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Preoperative Percutaneous Injection of Methyl Methacrylate and *N*-Butyl Cyanoacrylate in Vertebral Hemangiomas

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PURPOSE: To investigate the usefulness of preoperative percutaneous injections in vertebral hemangiomas. **METHODS:** Four patients presented with complicated vertebral hemangioma (spinal cord compression in three cases, intermittent spinal claudiction in one case). A three-part treatment was performed: initially, arterial embolization in three cases; 1 day later, percutaneous injections of methyl methacrylate into the vertebral body to strengthen it and of *N*-butyl cyanoacrylate into the posterior arch to optimize hemostasis during surgery; finally, the day after percutaneous injections, decompressive laminectomy and epidural hemangioma excision (when present). **RESULTS:** Laminectomy was performed with minimal blood loss. The epidural component present in three cases was excised without any difficulty. The follow-up (average, 20 months) showed no evidence of vertebral collapse. **CONCLUSION:** Percutaneous injections of methyl methacrylate and *N*-butyl cyanoacrylate might be useful before surgery for vertebral hemangiomas.

Index terms: Hemangioma; Spine, surgery; Interventional materials

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Vertebral hemangioma is a common benign lesion of the spine that is often asymptomatic and discovered incidentally during the evaluation of neck or back pain. Rarely, vertebral hemangioma may be painful and/or aggressive, resulting in spinal cord or nerve root compression (1–6). The treatment of choice for such complication has been surgical decompression with or without postoperative irradiation (1–4, 7–9). However, surgical intervention may be associated with profuse intraoperative bleeding and postoperative epidural hematoma. In addition, acute neurologic deterioration may occur because of vertebral collapse (1–3, 7, 9–14). To minimize these complications, preoperative arterial embolization (13–20) and intraoperative retrograde embolization of the vertebral body with methyl methacrylate polymer (acrylic cement) (12, 13) have been used in some cases.

Over the last few years, techniques of percutaneous vertebroplasty have developed and are used a great deal in some places for metastases, myelomatous lesions, and hemangiomas of the spine (21) (Deramond H, Galibert P, Debussche C, Pruvo JP, Heleg A, Hodes J, "Percutaneous Vertebroplasty with Methylmethacrylate: Technique, Method, Results," presented at the 1990 meeting of the Radiological Society of North America) (Bascoulergue Y, Duquesnel J, Leclercq R, Mottolese C, Lapras C, "Percutaneous Injection of Methyl Methacrylate in the Vertebral Body for the Treatment of Various Diseases: Percutaneous Vertebroplasty," presented at the 1988 meeting of the Radiological Society of North America). This procedure consists of the injection of methyl methacrylate polymer under fluoroscopic control through a needle into osteolytic vertebral bodies. The mechanical properties of this bone cement are caused by its hardening by polymerization, allowing a strengthening of the bone that may prevent vertebral collapse.

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TABLE 1: Clinical features of the four cases and therapeutic association performed

Case	Sex/Age, y	Clinical Findings	Spinal Level	Epidural Extension	Arterial Embolization	Methyl Methacrylate Injection		*N*-Butyl Cyanoacrylate Injection	
						Transpedicular Approach	Quantity	Approach	Quantity
1	F/63	Spastic paraparesis preventing the ambulation T-9 sensory loss Sphincter disturbance	T-8	Present	Yes	Left	6 mL	Right posterior part of body	2 mL
2	F/71	Dorsal pain Spastic paraparesis	T-8	Present	Yes	Left	6 mL	Left lamina Right lamina	1 mL 1 mL
3	M/55	Dorsal pain Spastic paraparesis	T-4	Present	Yes	Left	6 mL	Left lamina Right lamina	1 mL 1 mL
4	M/61	Lumbar pain Intermittent spinal claudication	L-5	Absent	No	Right Left	3 mL 3 mL	Left lamina Right lamina	1 mL 1 mL

N-Butyl cyanoacrylate is a rapidly polymerizing cyanoacrylate plastic used for embolization of intracranial arteriovenous malformations (22, 23). Its percutaneous injection into the hemangiomatous posterior arch to produce thrombosis before surgery could be advantageous, its liquid consistency allowing its diffusion into the epidural hemangioma and its lack of late solidification not making laminectomy difficult. We describe four patients in whom the combination of preoperative percutaneous injections of methyl methacrylate into the vertebral body to prevent vertebral collapse and of *N*-butyl cyanoacrylate into the posterior arch to minimize blood loss during decompressive surgery was performed.

Materials and Methods

Four patients aged 55 to 71 years were referred to our institution for treatment of a complicated vertebral hemangioma. Three patients presented with progressive spinal cord compression and one with intermittent spinal claudication (Table 1). Computed tomography scans performed in each case showed the characteristic honeycombed appearance of a thoracic (three cases) or lumbar (one case) vertebral hemangioma involving the body and the posterior arch. Epidural extension was seen in three cases (Fig 1A). Magnetic resonance imaging performed in three cases demonstrated the highly vascular lesions. Because of the severity of the clinical findings, surgical decompression was undertaken.

The characteristics of both injection materials are given in Table 2. Initially, in three cases, selective catheterization and embolization of the arterial feeders to vertebral hemangioma with dura mater were performed. In the fourth case, selective catheterization was not possible because of tortuosity of the arteries, and no embolization was performed.

One day later, percutaneous injection of methyl methacrylate polymer (Sulfix-6; Winterthur, Germany) into the vertebral body was undertaken to strengthen it. Sedation and analgesia (Funitrazepam, 2 mg; Bupremorphine, 0.2 mg) were given just before the patient was positioned prone on the table. One percentage of lidocaine was used for local anesthesia. A 10-gauge needle was inserted into the vertebral body via a transpedicular route under posteroanterior and lateral fluoroscopic controls. Transosseous phlebography was performed to see the angiomatous network and the venous drainage toward the perivertebral veins and epidural plexus. Then the methyl methacrylate polymer, with tantalum powder added to increase its radioopacity, was mixed until it had the consistency of paste and injected through the needle (Fig 1B). The injection was stopped when the methyl methacrylate filled the vertebral body. The incomplete distribution of methyl methacrylate in one case required an additional contralateral injection. Just after methyl methacrylate injection, percutaneous injection of *N*-butyl cyanoacrylate (histoacryl blue; Melsungen, Germany), tissue adhesive, and liquid embolizing agent was performed to produce thrombosis of the capillary and cavernous channels of the posterior and epidural hemangioma. An 18-gauge needle was inserted into the posterolateral aspect of the vertebral body in one case, and into each lamina in the other three cases. After transosseous phlebography, the *N*-butyl cyanoacrylate (rendered more radioopaque with the addition of iodized oil) was injected under both posteroanterior and lateral fluoroscopic controls (Figs 1C and D). The total duration of the procedure was on average 1.5 hours.

Nonsteroidal antiinflammatory drugs were given after injection to minimize the inflammatory reaction, and stopped 2 to 4 days later (mean, 3 days). A computed tomography scan was performed in each case after injection of methyl methacrylate to assess distribution within

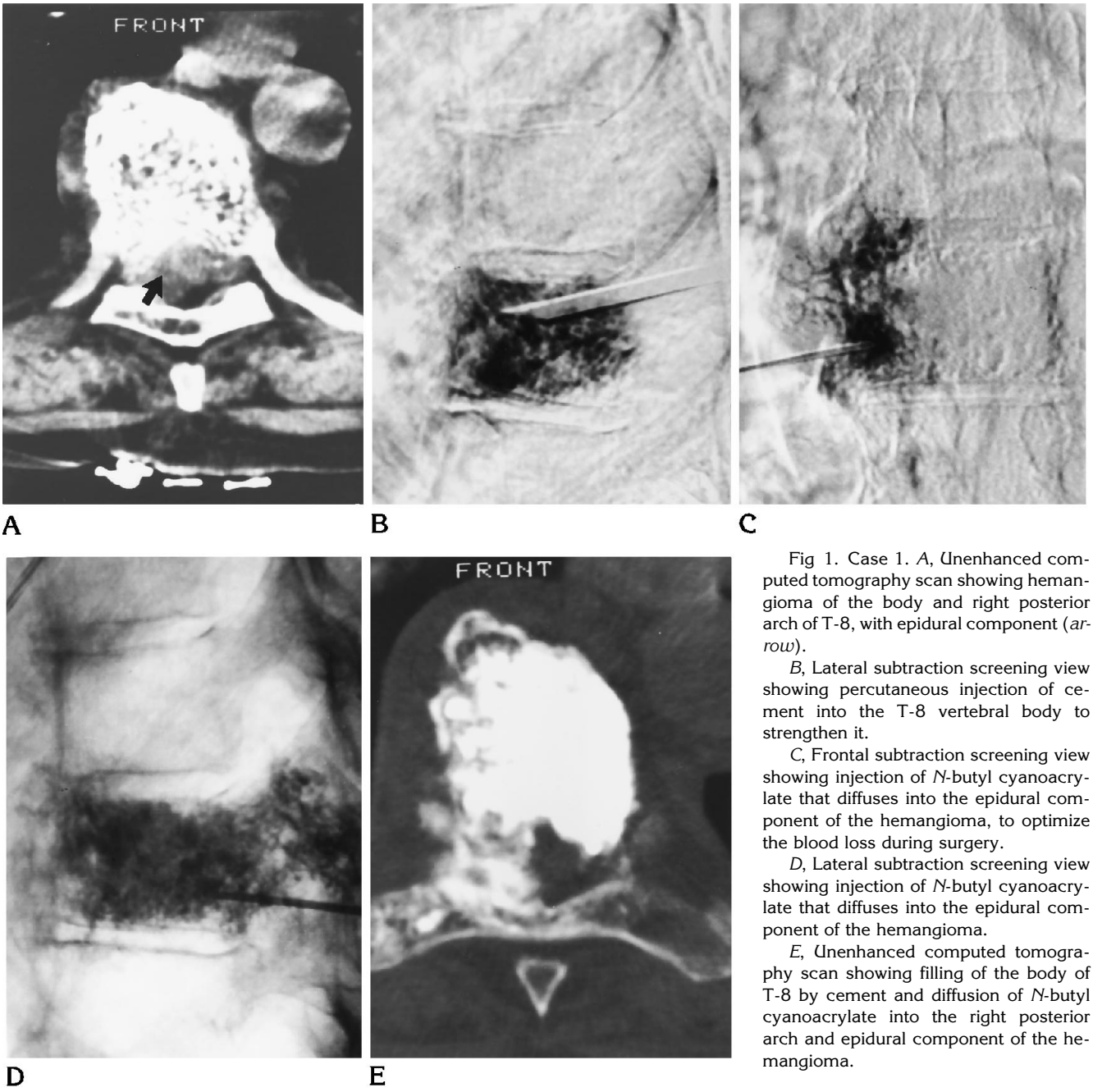

Fig 1. Case 1. *A*, Unenhanced computed tomography scan showing hemangioma of the body and right posterior arch of T-8, with epidural component (*arrow*).

B, Lateral subtraction screening view showing percutaneous injection of cement into the T-8 vertebral body to strengthen it.

C, Frontal subtraction screening view showing injection of *N*-butyl cyanoacrylate that diffuses into the epidural component of the hemangioma, to optimize the blood loss during surgery.

D, Lateral subtraction screening view showing injection of *N*-butyl cyanoacrylate that diffuses into the epidural component of the hemangioma.

E, Unenhanced computed tomography scan showing filling of the body of T-8 by cement and diffusion of *N*-butyl cyanoacrylate into the right posterior arch and epidural component of the hemangioma.

the vertebral body and of *N*-butyl cyanoacrylate within the posterior arch and epidural hemangioma (Fig 1E). Finally, the day after injection, decompressive laminectomy and epidural hemangioma excision (when present) were performed in each case. Radiotherapy was not performed in any case.

Results

No complication was observed during the percutaneous injection of methyl methacrylate and *N*-butyl cyanoacrylate. During surgery, the laminae had a softer consistency than usual for hemangioma, and the laminectomy was performed more easily. The epidural component of the vertebral hemangioma present in three cases had the consistency of paste. It had no vascularization and was excised without any difficulty. In each case, intraoperative blood loss was considered insignificant by the surgeon.

The mean follow-up after surgery was 20

TABLE 2: Attractiveness and differences of each material

	Site of Injection	Aim	Consistency during Injection	Final Consistency	Bore Needle
Methyl methacrylate polymer (cement)	Vertebral body	To prevent the vertebral collapse	Paste	Hard	Large
N-Butyl cyanoacrylate	Posterior arch	To produce thrombosis of the posterior arch and epidural component	Liquid	Paste	Thin

months (range, 8 to 24 months). Follow-up included clinical examination and plain films. In the first case, computed tomography and magnetic resonance imaging were performed 15 days after intervention. In the 15 days after surgery, there was improvement of pain and/or neurologic symptoms in each case. At 4 months, resolution of paraparesis permitted one patient to walk without assistance (case 1). In cases 2 and 3, the patient had no neurologic abnormality apart from mild proximal lower limb weakness. In case 4, the patient was free of symptoms. There was no change in the clinical status of the patients throughout the follow-up period. Follow-up radiographs showed no evidence of vertebral collapse.

Discussion

Vertebral hemangiomas are benign vascular lesions that have been demonstrated in 10% to 12% of spines in large autopsy series (9, 24). Despite their common occurrence and usual benign course, they occasionally behave as aggressive tumors and compress the spinal cord or nerve roots (2–6). The compression may be caused by the expanded vascular bone, epidural tumor extension from the vertebral body or posterior elements, epidural hematoma, a compression fracture of the hemangiomatous vertebra, or anomalous vessels draining or feeding the lesion (1, 2, 7, 9–11, 16, 25, 26). Compression of the anterior radiculomedullary artery may also be associated. The neurologic symptoms caused by the compression may be enhanced by venous congestion, bleeding, and thrombosis within the lesion, in combination with stasis of blood flow in the epidural venous plexus and secondary disturbances of cerebrospinal fluid circulation.

The compression usually requires surgical intervention, but the precise management of aggressive VH is dependent on the spinal level, the location of the lesion within the vertebra, the extent of spinal canal involvement, and the neurologic condition of the patient (1). A laminectomy is usually necessary, associated with excision of any existing soft-tissue component. However, management of these vascular tumors is complicated by the possibility of vertebral collapse if the vertebral body is involved and no surgical consolidation undertaken (7, 12), and the risks of profuse intraoperative bleeding and of postoperative hematoma (1–3, 9–10, 13–14). A procedure allowing a strengthening of the vertebral body and a thrombosis of the hemangiomatous posterior arch and epidural component before surgery is consequently very helpful.

The percutaneous injection of methyl methacrylate into the angiomatous vertebral body may prevent vertebral collapse. This technique was described by Deramond (21) (Deramond et al, "Percutaneous Vertebroplasty. . .") to strengthen the vertebral bodies weakened by hemangiomas, and therefore improve the stabilization of the spinal column. The mechanical properties of this cement are caused by its hardening by polymerization. This acrylic cement injection may also produce partial or complete resolution of spinal pain (21) (Deramond et al, "Percutaneous Vertebroplasty. . .") (Bascoulergue et al, "Percutaneous Injection. . .").

Percutaneous vertebroplasty has the advantage of being a technique that is less invasive than surgical exposure. The transpedicular route is easy to perform for an interventional radiologist and avoids spinal segmental nerve injury. Fluoroscopy during the methyl methacrylate injection allows assessment of its progression and diffusion within the vertebral body. The injection is stopped when the methyl methacrylate is distributed homogeneously and fills the body. This surveillance also allows detection of a posterior leak of methyl methacrylate into the spinal canal or neural foramina, as well as identification of venous drainage, in

which cases injection is immediately stopped. These latter complications most often occur in patients with cortical destruction in whom a fluid cement is injected (21). We decided to use a large bore needle (10 gauge) rather than a thinner one to inject a more solid cement and consequently minimize the risk of leak.

Neither cardiac, pulmonary, or hepatic toxicity nor allergic reaction has been described in cases of percutaneous injection of methyl methacrylate, the injected quantity always being less than that for a hip prosthesis (21–27) (Deramond et al, "Percutaneous Vertebroplasty. . ."') (Bascoulergue et al, "Percutaneous Injection. . ."). Possible thermal damage must be taken into consideration on account of the proximity of the spinal cord and the nerve roots (28). The injection of a nearly solid cement, its cessation in case of posterior leak, and the prescription of antiinflammatory agents should avoid this complication.

This type of methyl methacrylate injection may be an interesting alternative to the other techniques performed to avoid vertebral collapse. It is less invasive than vertebrectomy followed by strut grafting, and may be supervised more easily than intraoperative retrograde embolization with methyl methacrylate (12, 13). However, the potential risk of posterior leak of cement causing worsening neural compression means that this technique should be performed only in a neurosurgic center.

To minimize the risk of profuse intraoperative bleeding and postoperative hematoma, most authors consider the embolization of arterial feeders to the vertebral hemangioma an indispensable preliminary step in the presence of a highly vascular lesion (1, 4, 12, 16). Embolization has even been advocated by some as the sole therapy for spinal cord compression (29–31). However, in spite of the improvement in endovascular techniques, the embolization may be difficult to perform in the case of tortuous vessels (as in case 3) or when the artery of Adamkiewicz arises from the relevant intercostal arteries. Moreover, arterial embolization occludes feeding vessels, but does not destroy the capillary or cavernous channels of the hemangioma. In addition, the reduction of blood loss during decompressive surgery must be optimized in frail or elderly patients, as in our cases. Therefore, to obliterate the residual vascular bed in the three cases that had arterial embolization and as the sole procedure for preoperative hemostasis in the case for which arterial embolization was impossible, we decided to inject a liquid embolizing agent into the posterior elements.

N-Butyl cyanoacrylate is a tissue adhesive used in different specialities, but most frequently for embolization of intracranial arteriovenous malformations (22, 23), for endoscopic sclerotherapy of bleeding oesophageal and gastric varices (32, 33), and for plastic surgery (34, 35). We chose this product because of its low tissue reactivity and toxicity (22, 36), liquid consistency (allowing its injection with a thin needle and possible diffusion into the epidural hemangioma), and lack of late solidification that might make laminectomy difficult. The possibility of pulmonary embolism, secondary to the liquid consistency of the embolizing agent, is minimized by the small quantity injected and its almost instantaneous solidification. Moreover, phlebography performed before the injection allows visualization of the distribution of 1 to 3 mL of injected contrast medium, a quantity more than or equivalent to that of the injected *N*-butyl cyanoacrylate.

At surgery, no significant vascularization was found in the epidural hemangiomas and the posterior arches. Arterial and venous hemostasis was considerated to be complete. Postoperative irradiation may be used to treat the residual hemangioma, but its effectiveness is not uniform (36). Moreover, even if fractionated doses under 4000 cGy are considered to carry minimal risk (37, 38), the potential risk of radionecrosis and skin ulceration leads us to reserve it only for cases of recurrence.

In conclusion, we described four cases in which a combination of percutaneous injections was performed: methyl methacrylate injection into the vertebral body to strengthen it and, because a surgical decompression had to be undertaken, *N*-butyl cyanoacrylate injection into the posterior arch to optimize the reduction of blood loss during surgery. When arterial embolization is impossible, *N*-butyl cyanoacrylate injection might be the sole procedure of presurgical hemostasis. The rarity of aggressive vertebral hemangioma explains the small number of patients in this study and the lack of a comparative study in which preoperative injection is not performed. This small case series causes difficulty in analysis and interpretation of the results, but because intraoperative blood loss in each case was insignificant, preoperative injec-

tion was thought by the surgeon to have been valuable. However, more patients and a longer follow-up are required to confirm the usefulness of these injections.

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References

1. Fox MW, Onofrio BM. The natural history and management of symptomatic and asymptomatic vertebral hemangiomas. *J Neurosurg* 1993;78:36–45
2. Bergstrand A, Hook O, Lidvall H. Vertebral haemangiomas compressing the spinal cord. *Acta Neurol Scand* 1963;39:59–66
3. Krueger EG, Sobel GL, Weinstein C. Vertebral hemangioma with compression of spinal cord. *J Neurosurg* 1961;18:331–338
4. Nguyen JP, Djindjian M, Gaston A, et al. Vertebral hemangiomas presenting with neurologic symptoms. *Surg Neurol* 1987;27:391–397
5. MacAllister VL, Kendall BE, Bull JW. Symptomatic vertebral haemangiomas. *Brain* 1975;98:71–80
6. Mohan V, Gupta SK, Tuli SM, Sanyal B. Symptomatic vertebral haemangiomas. *Clin Radiol* 1980;31:575–579
7. Bell RL. Hemangioma of a dorsal vertebra with collapse and compression myelopathy. *J Neurosurg* 1955;12:570–576
8. Baker NB, Greeenspan A, Neurwirth M. Symptomatic vertebral hemangiomas: a report of four cases. *Skeletal Radiol* 1986;15:458–463
9. Lang EF Jr, Peserico L. Neurologic and surgical aspects of vertebral hemangiomas. *Surg Clin North Am* 1960;40:817–823
10. Blankstein A, Spiegelmann R, Shacked I, Schinder E, Chechick A. Hemangioma of the thoracic spine involving multiple adjacent levels: case report. *Paraplegia* 1988;26:186–191
11. Feuerman T, Dwan PS, Young RF. Vertebrectomy for treatment of vertebral hemangioma without preoperative embolization. Case report. *J Neurosurg* 1986;65:404–406
12. Nicola N, Lins E. Vertebral hemangioma: retrograde embolization-stabilization with methyl methacrylate. *Surg Neurol* 1987;27:481–486
13. Nicola N, Lins E. Vertebral hemangioma: late results of retrograde embolization-stabilization with methylmethacrylate in two cases. *Surg Neurol* 1993;40:491–494
14. Graham JJ, Yang WC. Vertebral hemangioma with compression fracture and paraparesis treated with preoperative embolization and vertebral resection. *Spine* 1984;9:97–101
15. Hemmy DC, Mc Gee DM, Armbrust FH, Larson SJ. Resection of a vertebral hemangioma after preoperative embolization: case report. *J Neurosurg* 1977;47:282–285
16. Benati A, Da Pian R, Mazza C, et al. Preoperative embolization of a vertebral haemangioma compressing the spinal cord. *Neuroradiology* 1974;7:181–183
17. Esparza J, Castro S, Portillo JM, Roger R. Vertebral hemangiomas: spinal angiography and preoperative embolization. *Surg Neurol* 1978;10:171–173
18. MacErlean DP, Shanik DG, Martin EA. Transcatheter embolization of bone tumour arteriovenous malformations. *Br J Radiol* 1978;51:414–419
19. Raco A, Ciappetta P, Artico M, Salvati M, Guidetti G, Guglielmi G. Vertebral hemangiomas with cord compression: the role of embolization in five cases. *Surg Neurol* 1990;34:164–168
20. Gaston A, Nguyen JP, Djindjian M, et al. Vertebral hemangioma: CT and arteriographic factors in three cases. *J Neuroradiol* 1985;12:21–33
21. Deramond H, Darrasson R, Galibert P. Percutaneous vertebroplasty with acrylic cement in the treatment of aggressive spinal angiomas. *Rachis* 1989;1:146–153
22. Jafar JJ, Davis AJ, Berenstein A, Choi IS, Kupersmith MJ. The effect of embolization with *N*-butyl cyanoacrylate prior to surgical resection of cerebral arteriovenous malformations. *J Neurosurg* 1993;78:60–69
23. Vinters HV, Lundie MJ, Kaufmann JCE. Long-term pathological follow-up of cerebral arteriovenous malformations treated by embolization with bucrylate. *N Engl J Med* 1986;314:477–483
24. Reizine D, Laredo JD, Richie MC, et al. Vertebral hemangiomas. In: Jeanmart L, ed. *Radiology of the Spine. Tumors.* Berlin: Springer-Verlag, 1986;73–80
25. Kosary IZ, Braham J, Shacked I, Shacked R. Spinal epidural hematoma due to hemangioma of vertebra. *Surg Neurol* 1977;7:61–62
26. Spill HW, Tijssen CC. Spinal epidural hematoma due to a vertebro-epidural hemangioma. *Clin Neurol Neurosurg* 1989;91:91–93
27. Convery FR, Gunn DR, Hughes JD, Martin WE. The relative safety of polymethylmethacrylate. *J Bone Joint Surg* 1975;57-A:57–64
28. Jefferiss CD, Lee AJC, Ling RSM. Thermal aspects of self-curing polymethylmethacrylate. *J Bone Joint Surg* 1975;57-B:511–518
29. Gross CE, Hodge CJ Jr, Binet EF, Fricheff J. Relief of spinal block during embolization of a vertebral body hemangioma: case report. *J Neurosurg* 1976;45:327–330
30. Heckster REM, Endtz LJ. Spinal-cord compression caused by vertebral haemangioma relieved by percutaneous catheter embolization: 15 years later. *Neuroradiology* 1987;29:101
31. Heckster REM, Luyendijk W, Tan TI. Spinal-cord compression caused by vertebral haemangioma relieved by percutaneous catheter embolization. *Neuroradiology* 1972;3:160–164
32. Feretis C, Tabakopoulos D, Benakis P, Xenofoutos M, Golematis B. Endoscopic hemostasis of oesophageal and gastric variceal bleeding with histoacryl. *Endoscopy* 1990;22:282–284
33. Labenz J, Borsch G. Successful endoscopic hemostasis of duodenal variceal bleeding with histoacryl. *Endoscopy* 1993;25:194
34. Ellis DA, Shaik A. The ideal tissue adhesive in facial plastic and reconstructive surgery. *J Otolaryngol* 1990;19:68–72
35. Trail IA, Powell ES, Nobel J, Grank S. The role of an adhesive (histoacryl) in tendon repair. *J Hand Surg* 1992;17:544–549
36. Pelz DM, Fox AJ, Vinnela F, Drake CC, Ferguson GG. Preoperative embolization of brain AVMs with isobutyl-2 cyanoacrylate. *AJNR Am J Neuroradiol* 1988;9:757–764
37. Yang ZY, Zhang LJ, Chen ZX, Hu HY. Hemangioma of the vertebral column: a report of twenty-three patients with special reference to functional recovery after radiation therapy. *Acta Radiol Oncol* 1985;24:129–132
38. Faria SL, Schlupp WR, Chiminazzo H Jr. Radiotherapy in the treatment of vertebral hemangiomas. *Int J Radiat Oncol Biol Phys* 1985;11:387–390