

## Spondylodiscitis after Percutaneous Vertebral Cement Injection

Alejandro Blasco, Teresa Bas\* and Paloma Bas

Department of Spine Unit, Hospital Universitario y Politécnico de La Fe, Valencia, Spain

\*Corresponding Author: Teresa Bas, Department of Spine Unit, Hospital Universitario y Politécnico de La Fe, Valencia, Spain.

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### Abstract

**Study Design:** Level IV case series.

**Objective:** To report the clinical findings and the treatment management of the spinal infections after PPCI performed in our center.

**Methods:** We performed a retrospective review of 8 patients with spondylodiscitis after Percutaneous vertebral cement injection (PCCI). Between January 2003 and June 2015 a total of 317 procedures were performed. Postoperative infection occurred in 7 cases and 1 was referred from another institution to be treated of infection (a total of 8 cases were analyzed). Polymethylmethacrylate (PMMA) was used in all cases.

**Results:** From a total of 317 PCCI carried out, at our institution, we found 8 patients with the diagnosis of spondylodiscitis. Mean ASA score among those patients with spondylodiscitis was 2.88 (2-4) and mean CCI was 2.38 (0 - 6). At the time of diagnosis of spondylodiscitis, pain was the main symptom, present in all patients (100%). Antibiotherapy was the first treatment, for all 8 cases. Surgical treatment was planned 7 out of 8 patients (87.5%) as antibiotics alone were unable to control infection. The mean follow-up was 18.87 months (1 - 60), 3 out of 8 patients suffering from spondylodiscitis (37.5%) died during follow-up.

**Conclusion:** Underlying disease can increase the risk of infection. Sometimes, the symptoms are nonspecific and the surgeon must be very suspicious. Surgery is not always the initial treatment but usually requires extensive anterior approach debridement, reconstruction and fixation.

**Keywords:** Spondylodiscitis; Percutaneous Vertebral Cement Injection

### Introduction

Percutaneous vertebral cement injection (PCCI) is a safe procedure used to treat painful vertebral compression fractures, vertebral malignancy and painful hemangiomas [1]. The main complications following PCCI are: cement leakage, rib fractures, epidural hematoma, pulmonary and paradox cerebral embolism, fractures of adjacent vertebra, proximal junctional kyphosis and infection [2,3]. The complication rates after vertebroplasty (VP) and kyphoplasty (KP) are between 1 - 3% [3]. Infection subsequently to PCCI is a rare but devastating complication. The infection rate after PCCI in different series stands between (0.5% - 1.9%) [4,5].

### Objective

To report the clinical findings and the treatment management of the spinal infections after PCCI performed in our center.

### Methods

We performed a retrospective review of 8 patients with spondylodiscitis after PCCI. Between January 2003 and June 2015 a total of 317 procedures were performed in that period of time: 123 KP at the orthopedic department and 194 at the Radiology department (33 KP, 152 VP and 9 Vesselplasty). Postoperative infection occurred in 7 cases and 1 was referred from another institution to be treated of infection (a total of 8 cases were analyzed). Polymethylmethacrylate (PMMA) was used in all cases. Among those PCCI infected, Kyphoplasty was performed in 2 cases and Vertebroplasty in 6 cases. This series included 5 females (62.5%) and 3 males (37.5%). The mean age was 66.13 years (range 45-82 years). The underlying pathology was osteoporotic fracture in 7 cases and metastatic breast cancer in 1 case.

Inclusion criteria (Figure 1) were patients treated in our hospital with vertebroplasty, kyphoplasty and vesselplasty. We focused on spine deep infections after these procedures using ICD-10 codes for osteomyelitis (ICD-10-CM M86.9), discitis (ICD-10-CM Code M46.40) and epidural abscess (2016 ICD-10-CM Code G06.2). We excluded those patients with lost follow-up, infections not related to these procedures and superficial infections. We performed a revision of charts searching for comorbidities and risk factors (Table 1) and the Charlson Comorbidity Index (CCI) and the American Society of Anesthesiologists Score (ASA). Physical examination, blood tests, including CRP and ESR, were review pre and postoperatively. Preoperatively, radiograph and magnetic resonance imaging were routinely carried out. Computed tomographies were conducted to assess bone destruction and posterior wall disruption. Outpatient's visit follow-up was arranged after 3, 12 and 24 months. When spondylodiscitis was suspected, a CT-guided biopsy was performed prior to antibiotics. In our series CT-guided biopsy was performed previous to surgery in 6 cases.

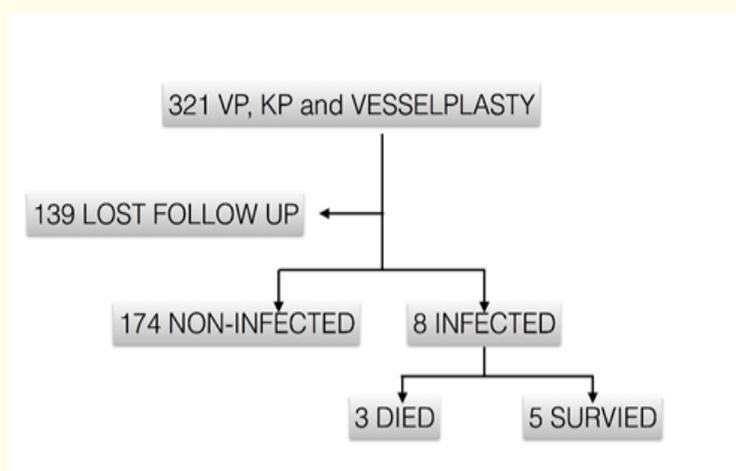


Figure 1

Case	Age	Sex	Level	Interval (VP/Kp to Surg)	CRP/ESR	ASA score	CCI score	Comorbidities	Surgery	Culture	Biopsy	Follow-up
1	60	F	KP LI	2 mo	154.6/80	ASA 2	0	HBP, Steroid, Osteoporosis	Posterior (360°)	S. epidermidis	Acute inflammation	12 mo
2	82	M	KP 112	4 mo	5.7/45	ASA 3	2	HBP, Surgery (Retroperitoneal sarcoma)	Ant + Post	Negative	Acute inflammation	36 mo
3	76	F	KP T10-11	NO	49/25	ASA 3	3	HBP, CAD, Renal transplantation, Hypothyroidis, recurrent UTI	NO	Negative. S. Mites (blood)	Acute inflammation	2 mo (exitus)
4	54	F	VP 112	5 mo	53/74	ASA 3	1	HBP, PMS, Steroid, Osteoporosis, DL	Ant + Post	Negative	Acute inflammation	60 mo
5	62	M	KP LI	23 mo	1.6/5	ASA 4	4	Hcv, Ictus	Ant	Negative	No inflammation	1 mo (exitus)
6	68	M	KP LI	1 mo	o 39.6/No	ASA 2	2	Huntington Corea, DL, CAD	Ant + Post	Staph. capitis	Chronic inflammation	11 mo
7	45	F	VPT9	1 mo	No	ASA 3	6	Breast cancer; Vertebral metastasis Recurrent UTI, HBP, MDD	Ant	Staph coag neg	Acute inflammation	17 mo (exitus)
8	82	F	VP T11	1 mo	61.5/80	ASA 3	1	HBP, Hypothyroidis, DM-1L Obesity, PVD	Post	Enterobacter cloacae multiresist	Acute inflammation and necrosis	12 mo
Mean	66.13			5.28 mo	52.11/51.5	2.88	2.38					18.87 mo

Results

From a total of 317 PVCI carried out, at our institution, we found 8 patients with the diagnosis of spondylodiscitis. The mean interval between index PVCI and surgical treatment remained 6 months (1 - 23 months) (Table 1). At diagnosis of spondylodiscitis, pain was present in all patients (100%) and was the main symptom referred. Mean preoperative C-Reactive protein (CRP) was 52.11 mg/l (1.6 - 154.6) and mean preoperative erythrocyte sedimentation rate (ESR) was 51.5 mm/h (5 - 80). Mean ASA score among those patients with spondylodiscitis was 2.88 (2 - 4) and mean CCI was 2.38 (0 - 6). In 6 patients a CT-guided biopsy was performed previous to surgery (5 showed negative culture results and 1 positive to negative-coagulase *Staphylococcus*).

Antibiotherapy was the first treatment, for all 8 cases. Surgical treatment was planned 7 out of 8 patients (87.5%) as antibiotics alone were unable to control infection. Debridement and stabilization was performed: through anterior approach alone in 2 patients (thoracotomy), 3 patients were treated through combined anterior (toracolumbotomy) and posterior approach (Figure 2) and 2 patients were treated via posterior approach alone (corpectomy through posterior approach) (Figure 3). All patients undergoing surgical treatment achieved bony fusion. The vertebral levels involved were L1 in 3 times, T12 twice and once T9, T11 and T10-11.

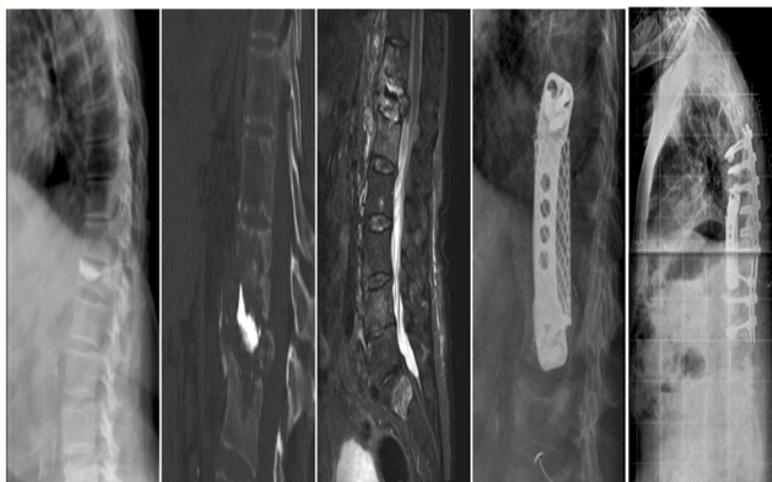


Figure 2

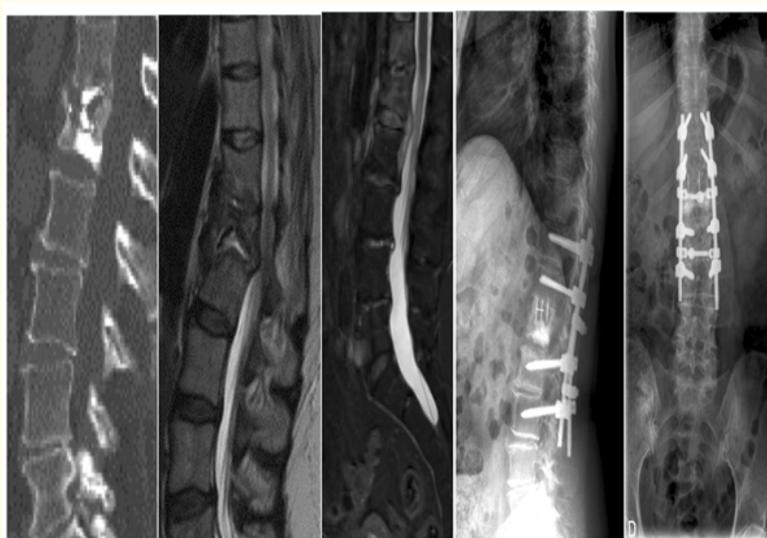


Figure 3

If operation was needed, we took at least 3 to 5 tissue samples from the infected vertebrae for both, microbiologic and anatomopathologic studies. Microbiologic specimens were cultured aerobically and anaerobically for at least 10 days. Culture media is examined for growth of both, high-grade pathogens (*Staphylococcus aureus*) and low-virulence organisms (*Propionibacterium* spp., *Corynebacterium* spp.). We ruled out as well, mycobacteriae and fungus. Intraoperative cultures were performed in 6 patients: 2 were negative, 1 was positive to *Staphylococcus epidermidis*, 1 was positive to *Staphylococcus capitis*, 1 was positive to negative-coagulase *Staphylococcus* and 1 was positive to multi-resistant *Enterobacter cloacae*. Intraoperative bone biopsy was taken as well, and histological examination showed inflammatory cells in 6 cases, chronic inflammation in 1 case and no evidence of inflammation or malignancy was observed in 1 case.

The mean follow-up was 18.87 months (1 - 60), 3 out of 8 patients suffering from spondylodiscitis (37.5%) died during follow-up. Patient 3 died 2 months after diagnosis (renal transplantation), patient 5 died a month after surgery (ASA score 4 and Hepatitis C virus), and patient 7 died 17 months after surgery (related to generalized breast cancer metastasis).

## Discussion

Infection is an uncommon but scary complication of PPCI [6]. Underlying diseases increase the risk of infection (immunosuppression, cancer disease, urinary tract infection, diabetes, renal insufficiency or steroid treatment) and the surgeon must be aware of that before PPCI, it is essential to rule out potential active infections [4]. Since most vertebral compression fractures affect elderly population with associated diseases, it can increase vital risk. In a systematic review and meta-analysis of balloon kyphoplasty, the overall mortality was 4.4%, and the perioperative mortality was 0.13% [7]. The infection rate after vertebral cement injection, in different series, is contained between (0.5% - 1.9%) [4,5]. From 2003 to 2015, a total of 317 PPCI were performed at our institution, and we found 8 patients diagnosed with spondylodiscitis (2.52%). We found that thoracolumbar junction (T12-L1) is the most frequent infected region after PPCI (5 of 8; 62.5%).

In our series, 3 out of 8 patients with spondylodiscitis (37.5%) died during mean follow-up of 18.87 months (1 - 60). ASA score and CCI have been previously related as predictors of complications after spinal surgery, of mortality after vertebral compression fracture, and as prognosticators of higher readmission rates in orthopedic surgery [8-11]. In our series, mean ASA score among those patients with spondylodiscitis was 2.88 (2 - 4) and mean CCI showed 2.38 (0 - 6). We found a tendency for a higher mean ASA score among those patients with spondylodiscitis who died than in those who did not (3.33 Vs. 2.6). We also found a tendency for a higher CCI among those patients suffering from spondylodiscitis who died than in those who did not (4.33 Vs. 1.2). In 2013, Lavelle found the ASA score as a predictive of mortality in a surgical population, while CCI was highly predictive of mortality in a non-surgical population. In 2014, Nota, *et al.* [12] found a mean CCI of 2.9 (0 - 15) in those patients who met Centers for Disease Control and Prevention surgical site infection criteria, while a mean CCI of just 1.7 (0 - 14) was only found in patients who did not meet these criteria ( $p < 0.001$ ). They found as well, an independent association between obesity, and posterior surgical approach, with a higher risk of infection in each of the three definitions of surgical site infection, they were using. We did not use cement with antibiotic in any case. However some authors argue that when practicing PPCI in patients with high risk of infection (e.g. ASA score or CCI), the use of antibiotic cement and prolonged perioperative antibiotic prophylaxis should be considered, in order to avoid infectious complications [13,14].

The symptoms of spondylitis after PPCI are nonspecific and the medical practitioner must be very suspicious on new onset back pain after certain asymptomatic period, following VP or KP. In our series, pain was present in all patients (100%). New onset back pain PPCI should be considered a sentinel sign of pyogenic spondylitis [4]. At this point, an analysis of ESR and CRP levels and blood cultures should be completed, together with X-rays, CT scan and MR tests to clearly define the situation. In our study, the mean interval between index procedure and surgery was 5.37 months (1 - 23 months), compared to 12.3 months in the series of Shin, *et al* [4] in 2008. In our series, negative cultures were found in three cases (42.85%). In a bibliography review, 3 out of 10 (30%) reported cases on pyogenic spondylitis following vertebroplasty, no bacteria were detected [14]. VATS, *et al.* [6] pointed out that polymerase chain reaction (PCR) is very helpful for diagnosing infections with long-lasting and unaccounted-for pain, after cement infection with inconclusive imaging studies and no organisms cultured from biopsy.

Conservative treatment together with antibiotics is the first step in the treatment of vertebral infections. But, in spondylodiscitis after percutaneous cement injection, that more often than not produces vertebral destruction and instability, and usually happens in patients with comorbidities, surgery is usually needed. Operative technique may require an extensive anterior approach for debridement and reconstruction using cages with posterior fixation. In an article of Abdelrahman in 2013, of a total of 29 of 36 (80.56%) spondylodiscitis after percutaneous cement injection were treated surgically, 6 of 36 (16.67%) were treated conservatively and 1 patient (2.77%) died before treatment was applied. In our series, 7 out of 8 patients with spondylodiscitis were surgically managed (87.5%) due to the fact that antibiotics alone were unable to control the infection.

The indications for surgery in spondylodiscitis are: neurological deficit, extreme debilitating pain, failure of medical treatment and fulminant sepsis [15,16]. The main line of surgery in cases of infected VP is irrigation, debridement and stabilization [13,16]. The use of spinal instrumentation in immune-compromised patients with pyogenic vertebral osteomyelitis is associated with low risk of long-term recurrent infection [17]. Given that the anterior column is the most commonly affected part, it makes sense to operate via anterior approach, which allows for an adequate debridement and removal of infected tissue. The anterior approach provides direct access to the most commonly affected part of the spine. Nevertheless, posterior instrumentation is mandatory when existing significant kyphosis or deformity, when more than one-level corpectomy is going to be performed or when the thoracolumbar junction is involved [16,18-23].

From the experience of the authors we summarize that:

- 1) In the event of a recurrent back pain after PPCI, a thorough analysis of risk factors and comorbidities should be performed including CRP and ESR analysis and enhanced MRI and CT images to rule out pyogenic spondylitis.
- 2) The main line of treatment of spondylodiscitis after PPCI is surgical debridement and stabilization.
- 3) In a patient with high ASA score or with comorbidities (CCI) we recommend to the use of cement with antibiotics for vertebroplasty or kyphoplasty.

## Conclusion

Infection is an uncommon but scary complication occurring after PPCI procedures, with no negligible mortality associated. Underlying disease can increase the risk of infection. Therefore we should exercise extreme caution, and the use of cement with antibiotics can be a good option. Sometimes, the symptoms are nonspecific and the surgeon must be very suspicious. In the event of surgical treatment, the surgical approach selected has to be individualized: the anterior approach provides direct access to the most commonly affected part of the spine but posterior instrumentation is mandatory when existing significant kyphosis or deformity.

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