebral augmentation procedures that include vertebroplasty and kyphoplasty are minimally invasive surgeries performed for compression fractures secondary to osteoporosis or malignancy. The potential short-term benefit is the improvement in pain, whereas long-term benefits may include limitation or reversal of height loss and spinal deformity and improved functional capability. They are fast becoming the standard of care, though complications have been reported, of which pulmonary embolism generates the most concern [2]. These procedures involve the introduction of a cement polymer, Polymethylmethacrylate (PMMA), into the vertebral body which can cause pulmonary cement embolism (PCE) from distant leakage of cement, by entering the venous plexus or intravascular; compatible with polymethylmethacrylate (PMMA) cement emboli (Fig. 2). The patient denied any shortness of breath, and was hemodynamically stable, with normal oxygen saturation at room air. Transthoracic echocardiogram exhibited normal ejection fraction with no evidence of right heart strain. Based on the current literature, the patient was not commenced on anticoagulation since she was asymptomatic, and the emboli was peripheral. The patient was stable on further outpatient follow up.

2. Case presentation

A 75-year-old female with a myriad of comorbidities including morbid obesity, hypothyroidism, Parkinson’s disease, osteoporosis, and rheumatoid arthritis on chronic steroids and methotrexate; presented with spontaneous onset of severe low back pain. She denied any trauma, fever or neurological symptoms. On Magnetic Resonance Imaging (MRI), she was diagnosed with acute compression fracture deformities at T9, T12, L1, L2, and L3. Initial conservative management included six weeks of bracing, physical therapy and pain management. Persistent symptoms led to the decision of performing multi-level balloon kyphoplasty. Post-surgical vitals, arterial blood gas, and serum chemistries were normal. On postoperative day 4 the patient complained of right-sided non-pleuritic chest pain, aggravated with movement and palpation. Chest X-Ray revealed linear, branching radiopacity overlying the right mid to upper lung fields (Fig. 1). A subsequent chest CT scan with intravenous contrast demonstrated multiple, small, branching, tubular hyperdensities contained in the right upper lobe pulmonary vasculature; compatible with polymethylmethacrylate (PMMA) cement emboli (Fig. 2). The patient denied any shortness of breath, and was hemodynamically stable, with normal oxygen saturation at room air. Transthoracic echocardiogram exhibited normal ejection fraction with no evidence of right heart strain. Based on the current literature, the patient was not commenced on anticoagulation since she was asymptomatic, and the emboli was peripheral. The patient was stable on further outpatient follow up.

* Corresponding author. 62 Newberry Avenue, Apt SF Staten Island, New York, 10304, USA.
E-mail address: sarahidiculla.psi@gmail.com (P.S. Idiculla).

https://doi.org/10.1016/j.rmcr.2019.100887
Received 12 June 2019; Accepted 15 June 2019
2213-0071/ © 2019 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/BY-NC-ND/4.0/).
and involves using a balloon to create a cavity within the vertebral body and injecting cement, helping to restore height and reduce kyphosis [4]. A large national inpatient database study including 63,459 patients found that kyphoplasty was associated with lower complication rates and decreased mortality as compared to vertebroplasty [7]. One of the most common complications seen with both these procedures is cement leakage causing PCE, which is comparatively lesser with kyphoplasty than vertebroplasty. Various factors influence the rates of cement leakage, for example, the amount and pressure at which the cement is injected, and insufficient fluidity of PMMA at the time of injection [13].

Pulmonary Cement Embolism (PCE) occurs when PMMA enters into the thoracic venous system through the venous connections formed by the valve-less vertebral venous plexus or embolizes through the aorta and anterior spinal artery. PMMA additionally has a prothrombotic effect, contributing to the thrombosis of the pulmonary vessels [3,8]. An increased proportion of these cases appears within days to weeks post-procedure, while in rare instances it can occur almost immediately [3]. The presentation can vary from an incidental radiological finding to a life-threatening event. Clinically, patients can exhibit dyspnea, tachypnea, cyanosis, dizziness, chest pain, cough, or hemothysis; and eventually may lead to cardio-respiratory compromise [6,9].

A high index of clinical suspicion and imaging tools are crucial for the diagnosis of PCE. No screening methods have been implicated for asymptomatic patients, while some clinicians do recommend routine imaging after vertebral augmentation procedures [9,12]. A chest X-ray revealing single or multiple high-density opacities in a tubular or branching pattern, matching to the pulmonary arterial distribution, is often indicative of PCE [2,3,9,10]. A CT angiogram of the chest should be performed to confirm the diagnosis. An echocardiogram is essential for a complete assessment, as cement can deposit in the right heart, and evaluate for secondary elevated pulmonary arterial pressure [2,9].

There are no standardized therapeutic guidelines that have been outlined for PCE, and the prevailing treatment is based on the various clinical cases that are currently available which includes the presence of symptoms and the location and size of the embolus [11]. A central embolism includes the main pulmonary trunk and the right or left pulmonary arteries and beyond that is peripheral embolism [9]. Krueger et al., in 2009 proposed a treatment algorithm that suggests, vigilant observation and regular follow-ups for asymptomatic peripheral embolisms. Patients with either symptomatic peripheral embolisms or asymptomatic central embolisms can be treated with initial heparinization followed by 6 months of consecutive Warfarin therapy. Life-long anticoagulation therapy does not seem to be beneficial but may be associated with increased bleeding risk, especially in the older population [6]. Surgical embolectomy may be considered in exceptional cases of massive central embolisms. In our case, the patient had an asymptomatic peripheral pulmonary embolism and was closely monitored on an outpatient basis without anticoagulation.

Recommendations for prevention of PCE including prone position during the surgical procedure, maintaining an elevated intrathoracic pressure [8], using blush venography with fluoroscopy prior to injection, which helps predict possible leaks [3], and use of inferior vena cava filters [5]. Maintaining adequate viscosity of the bone cement, injecting the right amount [6] as well as proper technique is also critical while performing these procedures.

3. Discussion

Osteoporotic fractures are those occurring from low-impact trauma, and vertebral compression fractures are the most common type encountered. This can result in debilitating back pain, with a marked decline in functional capability. Patient can develop height loss, kyphosis and also an increased risk for subsequent fractures. Vertebral augmentation procedures are minimally invasive image-guided techniques and include vertebroplasty and kyphoplasty, performed for vertebral compression fractures attributable to osteoporosis or malignancy.

Vertebroplasty was first performed by Galibert et al. [6] and involves the injection of a cement polymer, commonly PMMA into the vertebral body to prevent further loss of vertebral height as well as to alleviate pain [1]. Kyphoplasty was first performed by Reiley et al. [6]...
Article guarantor

Sara Idiculla, MBBS.

Financial Support

No financial disclosures.

Ethics

We hereby, confirm that informed consent was obtained from the patient for publication of the case details.

Conflicts of interest

None.

Study sponsors

None.

References

[1] Asem Mansour, et al., Cement Pulmonary Embolism as a Complication of Percutaneous Vertebroplasty in Cancer Patients vol. 18, Cancer Imaging: the official publication of the International Cancer Imaging Society, 8 Feb. 2018, https://doi.org/10.1186/s40644-018-0138-8

[2] Cement pulmonary embolism after percutaneous vertebroplasty and kyphoplasty: an overview Habib, Nicholas et al. Heart & Lung: The Journal of Acute and Critical Care, Volume 41, Issue 5, 509 – 511.

[3] Pulmonary cement embolism following balloon kyphoplasty: The impact of a procedural complication in a new era for lung cancer management Daniela Marta Rodrigues 1, Daniela Patrícia Cunha Machado 2, Sérgio André Campainha Fernandes 2 and Ana Maria Paixão Barroso 2 1 Department of Pulmonology, Hospital Pedro Hispano, São Mamede de Infesta, 4465-120 Matosinhos; 2 Multidisciplinary Unit of Thoracic Tumors, Department of Pulmonology, Centro Hospitalar Vila Nova de Gaia/Espinho, 4434-502 Vila Nova de Gaia, Portugal Received August 24, 2018; Accepted October 13, 2018.

[4] Alan C. Wang and Daniel K. Fahim: Safety and efficacy of balloon kyphoplasty at 4 or more levels in a single anesthetic session - J. Neurosurg. Spine, Volume 28, Issue 4, 355-456.

[5] Mouchammd Aqko, Mustafa Nazzal, Tahir Jammal, Mario- Castillo- Sang, Paul Clark, Gregory Casper: Prevention of cardiopulmonary embolization of polymethylmethacrylate cement fragment after kyphoplasty with insertion of inferior vena cava filter: J. Vasc. Surg. Volume 51, Issue 1, Pages: 210-213.

[6] A. Krueger, C. Bliesem, R. Zeitl, S. Ruchholz, Management of pulmonary cement embolism after percutaneous vertebroplasty and kyphoplasty: a systematic review of the literature, Eur. Spine J. 18 (2009) 1257-1265.

[7] Vadim Goz BA, Thomas J. Errico, Jeffrey H. Weinreb BS, Steven M. Koehler, Andrew C. Hecht, Virginie Lalage, Sheeraz A. Qureshi: Verteoplasty and kyphoplasty: national outcomes and trends in utilization from 2005 through 2010 - Spine J., Volume 15, Issue 5, Pages: 959-965.

[8] M.A. Rothermich, J.M. Buchowski, D.B. Bumpass, G.A. Patterson, Pulmonary cement embolization after vertebroplasty requiring pulmonary wedge resection, Clin. Orthop. Relat. Res. 472 (2014) 1652-1657.

[9] Asnas Nooh, Fahad H. Abduljabbar, Ahmed H. Abduljabbar, Peter Jarzem, Pulmonary artery cement embolism after a vertebroplasty,” case reports in orthopedics, Article ID 582769, 4 pages, 2015, 2015. https://doi.org/10.1155/2015/582769.

[10] G. Geraci, G. Lo Iacono, C. Lo Nigro, F. Cannizzaro, M. Cajozzo, G. Modica, Asymptomatic bone cement pulmonary embolism after vertebroplasty: case report and literature review, Case Rep Surg 2013 (2013) 591432, https://doi.org/10.1155/2013/591432.

[11] Y.J. Kim, J.W. Lee, K.W. Park, J.S. Yeom, H.S. Jeong, J.M. Park, H.S. Kang, Pulmonary cement embolism after percutaneous vertebroplasty in osteoporotic vertebral compression fractures: incidence, characteristics, and risk factors, Radiology 251 (2009) 250–259.

[12] A. Baumann, J. Taus, G. Baumann, M. Tomka, M. Hessinger, K. Tissenhausen, Cement embolisation into the vena cava and pulmonal arteries after vertebroplasty: interdisciplinairy management, Eur. J. Vasc. Endovasc. Surg. 31 (2006) 508–561.

[13] M. Boudissa, V. Morin, G. Kerschbaumer, J. Tonetti, Pulmonary cement embolism following percutaneous vertebroplasty: a case report, physiopathology and literature review, J. Clin. Case Rep. 5 (2015) 5, https://doi.org/10.4172/2165-7920.1000529.