

Case Report

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Pulmonary Cement Embolism Following Percutaneous Vertebroplasty: A Case Report, Physiopathology and Literature Review

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Abstract

Objective: We report a case of pulmonary cement embolism following percutaneous vertebroplasty performed for osteoporotic vertebral compression fracture.

Summary of background data: Asymptomatic pulmonary cement embolism, more than symptomatic pulmonary cement embolism, are not so rare from 2.1% to 26%.

Methods: The fifth day after surgery, an angioscan was performed because of respiratory failure. It showed a pulmonary cement embolism in the apical segment, medium lobe and ventro-basal segment of the right lung.

Results: Symptomatic treatment with oxygen and curative anticoagulation allowed a complete respiratory function recovering.

Conclusions: So as to better diagnose this complication, a careful analysis of the post-operative pulmonary X-ray and regular follow-up are necessary. The main interest of this case report is the knowledge of chest X-ray as a screening test for pulmonary cement embolism.

Keywords: Vertebroplasty; Pulmonary cement embolism; Leakage; Osteoporotic vertebral compression fracture

Introduction

Vertebroplasty is a percutaneous and efficient technic for treatment of painful osteoporotic vertebral compression fractures, traumatic vertebral fractures or myeloma fractures [1,2]. The first vertebroplasty was performed by Galibert in 1984 so as to treat a vertebral angioma in C2. Vertebroplasty consists in cement injection in the vertebral body of the painful vertebra [3]. Although this procedure seems to be efficient to decrease the pain and to improve the functional recovery of patients, there are complications such as same level re-fracture, radicular injuries, and cement embolism [4]. Majority of these complications are secondary to cement leakages and/or a bad filling of the vertebral body. Pulmonary cement embolism are under-estimated because many of them are asymptomatic or can become symptomatic many years after the vertebroplasty [5].

This case has three points of interest. Firstly, to be aware of this complication. Secondly, to screen quickly a symptomatic and asymptomatic cement pulmonary embolism by a systematic analysis of the post-operative chest X-ray. And thirdly, to give to patients an appropriate information on the necessity to have a regular follow-up and a diagnosis in emergency in case of respiratory signs.

Case Report

A 81 year-old woman who had presented an osteoporotic vertebral compression fracture of the eleventh (T11) and twelfth (T12) thoracic vertebra, type A1-3 according to the Magerl classification, was admitted in our institution for a vertebroplasty (Figure 1) [6]. The Visual Analogic Scale (VAS) before surgery was 7 on 10. We had performed a vertebroplasty for this patient a few months before on the second lumbar vertebra (L2) with an excellent result. The delay between the injury and the surgery was two days. We had noticed no respiratory disease for this patient.

A vertebroplasty under general anesthesia, in ventral decubitus with thoracic and iliac support and fluoroscopic control was performed. A partial but satisfying reduction of the fracture was obtained by prone position of the patient on butress. Trans pedicular

3 mm diameter, 150 mm length trocars (Vexim SA, 31130 Balma, France), was used to inject cement under fluoroscopic control. High-viscosity Poly-Methyl-Methacrylate (PMMA) cement



Figure 1: Pre-operative X-ray showing the osteoporotic vertebral compression fracture in T11 and T12 and the vertebroplasty in L2.

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Received April 25, 2015; **Accepted** May 20, 2015; **Published** May 22, 2015

Citation: Boudissa M, Morin V, Kerschbaumer G, Tonetti J (2015) Pulmonary Cement Embolism Following Percutaneous Vertebroplasty: A Case Report, Physiopathology and Literature Review. J Clin Case Rep 5: 529. doi:[10.4172/2165-7920.1000529](https://doi.org/10.4172/2165-7920.1000529)

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(Vexim SA, 31130 Balma, France) was used. Cement was injected when it was pasty. Injection was stopped as soon as a venous leakage was seen on T11 on the anterior and lateral side of the vertebra. In all, 6 ml of cement was injected in each vertebra (Figure 2). There was no other undesirable event during the surgery. Post-operative neurological exam was correct. Pain relief was obtained with VAS 2/10 at first post-operative day.

The fifth day, the patient suffered of respiratory distress with desaturation (PaO_2 80 mmHg and PaCO_2 36 mmHg). The patient received high concentration oxygenotherapy treatment. An angioscan was performed and showed pulmonary cement embolism in the apical segment, medium lobe and ventro-basal segment of the right lung (Figures 3 and 4). Curative anticoagulation and symptomatic oxygenotherapy allowed complete respiratory function recovering. At one year follow-up the patient has fully recovered with no respiratory symptoms and no pain-killer consumption.

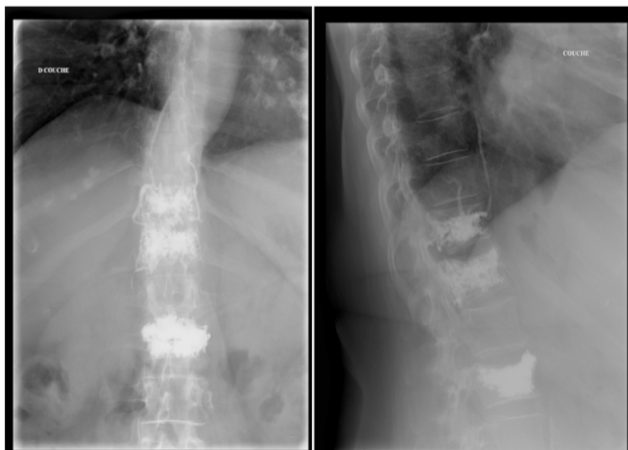
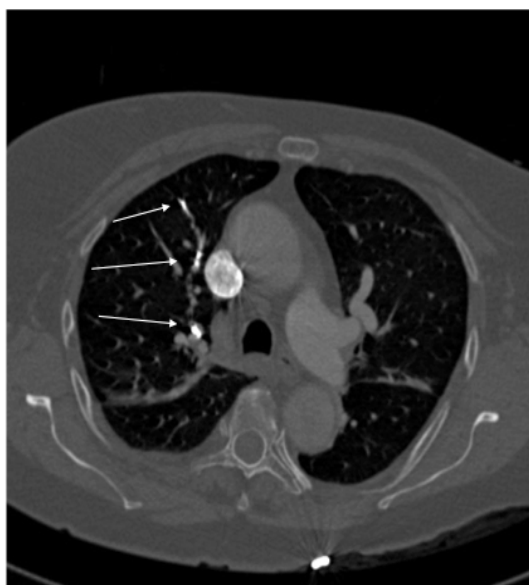


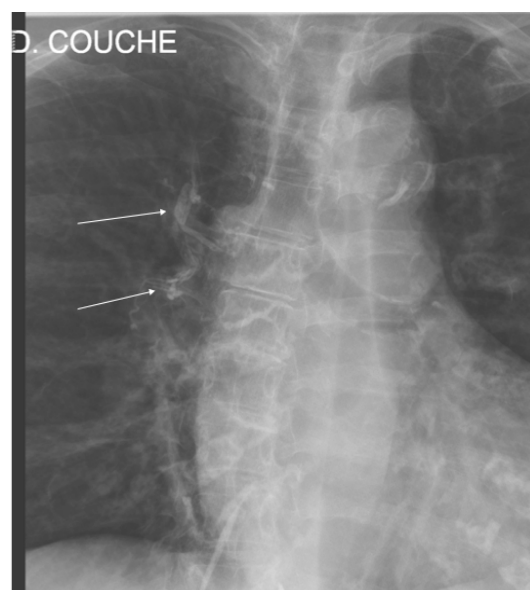
Figure 2: Post-operative X-ray showing the cement leakage in T11.



Figures 3: Angioscan showing a pulmonary cement embolism in the apical segment, medium lobe and ventro-basal segment of the right lung.



Figures 4: Angioscan showing a pulmonary cement embolism in the apical segment, medium lobe and ventro-basal segment of the right lung.

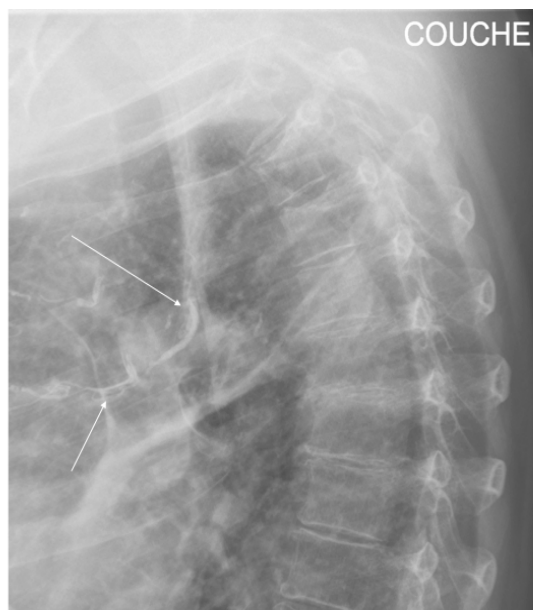


Figures 5: chest X-ray showing cement in the pulmonary vessels. A good way to get an earlier diagnosis.

Discussion

Since 25 years, vertebroplasty has become a current intervention for treatment of pain in osteoporotic vertebral compression fractures. Even if some studies do not find any statistical differences with a non-operative treatment, the majority of studies show a benefit in the decrease of pain and in an early home back [7,8].

However, the rate of pulmonary cement embolism, symptomatic or asymptomatic, varies from 2.1% to 26% according to the screening method after vertebroplasty and kyphoplasty [5]. Today, no studies show a significant bound between the surgical technic and the rate



Figures 6: chest X-ray showing cement in the pulmonary vessels. A good way to get an earlier diagnosis.

of cement pulmonary embolism although there is a statistic bound between cement leakage and asymptomatic cement pulmonary embolism [9]. This could explain the fact that there is no difference between vertebroplasty and kyphoplasty because the rate of cement leakage seems to be similar in our practice [10]. Pulmonary cement embolism follows a cement leakage beyond the peri-vertebral venous plexus. If the cement is too fluid, it can cross the hemiazygos vein, the azygos vein, the inferior vena cava and the pulmonary circulation [11]. Few studies give an interest to the physiopathology of cement leakage during vertebroplasty (their rate varies from 5 to 80% in the literature) but no predictive factors for cement leakage are highlighted. For some authors, the degree of vertebral kyphosis and the absence of avascular necrosis of the vertebral corpse could be bound with cement leakage [12]. For the others, the position of the trocar in the centre of the vertebral corpse could be responsible of leakage across epidural veins [13].

We have some hypothesis for the predictiv factors of cement leakage. The pressure during the injection seems to play a very important role. This pressure is correlated with the cement viscosity and not with the type of material used for the injection [14]. Krebs and al showed in an in-vivo study of measurement of intra-vertebral pressure that the pressure increases with the time of cement polymerization. A way to control this pressure is the opening or the closing of the contra-lateral trocar as it is suggested in the cadaveric study of Baroud et al. [15]. With the new low polymerization cements (high-viscosity), we think that it is necessary to consider the parameters which can modify the intra-vertebral pressure (material for injection, polymerization time and cement viscosity, opening or closing of the contra-lateral troca). Indeed, we think that the association fluidity (low polymerization cement) and high pressure injection is a risk factor of vascular cement leakage and pulmonary cement embolism.

By the way, those epidural venous leaks are not bound with the type of fractures. Clinical symptoms can appear during the surgery but the most often they appear in the days or the weeks following the surgery. They are no specific from the chest pain, dyspnea, cyanosis,

tachycardia, to the acute respiratory distress syndrom (ARDS) [5]. A systematic pulmonary X-ray after surgery could be helpful (Figures 5 and 6) especially for the diagnosis of asymptomatic pulmonary cement embolism (Choe and al found 4.6% of asymptomatic pulmonary cement embolism on systematic pulmonary X-ray in a serie of 65 patients) [9]. Angioscan, performed in emergency in case of symptomatic pulmonary cement embolism, confirm the diagnosis and the spread of the emboly.

A conservative treatment is performed in the majority of cases of symptomatic pulmonary cement embolism with oxygenotherapy and curative anticoagulation in emergency. The most often this treatment allows a complete respiratory function recovering [5]. The curativ anticoagulation is necessary because of the prothrombotic effect of PMMA cement emboly and the endothelial lesions. Sometimes, the evolution is dramatic with the necessity of endovascular embolectomy, in open surgery, or lobectomy because of pulmonary infarction. In case of asymptomatic pulmonary cement embolism in the peripherique vessels a regular follow-up is necessary. To our knowledge, 6 cases of death secondary to pulmonary cement embolism are described in the literature [16,17].

To conclude, pulmonary cement embolism, symptomatic or asymptomatic, is an under-estimated complication of vertebroplasty. The awareness of this complication should allow an earlier diagnosis, which lies on a systematic chest X-ray after the surgery or an angioscan in emergency in case of clinical signs. A treatment should be performed in emergency because of the possibilty of death. An appropriate information and a regular follow-up are necessary so as to avoid a delayed diagnosis in case of respiratory symptoms after the surgery [17].

References

- De Palma MJ, Ketchum JM, Frankel BM (2011) Percutaneous vertebroplasty for osteoporotic vertebral compression fractures in the nonagenarians: a prospective study evaluating pain reduction and new symptomatic fracture rate. *Spine (Phila Pa 1976)* 36: 277-282.
- Mazumdar A, Gilula LA (2010) Relief of radicular pain in metastatic disease by vertebroplasty. *Acta Radiol* 51: 179-182.
- Galibert P, Deramond H, Rosat P, Le Gars D (1987) [Preliminary note on the treatment of vertebral angioma by percutaneous acrylic vertebroplasty]. *Neurochirurgie* 33: 166-168.
- Ma X, Xing D, Ma J, Wang J, Chen Y (1976) Risk factors for new vertebral compression fracture after percutaneous vertebroplasty: qualitative evidence synthesized from a systematic review. *Spine* 38: E713-E722.
- Wang LJ, Yang HL, Shi YX, Jiang WM, Chen L (2012) Pulmonary cement embolism associated with percutaneous vertebroplasty or kyphoplasty: a systematic review. *Orthop Surg* 4: 182-189.
- Magerl F, Aebi M, Gertzbein SD, Harms J, Nazarian S (1994) A comprehensive classification of thoracic and lumbar injuries. *Eur Spine J* 3: 184-201.
- Buchbinder R, Osborne RH, Ebeling PR, Wark JD, Mitchell P, et al. (2009) A randomized trial of vertebroplasty for painful osteoporotic vertebral fractures. *N Engl J Med* 361: 557-568.
- Kallmes DF, Comstock BA, Heagerty PJ, Turner JA, Wilson DJ, et al. (2009) A randomized trial of vertebroplasty for osteoporotic spinal fractures. *N Engl J Med* 361: 569-579.
- Choe DH, Marom EM, Ahrar K, Truong MT, Madewell JE (2004) Pulmonary embolism of polymethyl methacrylate during percutaneous vertebroplasty and kyphoplasty. *AJR Am J Roentgenol* 183: 1097-1102.
- Garnier L, Tonetti J, Bodin A, Vouaillat H, Merloz P, et al. (2012) Kyphoplasty versus vertebroplasty in osteoporotic thoracolumbar spine fractures. Short-term retrospective review of a multicentre cohort of 127 consecutive patients. *Orthop Traumatol Surg Res* 98: S112-119.
- Groen RJ, du Toit DF, Phillips FM (2004) Anatomical and pathological considerations in percutaneous vertebroplasty and kyphoplasty: a reappraisal of the vertebral venous system. *Spine* 29: 1465-1471.

12. Tome-Bermejo F, Pinera AR, Duran-Alvarez C, Lopez-San Roman B, Mahillo I (1976) Identification of Risk Factors for the Occurrence of Cement Leakage During Percutaneous Vertebroplasty for Painful Osteoporotic or Malignant Vertebral Fracture. *Spine*.
13. Kaso G, Horvath Z, Szenohradszky K, Sándor J, Doczi (2008) Comparison of CT characteristics of extravertebral cement leakages after vertebroplasty performed by different navigation and injection techniques. *Acta Neurochir*. 150: 677-683.
14. Krebs J, Ferguson SJ, Bohner M, Baroud G, Steffen T, et al. (2005) Clinical measurements of cement injection pressure during vertebroplasty. *Spine (Phila Pa 1976)* 30: E118-122.
15. Baroud G, Vant C, Giannitsios D, Bohner M, Steffen T (2005) Effect of vertebral shell on injection pressure and intravertebral pressure in vertebroplasty. *Spine (Phila Pa 1976)* 30: 68-74.
16. Krueger A, Bliemel C, Zettl R, Ruchholtz S (2009) Management of pulmonary cement embolism after percutaneous vertebroplasty and kyphoplasty: a systematic review of the literature. *Eur Spine J* 18: 1257-1265.
17. Rothermich MA, Buchowski JM, Bumpass DB, Patterson GA (2014) Pulmonary cement embolization after vertebroplasty requiring pulmonary wedge resection. *Clin Orthop Relat Res* 472: 1652-1657.