

Preoperative Sclerotherapy Using Sodium Tetradecyl Sulphate (Fibro-Vein™) Can Assist in the Management of Vertebral Hemangiomas

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Abstract

Vertebral hemangiomas are benign lesions accounting for 2 to 3% of all spinal tumors. They are usually asymptomatic and found incidentally on imaging. Uncommonly, vertebral hemangiomas with significant epidural extension can result in radiculopathy or spinal cord compression. Decompressive surgery with or without stabilization is often required when neurological deficits are present. However, surgery can be associated with massive hemorrhage as these tumors are hypervascular. Preoperative embolization and sclerotherapy are well-known management strategies used to minimize intraoperative bleeding and improve symptoms. Recently, the use of sclerosants such as ethanol has decreased, due to reported complications such as Brown–Sequard syndrome. We describe the use of sodium tetradecyl sulfate (Fibro-Vein™, STD Pharmaceutical, Hereford, UK) as an effective alternative to ethanol in the preoperative management of vertebral hemangiomas. To our knowledge, this has not been previously reported. In three patients, we demonstrated minimal intraoperative blood loss using a combination of preoperative embolization of arterial feeders and sclerotherapy with sodium tetradecyl sulfate to control and secure venous drainage. No patients developed complications related to the procedure. In addition to minimal blood loss, a clear dissection plane was also noted intraoperatively.

Keywords

- ▶ vertebral hemangioma
- ▶ sclerotherapy
- ▶ Fibro-Vein™

Vertebral hemangiomas are benign lesions accounting for 2 to 3% of all spinal tumors.¹ They are usually asymptomatic and found incidentally on imaging.² Uncommonly, vertebral hemangiomas with significant epidural extension can result in radiculopathy or spinal cord compression.² Decompressive surgery with or without stabilization is often required when neurological deficits are present.³ However, surgery can be associated with massive hemorrhage as these tumors are vascular. Preoperative embolization and sclerotherapy are known management options to control intraoperative bleeding.³ Our strategy involves performing angioembolization to

secure the arterial component of the vertebral hemangioma followed by sclerotherapy to control the venous component. Recently, the use of sclerosants such as ethanol has decreased due to the number of reported complications. We describe the use of sodium tetradecyl sulfate (Fibro-Vein™, STD Pharmaceutical, Hereford, UK) as an effective alternative to ethanol in the preoperative management of vertebral hemangiomas.

Case 1

A 36-year-old man presented with bilateral L3 radiculopathies. Symptoms were nonresponsive to medical therapy.

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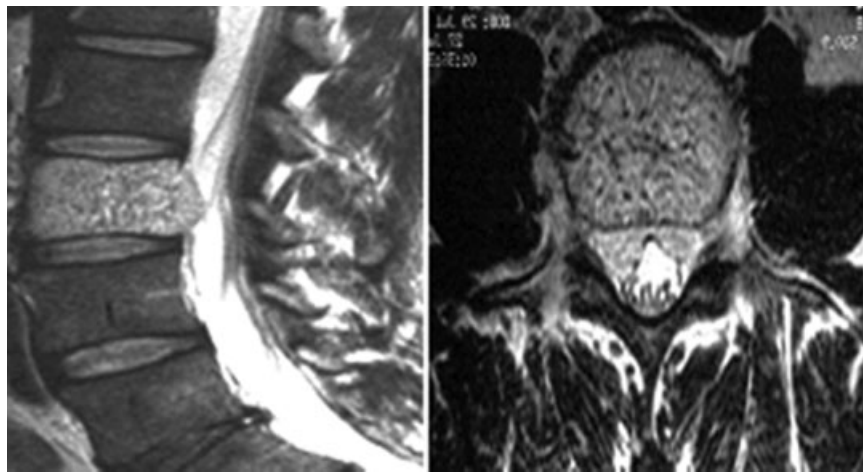


Figure 1 Magnetic resonance image of L3 vertebral body hemangioma with epidural extension.

Magnetic resonance imaging (MRI) demonstrated a multi-compartmental L3 vertebral hemangioma with a bony and large epidural component with compression of nerve roots (**►Fig. 1**). The patient initially underwent a spinal angiogram and a marked vascular supply from the left L3 lumbar artery was noted (**►Fig. 2A**). Polyvinyl alcohol embolization (Con-tour®, Boston Scientific, MA) was performed to secure the arterial component of the hemangioma. The postembolization angiogram demonstrated very little filling in the epidural venous plexus (**►Fig. 2B**). Postembolization computed tomography scan in the arterial and venous phase demonstrated no filling of the hemangioma in the arterial phase (**►Fig. 3A**). However, there was filling in the venous phase confirming need to perform sclerotherapy to manage the venous component (**►Fig. 3B**).

Procedure

The patient was placed in prone position and under fluoroscopic guidance, a 16-gauge bone needle was inserted into the middle of the L3 vertebral body through a left transpedicular approach (**►Fig. 4**). Following confirmation of level, 6 mL of contrast was injected. Stasis of contrast in the vertebral body ruled out any dangerous basivertebral venous anastomosis. Slow progressive injection of 4 mL of sodium tetradecyl sulfate mixed with 4 mL of contrast was

performed leading to a dense staining of the L3 vertebral body.

Two days following sclerotherapy, the patient underwent an L3–4 lumbar laminectomy and decompression of the epidural mass. Intraoperatively, the surgeon reported less vascularity and good surgical dissection plane. The patient had no postoperative transfusion or drop in hemoglobin. MRI after surgery again confirmed the devascularization of the vertebral body component hemangioma secondary to sodium tetradecyl sulfate. At 4-year follow-up, there is no recurrence of the hemangioma on imaging.

Case 2

A 50-year-old woman had 2-year history of worsening bilateral L5 radiculopathy. Her symptoms remained unchanged with multiple cortisone injections and maximal medical therapy. MRI of her lumbar spine revealed a multicompartamental L5 vertebral hemangioma, with a bony and epidural tumor encircling the L5 nerve roots (**►Fig. 5A**). Prior to surgery, she underwent angioembolization confirming marked arterial supply from the left L5 lumbar artery. Micro-coils (Target Therapeutics, Santa Monica, CA) were placed in the left L5 lumbar artery distally due to its anastomosis with the inferior mesenteric artery on angiogram. Following this,

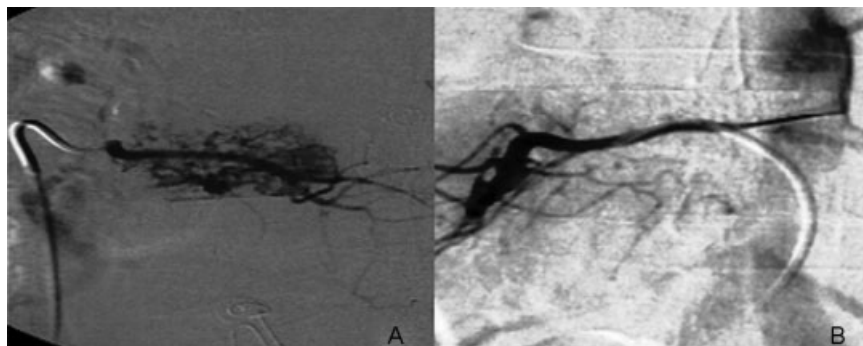


Figure 2 (A) Angiogram of hemangioma supplied by left L3 lumbar artery. (B) Angiogram of no filling after embolization of left L3 lumbar artery.

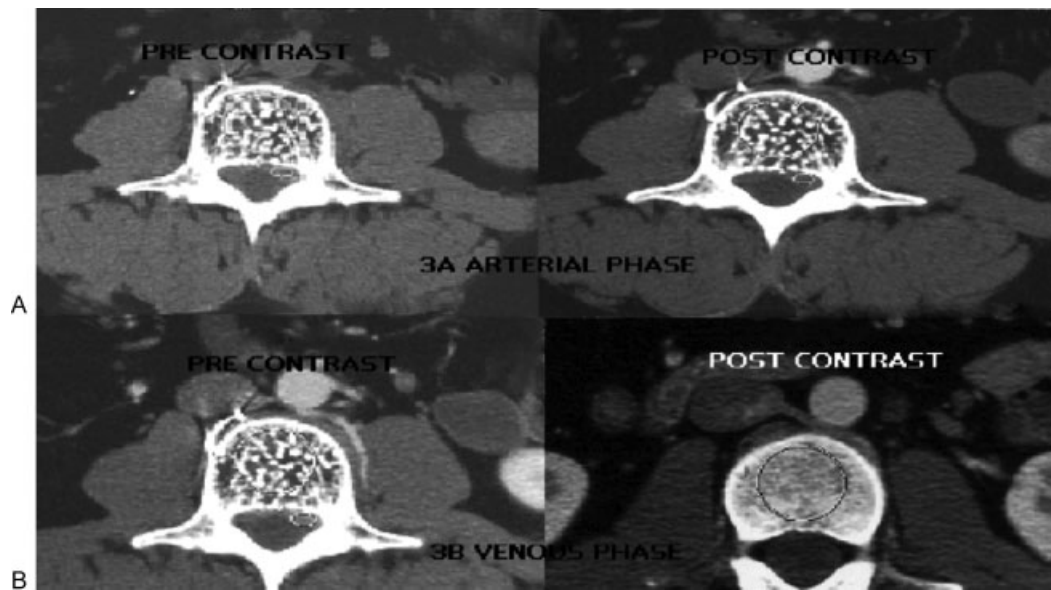


Figure 3 (A) Computed tomography (arterial phase) showing no filling with contrast postangiogram. (B) Computed tomography (venous phase) showing filling with contrast in venous phase.

the patient underwent sclerotherapy of the L5 vertebrae with sodium tetradecyl sulfate. Her sclerotherapy was performed with a transpedicular approach as described in case 1. Post-procedural MRI confirmed devascularization of the vertebral body component of the hemangioma following sclerotherapy (► **Fig. 5B**). There was still uptake of contrast in the epidural component, confirming no dangerous spillage of Fibro-Vein™ into the epidural venous plexus, which can lead to worsening of pain or motor deficits. Two days postprocedure, she underwent an L4–5 laminectomy and poster lateral fusion. There was minimal blood loss intraoperatively, assisting good surgical decompression of the epidural component of the hemangioma. The patient recovered with no postprocedural complications.

Case 3

An 84-year-old man presented with worsening mobility on a background history of a previous thoracic laminectomy performed 2 years previously for vertebral hemangioma. At the time of initial surgery, no preoperative embolization or

sclerotherapy was performed. The patient underwent a T3 to T5 laminectomy, and the vascular epidural mass was debulked. There was extensive intraoperative bleeding.

Repeat imaging showed T4 vertebral hemangioma with a large epidural component. The patient underwent sclerotherapy through a transpedicular approach with sodium tetradecyl sulfate to the T4 vertebral body. A vertebroplasty with

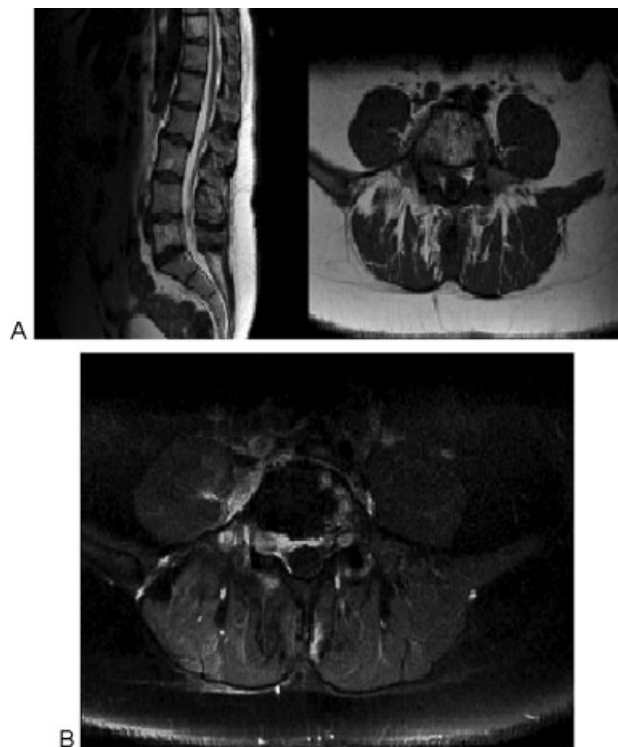


Figure 5 (A) L5 vertebral body hemangioma with epidural component. (B) Less contrast enhancement of hemangioma after sclerotherapy.

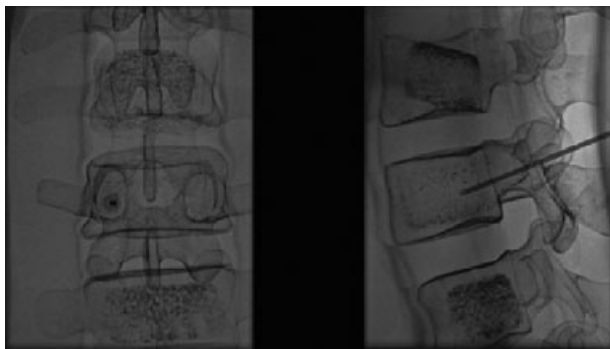


Figure 4 Transpedicular approach.

1 mL of methyl methacrylate was also performed to secure the tract and provide stability to the vertebral body. This was followed by surgery and removal of the epidural component of the hemangioma. There was minimal blood loss in comparison to previous surgery. The patient recovered well with no evidence of recurrence at 2-year follow-up.

Case 4

A 32-year-old man presented with upper thoracic back pain and progressive increase in known T1–T3 vertebral hemangioma under surveillance for 2 years. His MRI revealed a multicompartmental hemangioma with a vertebral body and epidural component at T2. Sclerotherapy was attempted through a transpedicular approach as described previously. There was no stasis of contrast in the vertebral body with extensive filling in epidural and paravertebral venous plexus, suggesting dangerous anastomosis (►Fig. 6). Hence, the procedure was abandoned. Surgery was performed with no preoperative adjuvant therapy. The tumor was noted to be highly vascular but hemostasis was manageable.

Discussion

Vertebral hemangiomas are benign lesions usually of dysembryogenetic or hamartomatous origin.⁴ They are usually identified incidentally in the lower thoracic and lumbar spine on imaging.⁵ They are usually asymptomatic but can present with local or radicular pain and neurological deficits ranging from myelopathy to paralysis.⁵ The reported mechanisms of cord compression include (1) compression of spinal cord from epidural soft tissue mass, (2) expansion of bony elements, (3) compression fracture from involved vertebral body, and (4) epidural hematoma.⁴

The treatment of symptomatic vertebral hemangioma is still controversial.³ There are several options available and multiple modalities have been used on a single patient. The options include surgical decompression, endovascular embolization, radiotherapy, and injection of absolute ethanol or

methyl methacrylate into the vertebral body or a combination of these.^{1,3}

The aims of surgery include bony decompression by laminectomy or vertebrectomy and excision of soft tissue components of the tumor compressing the neural elements.^{3,6} This may need to be combined with instrumentation for stability. Surgery is associated with massive intraoperative blood loss and high risk of epidural hematoma formation due the vascularity of these tumors.² Our preoperative approach is to perform angioembolization to block the arterial component of the tumor followed by sclerotherapy with sodium tetradecyl sulfate to reduce the venous component of this vascular lesion. In select cases, vertebroplasty with methyl methacrylate can be used, if there are any concerns in regards to bony stability following embolization and sclerotherapy.

The commonly used sclerosants in the preoperative management of vertebral hemangiomas include absolute alcohol and 5% ethanol-amine oleate.⁷ There are documented cases of serious complications related to ethanol sclerotherapy such as posttreatment Brown-Sequard syndrome and pathological fracture.⁸ These reports have decreased its popularity since its first use in 1994.⁷

Sodium tetradecyl sulfate is another known sclerosant used in the management of varicose veins and gastroesophageal varices.⁹ Its use is also well documented in the treatment of congenital vascular lesions such as cutaneous hemangiomas and venous malformations in children.⁹ It acts by causing intimal inflammation, thrombus formation, and hence leading to permanent obliteration of the vessel.⁹ O'Donovan et al noted only minor skin ulcerations related to sodium tetradecyl sulfate use in the treatment of symptomatic pediatric hemangiomas and venous malformations.⁹

There is one case report documenting its safety and efficacy intraoperatively in the treatment of vertebral hemangioma.¹⁰ The sclerosant was directly injected into the vertebral body during surgery.¹⁰ Through our preoperative technique, we are able to rule out any dangerous anastomosis, which may potentially lead to extensive sclerosis of the epidural venous plexus. None of our three patients developed any complications related to the procedure or the sclerosant. In addition, minimal blood loss and no blood transfusion were required postoperatively.

Vertebral hemangiomas can be divided into four categories based on clinical manifestations:¹¹

1. Asymptomatic patient with no sign of aggressiveness
2. Symptomatic patient with no sign of aggressiveness
3. Asymptomatic patient with signs of aggressiveness
4. Symptomatic patient with signs of aggressiveness

Guarnieri et al described signs of aggressiveness as hypointensity on T1-weighted MRI and hyperintensity on T2-weighted images with gadolinium enhancement, presence of epidural extension, or cortical erosion due to expansion of the vertebral body.¹¹ There is usually general consensus that category 1 lesions do not treatment and patients with category 3 lesions may need close monitoring with imaging.^{3,11} Vertebroplasty with poly(methyl methacrylate) has been

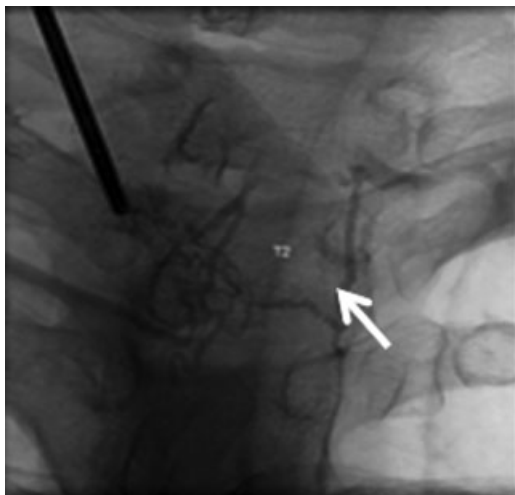


Figure 6 Filling in paravertebral venous plexus.

advocated by some authors as a possible treatment for symptomatic patients with low back pain even in the absence of radiological aggressiveness.¹¹ This concept is controversial and there is no clear consensus. Small studies with limited number of patients report a success rate between 80% and 100% and a complication rate of 1 to 10%.¹² Unlike sodium tetradecyl sulfate, vertebroplasty does not obliterate the hemangioma and progressive expansion into epidural space can cause recurrent cord compression.³ There is also a reported risk of cement leakage into the epidural space causing spinal cord damage.¹² Due to the risk of reexpansion into epidural space and recurrent cord compression, vertebroplasty is not used in the treatment of symptomatic patients with neurological deficits.³ With further study, we believe that sodium tetradecyl sulfate could be used as an alternative to poly(methyl methacrylate) in the treatment of painful noncompressive lesions.

In conclusion, to the best of our knowledge, this is the first reported preoperative use of sodium tetradecyl sulfate as a sclerosant in vertebral hemangiomas. Preoperative embolization in combination with sodium tetradecyl sulfate can greatly reduce the vascularity of these tumors. This leads to reduced need for blood transfusion and improved surgical exposure and outcome. Sodium tetradecyl sulfate can be an effective preoperative sclerosant with some limitations, and our approach can identify the patients likely to benefit from this novel agent.

Disclosures

Omprakash Damodaran, None
Will McAuliffe, None
George Wong, None
Eamonn McCloskey, None
Gabriel Lee, None

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