

Percutaneous vertebroplasty with or without sclerotherapy for the treatment of symptomatic spinal haemangiomas: study of clinical safety and efficacy

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ABSTRACT

Purpose: To illustrate safety and efficacy of percutaneous vertebroplasty (either solely performed or in combination to alcohol sclerotherapy) for treatment of symptomatic, aggressive vertebral haemangiomas in a series of consecutive patients.

Material and Methods: Institutional database research from 1/1/2010 until 31/8/2020 identified 25 patients with 31 symptomatic, aggressive vertebral haemangiomas suffering from pain with or without neurologic compromise underwent percutaneous vertebroplasty either solely performed or in combi-

nation to alcohol sclerotherapy. When haemangioma was restrained to the vertebral body, percutaneous vertebroplasty was performed as the only treatment technique. When an epidural component was also present causing pressure effects upon the spinal sac, sclerotherapy was additionally performed with alcohol injection at the level of the vertebral pedicles. CT scan assessed implant distribution the morning post therapy and MRI was performed 6 months post. Numeric Visual pain scores (NVS) prior- and post-treatment were compared using Paired Samples t-Test and



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Wilcoxon Signed Rank Test.

Results: Mean pain score prior to any therapy was 8.52 ± 1.388 NVS units. Mean pain score at 12 months post therapy was 1.68 ± 2.445 NVS units. There was a mean reduction of 6.84 ± 3.145 NVS units. The comparison of the patients' self-reported outcomes concerning pain reduction and mobility improvement prior and post therapy was considered statistically significant

($p < 0.001$). No complication was noted.

Conclusions: Percutaneous vertebroplasty (either solely performed or in combination to alcohol sclerotherapy) seems to be a safe and efficient technique for the treatment of symptomatic, aggressive vertebral haemangiomas resulting in significant pain reduction and mobility improvement. Proper patient selection is a prerequisite for high success rate.



KEY WORDS

Spine; Haemangioma; Pain; Vertebroplasty; Sclerotherapy

Introduction

Vertebral haemangiomas are benign, usually asymptomatic tumours which are commonly illustrated as incidental imaging findings in spine cross sectional imaging studies [1-3]. Rarely (in 0.9-1.2% of the cases), vertebral haemangiomas present as an aggressive symptomatic lesion, causing pain and/or neurologic compromise [2, 3]. Pain is usually associated to the presence of a pathologic fracture and collapse of the vertebral body whilst neurologic compromise is usually associated to cord compression, which is more often encountered when the haemangioma has an epidural component [1]. The proposed therapies for symptomatic vertebral haemangiomas include trans-arterial embolisation with liquid agents, open surgery, radiotherapy, percutaneous vertebroplasty, sclerotherapy and direct ethanol injection inside the haemangioma [4].

Galibert and Deramond in 1984 introduced percutaneous vertebroplasty in every day clinical practice reporting the treatment of a painful and aggressive vertebral body haemangioma in the cervical spine [5]. Ever since the technique has evolved and its indications have extended, including osteoporotic, traumatic and pathologic fractures as well as benign and malignant lesions; solidifying the fractured vertebra seems to significantly reduce pain with consequent mobility improvement [6-10]. As far as vertebral haemangiomas are concerned, percutaneous vertebroplasty (with or without sclerotherapy) is indicated in symptomatic lesions (aggressive or not) with or without neurologic compromise [11].

The purpose of this retrospective study is to illustrate

safety and efficacy of percutaneous vertebroplasty (either solely performed or in combination to alcohol sclerotherapy) for the treatment of symptomatic, aggressive vertebral haemangiomas in a series of consecutive patients.

Material and Methods

Institutional Review Board approval was obtained Institutional Review Board of the General University Hospital "ATTIKON" approved the present retrospective study. All patients were informed about the technique itself as well as about possible benefits and complications. Patients signed a written consent form to the procedure and the study. Authors have no conflict of interest to declare.

Patient selection and evaluation

Institutional database research from 1/1/2010 until 31/8/2020 identified 25 patients with a total of 31 symptomatic, aggressive vertebral haemangiomas, suffering from pain with or without neurologic compromise who underwent percutaneous vertebroplasty during the last 10 years, either solely performed or in combination to alcohol sclerotherapy. Instead in cases of haemangioma restrained to the vertebral body percutaneous vertebroplasty was performed as the only treatment technique. When an epidural component was also present causing pressure effects upon the spinal sac, sclerotherapy was additionally performed with alcohol injection at the level of the vertebral pedicles.

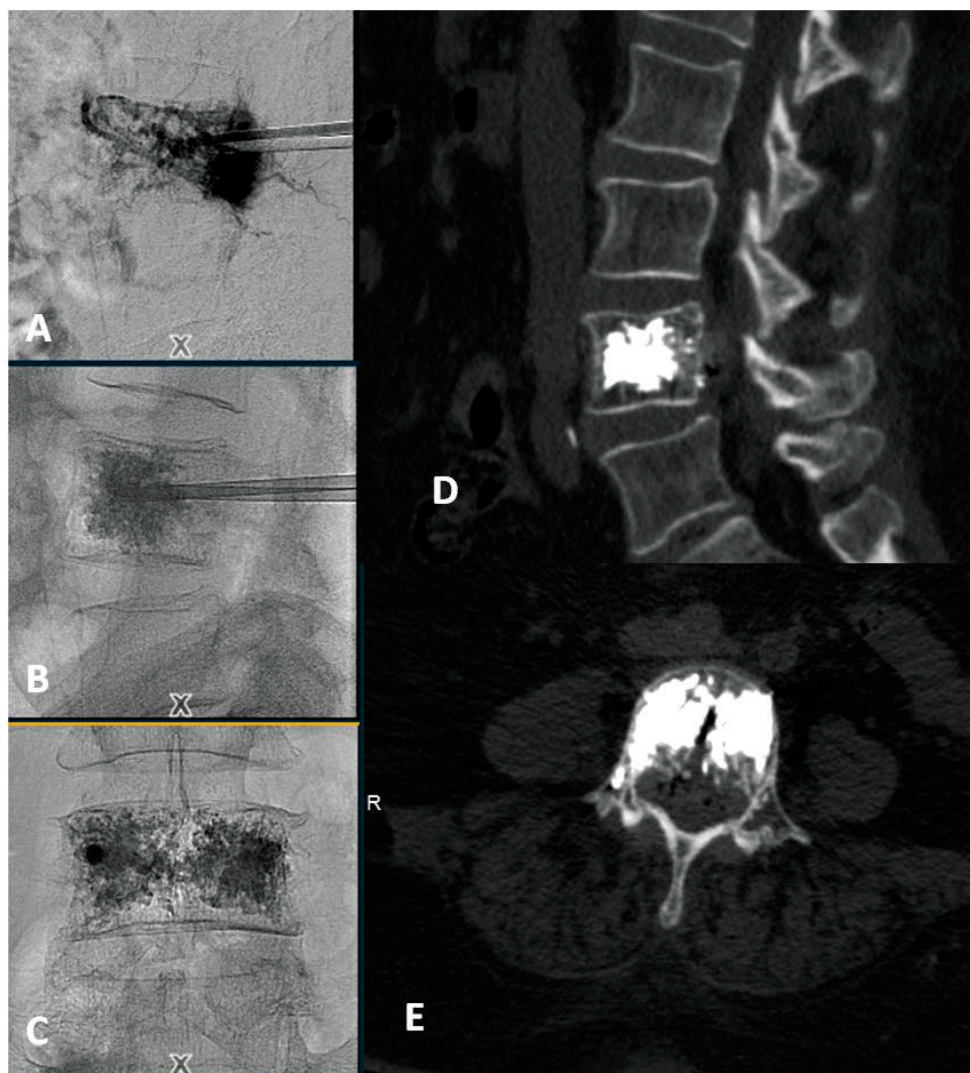


Fig. 1. A 70 year-old female patient with an aggressive L4 haemangioma extending in the anterior epidural space. **A.** Fluoroscopy lateral view-bone trocars are placed just beyond the posterior vertebral wall and alcohol mixed with contrast medium is injected. **B.** Fluoroscopy lateral view-following ethanol injection needles are advanced to the anterior third of the vertebral body and cement injection is performed. **C.** Fluoroscopy postero-anterior view-distribution of cement is bilateral in the vertebral body from upper to lower endplate. **D.** CT sagittal reconstruction illustrating polymer in the vertebral body covering the lesion and air bubbles in the haemangioma's part in the anterior epidural space post sclerotherapy. **E.** CT axial scan illustrating polymer in the vertebral body covering the lesion and air bubbles in the haemangioma's part in the anterior epidural space post sclerotherapy.

Each patient underwent physical examination and coagulation laboratory tests at least 24 hours prior to the percutaneous vertebroplasty ± sclerotherapy session. Evaluation of all imaging studies in correlation with the patients' medical record was performed before each procedure. Pre operational imaging included X-Rays, CT and multiplane MRI (sequences list included T1W-, T2W-, STIR, TIW- fat saturated post Gadolinium IV in-

jection in axial and sagittal plane). Exclusion criteria for the procedure included untreatable coagulopathy, active, systemic or local infections and patient unwilling to consent to the procedure.

Percutaneous vertebroplasty procedure

Preoperative antibiotics (a single dose of Piperacillin + Tazobactam 4g/0.5g) was intravenously administered

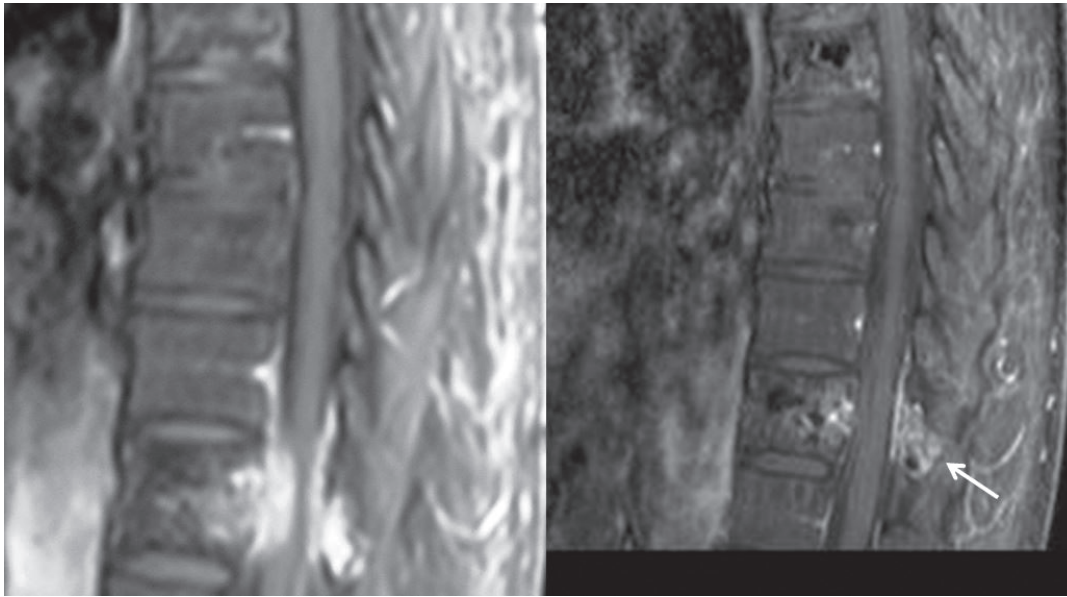


Fig. 2. A 50 year-old male patient with an aggressive T11 haemangioma extending in the anterior epidural space and a second lesion at T6 restrained within the vertebral body. Patient was treated with vertebroplasty + sclerotherapy at T11 level and vertebroplasty alone at T6 level. Fat suppressed contrast-enhanced sagittal T1w MR images prior (left image) and 6 months post (right image) injection, visualise significant reduction of the epidural component and pressure effects. Although significantly reduced in size, limited remnants of the lesion can be noted in the posterior vertebral elements (white arrow) without however any pressure effect.

45-60 minutes prior intervention. Under extensive local sterility, anaesthesiology care, cardiovascular monitoring and fluoroscopic guidance, bilateral trans-pedicular access was performed using 13 Gauge vertebroplasty needles (Cemento plus vertebroplasty system, Optimed Medizinische Instrumente GmbH, Ettlingen/DE). In the cases where the haemangioma was restrained to the vertebral body, percutaneous vertebroplasty was performed as the only treatment technique. Each needle's correct final position in the anterior third of the vertebral body was fluoroscopically verified post injection of a small amount of contrast medium. Then polymethylmethacrylate (PMMA) injection was performed under continuous fluoroscopy. When the epidural component was causing pressure effects upon the spinal sac, with associated neurological symptoms (pain, dysaesthesia and/or motor deficit), and if the Adamkiewicz artery was not stemming from the segment, sclerotherapy was additionally performed with 1 cc of alcohol injection at the level of the vertebral pedicles, mixed with 1 cc of contrast media. Prior to sclerotherapy and alcohol injection, angiographic run post contrast medium injection was performed at the pedicular level to verify

extent and distribution of the haemangioma's vascularity. Then, the session was concluded with standard vertebroplasty and PMMA injection within the vertebral body (**Fig. 1**). Injection goal was to fill as much as possible if not the whole of the vertebral component with PMMA.

CT assessed implant position 24 hours post treatment. Patients remained in the hospital overnight and were then discharged with instructions concerning systemic corticosteroid per os administration for the first week.

Outcome measures

Pain and mobility were recorded prior and the morning post vertebroplasty ± sclerotherapy session with clinical evaluation and an inventory containing a Numeric Visual Scale (NVS). This inventory includes questions concerning the pain itself and its influence upon patient's activity (sleep, occupation and housework, walking) and mobility impairment.

Follow-up consisted of clinical visits (general, clinical and neurological condition, pain reduction and mobility improvement according to NVS scale) at 1 week, 1 month and 6 and 12 months post the treatment session.

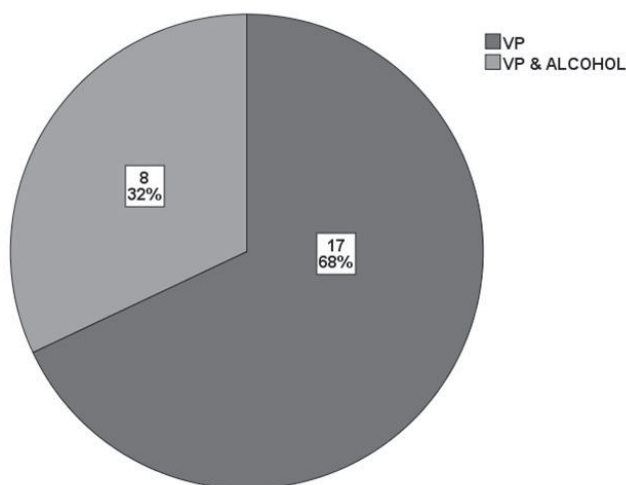


Fig. 3. Chart illustrating vertebral lesions treated with and without sclerotherapy. VP: vertebroplasty

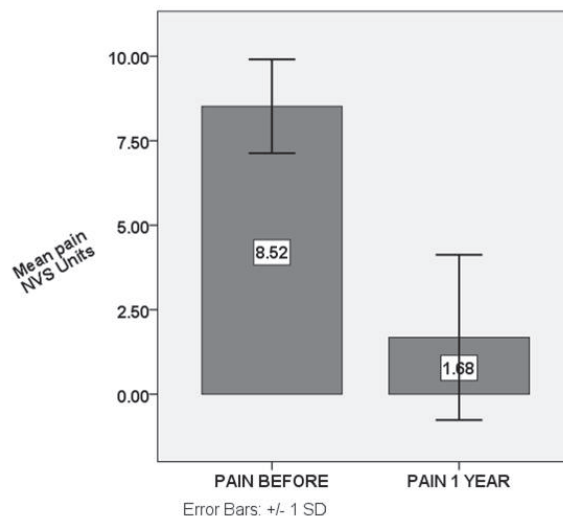


Fig. 4. Chart illustrating mean pain values pre and 1 year post therapy.

MRI was performed at the 6 months follow-up (**Fig. 2**). Questions asked during the follow-up period concerned the pain reduction and mobility improvement and whether the procedure had decreased or totally relieved the symptoms they were treated for.

Mobility evaluation was performed using four criteria: Normal mobility, moderate mobility (painful walking without English canes), limited mobility (mobility with English canes), and very limited mobility (impossible). Complications were graded according to international reporting standards [12].

Statistical analysis

Data were summarised using mean value, median value and Standard Deviation. NVS pain scores prior and post therapy were compared using Paired Samples t-Test and Wilcoxon Signed Rank Test. P values <0.05 were considered to indicate a statistically significant difference. Statistical analyses were performed with IBM SPSS Statistics 21.

Results

All patients completed the 12 months follow-up period. In all patients a radiological satisfactory filling of the haemangioma was achieved. Distribution of the treated vertebral bodies is included in **Table 1**. Concerning treatment type, 17/25 (68%) patients underwent percutaneous vertebroplasty solely performed whilst 8/25 (32%) patients underwent percutaneous vertebroplasty

combined to ethanol sclerotherapy at the level of bilateral pedicles (**Fig. 3**).

Comparing the patient’s scores pre (8.52 ± 1.388 NVS units) and 1 year post (1.68 ± 2.445 NVS units) percutaneous vertebroplasty \pm sclerotherapy session, patients in our study presented a mean decrease of 6.84 ± 3.145 NVS units (**Fig. 4**). The comparison of the patients’ self-reported outcomes concerning pain reduction and mobility improvement prior and post therapy is statistically significant ($p < 0.001$). There was no change or migration of the cement during the follow-up period, assessed by MRI. There were no clinically significant PMMA extra-vertebral leakages noticed. Overall mobility improved in all patients. No clinically significant complications (minor or major) were noted in our study population.

Discussion

Haemangiomas in the spine are classified as cavernous or capillary. Cavernous haemangiomas are the most common subtype and are characterised by venous engorgement with large sinusoidal spaces [1, 3]. Fatty haemangiomas are clinically insignificant and usually asymptomatic findings. Active vertebral haemangiomas may result in symptoms due to impaired trabecular architecture owed to venous engorgement, while presence of an epidural component with compression of dural sac classify them as Aggressive haemangiomas [1, 3]. Epidural extension of the haemangioma along

Table 1. Distribution of the treated vertebral bodies.

Vertebral level	Frequency	Percent
T3	1	3.2
T5	1	3.2
T6	1	3.2
T7	1	3.2
T9	3	9.7
T10	3	9.7
T11	1	3.2
T12	4	12.9
L1	5	16.1
L2	3	9.7
L3	3	9.7
L4	3	9.7
L5	2	6.5
Total	31	100.0

with angiomatous hypertrophy of the vertebral arch and vertebral body ballooning can cause stenosis of the spinal canal, with severe neurological compromise [2]. Surgical options and radiotherapy are limited by high complication rate, related mostly to bleeding and radiation myelopathy respectively [1]. On the other hand the minimally invasive character of percutaneous vertebroplasty renders the technique an attractive replacement therapy governed by high success and low complications rates. Complications such as venous thromboembolism, bleeding, and infection are rare post vertebroplasty due to the technique's minimally invasive nature; the most common complication noted is cement leakage which in the vast majority of cases is minor and asymptomatic [9, 10]. In some cases, sclerotherapy and PMMA injection have to be performed in different sessions because of the opacification of the lesion that makes it difficult to see any cement leakages. Pre-procedural intraosseous phlebography prior is performed to map and evaluate epidural vasculature pre and post embolisation. Digital subtractive angiography (DSA) performed prior to the

vertebroplasty session in order to visualise the Adamkiewicz artery significantly contributes to charting the relationship of the artery to the target lesion. During percutaneous vertebroplasty, haemangioma and the main vascular bed is filled with the PMMA cement, stabilising thus the vertebral body, solidifying the potential fracture and thrombosing the intraosseous vascular component [1, 13]. Whenever a haemangioma extends to the vertebral pedicles an alteration of standard vertebroplasty may be necessary termed pediculoplasty; this technique includes injection of PMMA at the pedicular level and can be performed either with single- or double-needle technique [14]. The intralesional injection of ethanol results in devascularisation and shrinkage of the lesion with subsequent pressure reduction due to thrombosis of the vascular spaces and endothelial destruction, aiming mainly at the epidural component [1, 3]. Fluoroscopy with or without cone beam CT constitutes the ideal guidance method for this combination technique.

Combining percutaneous vertebroplasty and intral- esional ethanol injection is a procedure rapidly performed (total duration is less than 60 minutes) with short hospital stay; patients are discharged the morning after with advices for a prophylactic short course of per os cortisone for 6 days. The recovering of this percutaneous technique is faster and requires no rehabilitation as opposed to regular surgery. The present study adds to the growing number of case series showing that percutaneous techniques constitute an efficacious and safe therapy for symptomatic vertebral haemangiomas [3, 15-23]. Nambiar et al. applied percutaneous vertebroplasty as a stand-alone therapy in 50 symptomatic patients with vertebral haemangiomas reporting good post-procedural outcomes (78% total pain relief) with rare complications such as cement leakage or neurologic injury [21]. Jian applied polymer injection in 8 patients with vertebral haemangiomas at the cervical spine, reporting statistically significant pain reduction (from 6.9 ± 0.6 preoperatively to a final score of 1.2 ± 0.5) concluding that vertebroplasty appears to be an effective and safe treatment for these lesions [15]. Liu et al. retrospectively evaluated 31 patients with vertebral haemangiomas treated with percutaneous vertebroplasty reporting post-therapeutic significant improvement of both visual analogue scale (VAS) and modified Roland-Morris Disability Questionnaire (RDQ) scores

[16]. Tomasian et al. reported 2 cases of vertebral haemangiomas treated with an articulating navigational bipolar RF electrode with 2 active thermocouples embedded along the electrode shaft; there was complete resolution of pain in both cases [22]. Kelekis et al. as well as Degrieck et al. have described selective/direct sclerotherapy using respectively sodium-tetradecyl-sulfate or ethanol application at the compressive epidural components of the vertebral hemangioma [4, 23]. Results of our study reporting significant pain reduction and mobility improvement are in accordance to those reported by other studies in the literature [15-18]. Additionally, there are scarce reports in the literature describing the use of kyphoplasty as an alternative to vertebroplasty for percutaneous management of symptomatic vertebral haemangiomas [18-20].

Limitations of our study include the small patient sample and the lack of a control group which will consist of patients undergoing surgery, radiotherapy or kyphoplasty and will be randomised and prospec-

tively compared. The retrospective analysis and design of our study is another limitation.

Conclusion

Percutaneous vertebroplasty (either solely performed or in combination to alcohol sclerotherapy) seems to be a safe and efficient technique for the treatment of symptomatic, aggressive vertebral haemangiomas, resulting in significant pain reduction and mobility improvement. Proper patient selection is a prerequisite for high success rate. **R**

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Ethical approval

Institutional Review Board of the General University Hospital "ATTIKON" approved the present retrospective study

Conflict of interest

The author declared no conflicts of interest.

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