Original Article

Percutaneous vertebroplasty in symptomatic hemangioma versus osteoporotic compression fracture

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Abstract

Background: Percutaneous vertebroplasty (PVP) is more commonly used for osteoporotic compression fractures (OCFs) and osteolytic vertebral body tumors. This study aimed to study the differences between OCFs and vertebral hemangiomas (VHs) treated with PVP.

Materials and Methods: Between September 2007 and January 2010, we prospectively treated 28 consecutive patients of OCFs (43 recently symptomatic OCFs) and 24 cases of VHs (26 VHs). We used visual analogue scale (VAS) pain and Oswestry Disability Index (ODI) to evaluate the patients. The followup period in group 1 and 2 were 25.1 months (range 12 - 31 months) and 21.3 months (range 14 - 28 months), respectively. Comparison of means was carried out with the Chi Square Tests, *t*-test, and N Par-Test for multiple comparisons, whenever appropriate. The level of statistical significance was set at $P < 0.05$.

Results: Following PVP the VAS score decreased to 4.57 and 4.17 in group 1 and 2, respectively. The ODI scores were 32.5% and 30%, respectively. This decrease in ODI scores lasted throughout the followup period.

Conclusions: Although the preoperative scores were significantly different between group 1 and 2, there was no significant difference between two groups following the PVP.

Key words: Percutaneous vertebroplasty, osteoporotic compression fracture, vertebral hemangioma

Introduction

Percutaneous vertebroplasty (PVP) for the treatment of symptomatic hemangioma of the C2 was first reported by Galibert and Deramond.[1] Gradually, the technique became widespread, and today it is mainly used for the treatment of osteoporotic compression fractures (OCFs) and also osteolytic vertebral body tumors like vertebral hemangioma (VH), multiple myeloma, lymphoma, or metastatic lesions.[2-6] It is also occasionally used for the treatment of painful Schmorl nodes.[7]

OCFs of vertebral body are common fractures that usually occur in the patients with osteoporosis.[8] They are usually treated nonoperatively with different types of drugs like analgesics, bisphosphonates,[9] calcitonin,[10] and sometimes bracing.[11] In patients who are resistant to this initial treatment for at least 6 weeks, vertebroplasty or kyphoplasty is an invaluable modality.[12]

VHs are common benign spinal tumors (with overall incidence of 10-12% in the general population) but are rarely symptomatic.[13] They are usually discovered incidentally on imaging studies by their characteristic appearance. Prominent vertical striations or honeycomb pattern on plain radiography (due to thickened vertebral body trabeculae) and polka dots appearance on axial computed tomography (CT) are usually diagnostic.[14] These lesions are usually limited to vertebral body and their pathognomonic features on magnetic resonance image (MRI) are increased signal intensity on both T1- and T2-weighted images.[15] In the past, symptomatic VHs were usually treated by radiotherapy, selective arterial embolization, or surgical excision and stabilization. Nonetheless, all of these treatment modalities have documented hazardous complications[16] and currently most specialists prefer to treat these lesions by PVP preceded with or without intralesional ethanol injection.[17,18]

This study compares the clinical efficacy of PVP in the surgical treatment of the patients with OCFs *vs* VHs.

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Materials and Methods

28 patients with OCF and 24 cases with symptomatic VH categorized as group 1 and group 2 respectively, treated prospectively between September 2007 and January 2010, were included in the study.

Group 1 included 28 cases (23 females, 5 males), of mean age of 66.8 years (range 51-90 years; SD = 10.1) with 43 recently symptomatic OCFs (43 fractures in 28 patients). The inclusion criteria in this group were a compression fracture (with intact middle column), local midline pain, and tenderness corresponding to the fractured level, refractory pain of 6 weeks duration not responding to conservative treatment (drugs and brace), age older than 40 years, increased signal intensity in T2-weighted images on MRI, hot spot in technetium^{99m} bone scan in the fracture site, and who have given a written informed consent.

Patients with progressive neurologic deficit, radiologic evidence of neural compression, uncorrectable hemorrhagic disorders, compression fracture due to tumoral involvement or infection, severe vertebral body collapse (more than two third of the primary height loss), fracture line extending to the posterior vertebral body, inability to lie in prone positioning for about 1 hour, presence of osteosclerosis in vertebral trabecular network, or followup period of less than 12 months was excluded from the study.

Group 2 comprised 24 cases (16 males and 8 females) with a mean age of 44.5 years (range 35-52 years; SD = 7.3). In both groups, CT and MRI scanning were routinely performed to determine the anatomical details. In group 2, MRI studies were carried out with and without gadolinium enhancement to differentiate lipomatous lesions from VHs.

Kostuik and colleagues divided Denis 3 columns to 6 lateral columns by a bisecting line. The spine was supposed to be unstable if 3 or more segments were destroyed in vertebral femoral involvement. [Figure 1].[19] Our inclusion criteria for group 2 comprised symptomatic VHs with or without radiologic signs of aggressiveness and silent but aggressive VHs. Aggressiveness was identified by significant (more than 3 segments) or progressive tumoral involvement of the vertebra, extension to the posterior column or neural impingement, significant soft tissue mass, vertebral body fracture, or irregular honeycombed pattern on plain radiographs. Hemangiomas causes neural impingement and/or gross posterior vertebral body cortex destruction were excluded from this study.

In preoperative study, anteroposterior and lateral standing radiographs, technetium bone scan, CT and MRI scanning were done for all patients. A comprehensive clinical examination was carried out and then pain intensity and disability were assessed by a 0 to 10 pain intensity numerical rating scale (visual analogue scale; VAS[20]) and Oswestry Disability Index (ODI),[21,22] respectively. Informed consent was taken from all patients. All operations were performed by the first author (FOK).

PVP was undertaken according to the standard technique described in the literature.[23] If cement distribution throughout the body was unsatisfactory, PVP was also tried from the contralateral side. If cement extravasated or extended to the posterior third of the vertebral body, the injection was stopped immediately [Figure 2]. Particularly in aggressive VHs, it was aimed to fill the lesion almost completely with a bipedicular cement injection [Figure 3].

After surgery, the patient was discharged from the hospital on the same or next day (depending on the severity and duration of the anesthesia). Postoperatively, the Questionnaires were completed again in 2 weeks, 2, 6, 12 months, and on the latest followup visit.

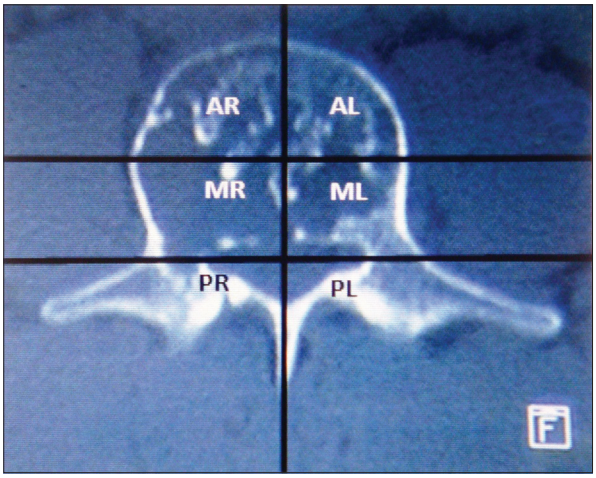

Figure 1: In osteolytic tumoral involvement, the spine is assumed to be unstable if three or more segments are destroyed (AL = Anterior left; AR = Anterior right; ML = Middle left; MR = Middle right; PL = Posterior left; PR = Posterior right)

Figure 2: A 68-year-old female with two levels OCFs at T12 and L2. Note that with only PVP and prone positioning, collapsed T12 was relatively reduced

Statistical analysis

The data were expressed as means standard error of the mean (SEM). The statistical analyses were performed using one- and two-way analyses of variance (ANOVA) with score (i.e., the differences between group 1 and 2) as the dependent factor. Postcomparison of means was carried out with the Chi Square Tests, *t*-test, and N-Par Test for multiple comparisons, when appropriate. The level of statistical significance was set at $P < 0.05$. Calculations were performed using the SPSS statistical package version 11.

Results

The mean followup period in group 1 and 2 were 25.1 months (range 12-31 months) and 21.3 months (range 14-28 months), respectively. Male to female ratio in group 1 and 2 were 5/23 and 16/8, respectively; while the mean age of the cases in group 1 was 66.8 years (range, 49-80 years) and in group 2, 44.5 years (range, 23-59 years) The sex and age distribution were not similar in the groups, statistically.

Table 1 shows the summary of the number and the type (uni- or bipedicular) of PVP and the type of anesthesia used in operations. Overall, we treated 43 vertebrae (28 cases) in group 1 and 26 vertebrae (24 cases) in the other group.

The mean preoperative disability indices and efficacy of the treatment (PVP) were depicted by VAS and ODI in both groups on Table 2. Efficacy of PVP was the amount that PVP could decrease the patient disability indices (preoperative VAS and ODI minus postoperative items). Statistical analysis of preoperative scores showed that there was a significant difference between VAS (and also ODI) in group 1 and 2. Even though there was not any significant difference in the efficacy of PVP in any of the groups, this efficacy remained unchanged throughout the followup period from 2 weeks till 12 months after surgery.

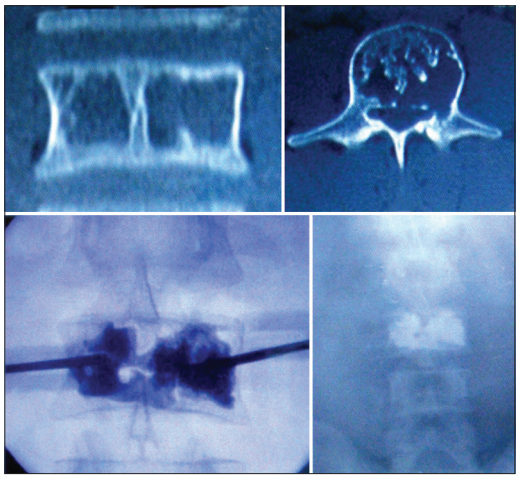

Figure 3: Bipedicular PVP in a patient with aggressive unstable VH

Asymptomatic leakage of cement occurred in 25 vertebrae (11 in group 1 and 14 in the other one). During the followup period, we did not encounter any significant complication (such as adjacent vertebral fracture or neurologic injury[24]).

Discussion

There are no reports comparing the clinical results of PVP in the patients with OCF *vs* VH, but the efficacy of PVP for OCF or VH has been repeatedly reported.[4,12,17,18] Kawanishi *et al*. conducted PVP in 24 cases (30 vertebrae) with OCF and reported that the mean VAS score reduced from 6.9 preoperatively to 1.2 after the surgery (this treatment efficacy is in concordance with our VAS scores in group 1). Before the surgery, only eight patients could walk without any help while after PVP, this increased to 20. Kawanishi concluded that in symptomatic OCF patients, well done PVP can eliminate pain in >90% of the cases.[4]

Muijs *et al*. studied the clinical and radiologic results of 30 patients treated with PVP. They followed up the patients for 36 months and evaluated pain and disability with VAS and SF-36, respectively, and finally reported a significant and lasting mean back pain reduction of 3.1 points in VAS and an overall increase in the quality of life. Prevalence of asymptomatic cement leakage was 81%.[12] This number is double than what we observed in our OCF group (39%).

Guarnieri *et al*., evaluated the efficacy of PVP in 24 patients (36 vertebrae) with symptomatic VH. Two of 24 patients had epidural extension on MRI. The uni- to bipedicular approach ratio was 16 to 6 while in our study, this ratio was 4 to 22. All operations except cervical spine were done under local anesthesia and even upto 5 vertebrae were treated in one session. Similar to our study, their evaluation methods were VAS and ODI. They stated satisfactory results in all the cases that lasted throughout the followup period. Subclinical cement leakage occurred in 4 cases.

Boschi *et al*.[18] confirmed the legitimacy of PVP in the treatment of painful VH. He treated and followed up 24 patients (11 males and 13 females) with only unipedicular approach under local anesthesia. The mean followup period

Table 1: Distribution of Percutaneous vertebroplasty (number and type) and type of anesthesia in group 1 and 2

Group	1 level (%)	2 levels (%)	3 levels (%)	4 levels (2 sessions) (%)	Uni-pedicular (%)	Bi-pedicular (%)	GA* (%)
1	18 (64.3)	6 (21.4)	3 (10.7)	1 (3.5)	32 (74)	11 (26)	9 (32.1)
2	22 (91.7)	2 (8.3)	0 (0)	0 (0)	4 (15)	22 (85)	8 (33.3)

*General anesthesia (in the other operations, local anesthesia was sufficient)

Table 2: Efficacy of treatment in both groups (adjusted by age and sex)

Outcome scale	Preoperative	Mean treatment effect			
		2 weeks	2 months	6 months	12 months
VAS[♱]					
Group 1	6.3 (5-8)	4.57	5.32	5.32	5.00
Group 2	4.5 (2-6)	4.17	4.17	4.33	4.17
P value	0.001	0.353	0.910	0.833	0.894
ODI*					
Group 1	53 (40-70)	32.50	33.64	33.21	32.71
Group 2	31.3 (18-40)	30.00	30.67	30.67	30.67
P value	<0.001	0.285	0.182	0.187	0.6667

[♱]VAS = Visual analogue scale, *ODI = Oswestry disability index

was 5.8 years. This study verified the high efficacy of PVP in these cases without any significant complications.

The limitation of this study is a short followup (max 31 months). In conclusion, we observed no significant difference in the efficacy of PVP in these two groups which remained unchanged during the followup period.

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