

Symptomatic vertebral hemangioma: Treatment with radiotherapy

ABSTRACT

Background: Vertebrae are the second commonest site among skeletal locations affected by hemangioma, but only about one per cent becomes symptomatic throughout the life. Though surgery, intra vertebral injection of various sclerosing agents have been tried in treating this benign process, no general consensus regarding management has been reached. Radiotherapy is emerging as a low cost, simple, non-invasive but very effective modality of treatment of symptomatic vertebral hemangioma.

Aim: This study aims to find out the role of external beam radiotherapy in alleviating the symptoms of symptomatic vertebral hemangiomas without compromising the quality of life.

Materials and Methods: Seven consecutive patients with symptomatic vertebral hemangioma were treated with a fixed dose of external beam radiotherapy; and muscle power was assessed before, after treatment and during follow-up.

Results: All patients showed improvement of muscle power, which increased with the passage of time. Pain relief with improvement of quality of life was obtained in all the patients.

Conclusion: Effect of radiotherapy on vertebral hemangioma is dose-dependent and the dose limiting factor is the spinal cord tolerance. In the present era of IMRT, greater dose can be delivered to the parts of vertebra affected by the hemangioma without compromising the spinal cord tolerance and expected to give better results.

KEY WORDS: Radiotherapy, symptomatic vertebral hemangioma, vertebral hemangioma

INTRODUCTION

Haemangiomas are benign slow growing vascular tumors that may occur anywhere in the body including bone. Vertebral hemangioma was first described by Virchow in 1867 and characteristic radiological appearances were first noted by Perman in 1926.^[1] The true incidence of vertebral hemangioma is unknown as majority of them are asymptomatic and remain undiagnosed throughout the life. In an extensive autopsy study, Schmorl *et al.*^[2] found the presence of hemangiomas in 11% of the spines. They may be detected as incidental roentgenographic findings or when produce local pain and/or swelling and/or symptoms or signs of spinal cord compression. Only 0.9-1.2% of the vertebral hemangiomas become symptomatic in some part of life.^[3] There is no general consensus regarding treatment modality of the symptomatic vertebral hemangioma. Historically, they were treated by surgery in the form of curettage or total or near total excision of the tumor. But it is often hazardous due to high vascularity. Laminectomy to produce spinal cord decompression, injection of methyl methacrylate or absolute alcohol into the vertebral body, endovascular embolization or any combination of them have been used

with varying degrees of success. Radiotherapy has also been used as an adjunct to surgery and rarely as a sole modality. But no definite dose-response relationship has been described in the literature due to rarity of the tumor. The aim of this observational study was to define the role of radiotherapy in alleviating the symptoms of vertebral hemangiomas with improvement of quality of life.

MATERIALS AND METHODS

From June 2005 to October 2008, seven patients of vertebral hemangioma with varying degrees of spinal cord or nerve root compression and without any prior therapeutic management attended the radiotherapy department. Through clinical examination was done and muscle power was assessed and graded as follows:^[4]

- 0 = Paralysis i.e. No movement.
- 1 = Severe weakness i.e. Movement with gravity eliminated.
- 2 = Moderate weakness i.e. Movement against gravity but not against mild resistance.
- 3 = Mild weakness i.e. Movement against moderate resistance.
- 4 = Full strength.

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Patient characteristics have been shown in Table 1. Out of seven patients, four were diagnosed by plain X-ray showing well circumscribed zone of rarefaction intermingled with axial sclerotic strands. In two patients, in whom plain X-ray was inclusive diagnosis was confirmed by CT scan showing typical 'polka dot' appearance [Figure 1]. In one patient, no definite diagnosis could be reached even by MRI which showed paravertebral mass [Figure 2] and neoplastic or tubercular lesions could not be excluded. Ultimately diagnosis was confirmed by open biopsy. CT scan and/or MRI were done whenever possible, but could not be done routinely in all patients due to their economic constrain. Routine blood examination, X-ray whole spine, X-ray chest and abdominal ultrasonography were conducted in all patients.

Once a diagnosis was reached, informed written consent was taken from all patients countersigned by their immediate relative. Radiotherapy was delivered by direct posterior beam using Cobalt-60 machine. Depth of radiation was calculated from the X-ray or CT scan plates and vertebral levels for treatment delivery were confirmed with the help of C-arm machine. One vertebra above and one vertebra below of the affected vertebra (e) were included within the radiation field.

A dose of 4000 cGy in 20 fractions in 4 weeks was delivered at the midpoint of the vertebral body. Oral dexamethasone at a dose of 24 mg daily in divided doses was started along with radiotherapy and gradually tailored off at the end of radiation to minimize radiation induced edema. Analgesics were given as required; physiotherapy was started as soon as patient's condition permitted and continued even after completion of radiation. Muscle power was assessed at the beginning of radiation, six weeks after completion and thereafter at three months interval for the first year and six months interval thereafter during follow-up.

RESULTS

Out of seven patients, five were female and two male. Dorsal vertebra was affected in five patients, lumbar in one and both dorsal and lumbar in one. The average age of the patients was 36 years; average duration of symptoms 10.6 months. All patients complained of pain, one had paraplegia, five had paraparesis with varying degrees of muscle weakness and one had swelling of the lower back. All patients had varying degrees of numbness and sensory loss of the lower extremities. Single vertebra involvement was found in four patients and multiple vertebrae involvement in three. Patient characteristics have been shown in Table 1. All patients tolerated radiotherapy quite well without any significant problem. Pain became tolerable from the third week of radiation and from six weeks onwards after completion of radiation, analgesics were no more required in any of them. Muscle power gradually improved but recovery of sensory loss took a rather longer period and was very difficult to assess. Results of muscle power assessment before and after treatment have been shown in Table 2.

Table 1: Patient Characteristics (n = 7)

Patient no.	Age (yrs.) and sex	Vertebral body involvement	Chief symptoms	Duration of symptoms (months)
1	31, Male	D-6	Pain, paraplegia	9
2	39, Female	D-11	Pain, paraparesis	7
3	46, Female	L-1	Pain, swelling	18
4	42, Female	D-7 and 8	Pain, paraparesis	13
5	44, Male	D-5	Pain, paraparesis	4
6	33, Female	D-10 and 11	Pain, paraparesis	11
7	17, Female	D-12, L-1,2,3	Pain, paraparesis	12



Figure 1: CT Scan of vertebral hemangioma showing Polka Dot appearance



Figure 2: MRI of vertebral hemangioma showing paravertebral mass

Table 2: Muscle power assessment (n = 7)

Patient no.	At the beginning of therapy	At 6 weeks	At 6 months	At one year	At two years of completion of therapy
1	0	1	3	3	3
2	2	3	3	4	4
3	3	3	4	4	Lost from F. up
4	2	2	2	3	3
5	1	1	2	Lost from follow up	-
6	1	2	3	3	Not yet reached
7	2	3	4	Not yet reached	-

DISCUSSION

Hemangiomas are benign slow growing vascular tumors composed of newly formed capillary, cavernous or venous blood vessels. Among skeletal locations, vertebrae are second commonest site and thoracic spine is affected most frequently.^[5] In the present series, five out of seven vertebral hemangiomas were of thoracic origin. Most of the hemangiomas are asymptomatic and remain undetected throughout the life. The initial complaints of the patients with symptomatic vertebral hemangiomas are localized pain and muscle spasm. Neurologic complications may dominate the clinical picture with compression of the nerve root, spinal cord or the cauda equina. Around one per cent of the vertebral hemangiomas produces symptoms due to spinal cord or root compression. Symptomatic hemangiomas of the vertebral bodies associated with neurologic manifestations are usually located in the mid thoracic region, where diameter of the spinal canal is also small. Cord compression is more likely to occur with lesions that extend into the pedicles and laminae of thoracic vertebra where cord occupies most of the volume of the spinal canal.^[6] Sometimes, cord compression may occur due to (i) Expansion of the involved and therefore enlarged, deformed vertebra encroaching upon the spinal cord (ii) Extension of the tumor into the extra dural space (iii) Extra dural hematoma and (iv) Rarely due to compression fracture of the involved vertebra. Out of the seven cases of the present series, in four, spinal cord compression occurred due to expansion of the vertebra and in three it was due to extension of the tumor in to the extra dural space.

Usually, vertebral hemangiomas are diagnosed by plain X-ray showing axial sclerotic strands produced by vertical trabeculae reinforced by new bone formation between areas of rarefaction. These thick vertical trabeculae may make the affected vertebra stronger than the adjacent normal ones and therefore, vertebral collapse is rare in vertebral hemangiomas. Collapse of a vertebral body in one case was described by Bergstrand *et al.*^[7] in which, one intervertebral foramina was also enlarged due to extension of the hemangioma along a nerve root. Sometimes, the bony contour extensively expanded with coarse radiating trabeculae of bone running parallel to the vascular channels producing a 'sun burst' appearance. Rarely, involvement of the pedicles may make vertebral end plates 'ill defined' mimicking destruction by metastasis.

In hemangioma, para vertebral soft tissue mass may be

produced due to extra spinal extension of the tumor or of hemorrhage. The inter vertebral disc space usually remains intact but in the presence of a para vertebral mass without specific bony changes the diagnosis is often confused with the more common inflammatory or neoplastic lesions. Myelography gives no specific evidence as to the nature of the lesion but is valuable in showing the position and extent of the tumor compression on the theca. In one of our patients, a large para-vertebral mass was found in whom diagnosis could not be ascertained even by MRI and open biopsy had to be done.

Historically, surgery was the treatment of choice in symptomatic vertebral hemangiomas. The aim was spinal cord decompression and sometimes only partial removal of the tumor. The operation of laminectomy to relieve cord compression may be hazardous in vertebral hemangiomas. Hemorrhage may occur from large vascular channels or from the abnormally dilated veins draining the hemangioma. McAllister *et al.*^[1] reported three cases in which bleeding was considerable and difficult to control, out of eight cases described by him, and high mortality from postoperative shock was a feature of early surgical experiences. They stressed the importance of spinal angiography in vertebral hemangiomas. Where radiological diagnosis is uncertain but hemangioma is suspected, spinal angiography may confirm or exclude the diagnosis. In addition, it shows the extent of the lesion as well as relationship of the blood supply of the spinal cord to the lesion, providing important information for planning the surgical approach. The arteries feeding the tumor are thus located and provided they don't also supply the anterior radiculo-medullary artery, can be occluded to reduce vascularity either by embolisation or by ligation. Occlusion of the feeding arteries alone diminish blood supply sufficiently to reduce the size of the tumor and make operative procedures like decompressive laminectomy or excision of the tumor a much safer one.

Direct injection of ethanol into the vertebral hemangioma causing cord or radicular compression, is a very effective technique to relieve the compression immediately. Doppman *et al.*^[6] injected ethanol directly into the vertebral hemangioma under computed tomographic guidance. They treated 11 patients of whom six were paraplegic and five were suffering from radiculopathy. Five of the six paraplegic patients recovered completely and the sixth one improved considerably. Of the five patients with radiculopathy, two had complete and five had partial relief of pain. After a mean follow up of

40.6 months (excluding the 11th patient), all hemangiomas remained obliterated and all patients maintained their improved status. Two patients developed pathological fracture requiring surgical bracing. But the procedure was very complicated, requiring sophisticated instruments as all patients had to undergo:

1. Magnetic resonance imaging of the involved and adjacent vertebrae to evaluate the aggressiveness of the hemangioma and to demonstrate encroachment of the spinal canal and intervertebral foramina
2. Catheterization of the segmental arteries at the level of the hemangioma and one level above and below the lesion for selective spinal angiography with computed tomography
3. Accurate positioning of the needle tip in a vascular portion of the hemangioma

In a country like India, where most of the Government hospitals suffer from severe infrastructural deficiencies and majority of the patients attending these hospitals are 'Below Poverty Line,' such elaborate and sophisticated procedures are beyond the dream of most of the oncologists.

Murugan *et al.*^[8] report results of 13 patients of vertebral hemangioma treated with various forms of management. However, they stress the importance of CT guided percutaneous transpedicular injection of absolute alcohol. Four patients underwent treatment in this method and three of them improved by one Ranawat grade within the first 48 hours while the fourth who had presented with total cord damage for a period of three months did not show any improvement in motor power or sensory symptoms, but her back pain reduced significantly.

Recently, percutaneous injection of methyl methacrylate into the vertebral body has generated considerable interest.^[9] Methyl methacrylate is an ideal agent to stabilize the vertebral bodies which are at risk of collapse. But leakage of the agent into the draining veins or posteriorly into the spinal canal may be hazardous. Even in a para paretic patient, due to extension of the hemangioma into the spinal canal, methacrylate may fill the intra spinal compartment and may exacerbate the already existing cord compression requiring immediate laminectomy. In addition, when laminae and pedicles are also involved by the hemangioma which is a frequent feature in cord compression, the surgeon may still encounter considerable intra operative bleeding during laminectomy.^[6] To overcome this complication, Cotton *et al.*^[10] have recommended the injection of methyl methacrylate into the vertebral body and N-butyl cyanoacrylate into the laminae and pedicles. Methyl methacrylate strengthens the vertebral body to prevent pathological fracture and cyanoacrylate reduces the intra operative bleeding during subsequent laminectomy. As all the patients of the present study had features of cord or root compression, methyl methacrylate with or without cyanoacrylate could not be used in them for the fear of exacerbation of the existing

situation.

Radiotherapy has produced good results in the treatment of vertebral hemangiomas. McAllister *et al.*^[1] reported the results of treatment of eight patients with vertebral hemangiomas. Of their eight patients, two were treated with surgery alone, four received postoperative radiotherapy also, and the remaining two received radiotherapy alone. Of the two patients who were treated with surgery alone, one died postoperatively and the other, though showed signs of improvement, lost from follow up seven months after surgery. All the six patients who received radiotherapy, either alone or postoperatively, showed good improvement of their symptoms or had no evidence of disease progression after a variable period of follow-up up to 14 years. Suparna *et al.*^[11] reported the retrospective results of six patients of symptomatic vertebral hemangioma treated with external radiotherapy. Four patients had received radiotherapy alone and two had received post operative radiotherapy. Patients were evaluated in terms of symptom relief. Of the four patients who had received radiotherapy alone, complete response was obtained in one, good response in two and partial response in the remaining one patient. The two patients who had receive post operative radiotherapy, showed no response to treatment. However, the radiation dose was variable ranging from 3600 to 4000 cGy in 200 cGy per fraction regimen. Faria *et al.*^[12] treated nine patients with vertebral hemangioma with external radiotherapy only. Only one patient had paraplegia and the rest had back pain of variable intensity which was totally subjective and difficult to measure. The paraplegic patient recovered completely and was 'symptom free' 28 months after radiotherapy. Seven patients had 'no pain' or 'almost no pain' at six to 44 months of follow-up. One patient reported 50% improvement at long term follow-up and only one patient had 'no response,' which had partial collapse of D11 vertebra and was treated for Pott's disease for six months before initiating radiotherapy. Vertebral collapse, though a possibility in hemangioma, is rare and histological diagnosis was never done in the above patient. They used a varying dose of radiotherapy ranging from 3000 cGy in 15 fractions to 4000 cGy in 20 fractions with equivalent results. Yang *et al.*^[13] treated 23 patients suffering from symptomatic vertebral hemangioma with radiotherapy. Five out of seven paraplegic patients recovered sufficiently to be able to walk again. Pain in the back and numbness in the limbs were completely or markedly relieved in 80 and 88% of the patients respectively. Their recommended dose was 3000 to 4000 cGy in four to six weeks. Rades *et al.*^[14] by their L-Q model statistical analysis suggested that a dose of 4000 cGy of radiotherapy in 20 fractions gives good pain relief in symptomatic vertebral hemangiomas. We also have treated our patients with the dose and fractionation as proposed by Rades *et al.* and has obtained good results.

CONCLUSION

The application of radiotherapy in hemangiomas is to

eliminate the abnormal veins and capillaries to reduce the size of the lesion and a known long term effect of radiotherapy is impairment of circulation by causing vascular endothelial damage. Some authors have mentioned the use of radiotherapy as a part of treatment but without any information about the dose and fractionation. Probably, 4000 cGy in conventional fractionation as used by us is the best dose at present, as greater the dose, greater is the vascular damage and it is close to the tolerance level (TD 5/5) of the spinal cord. However, in the present era of Intensity Modulated Radiation Therapy (IMRT) and Image Guided Radiation Therapy (IGRT), higher doses of radiation may be delivered to the involved parts of the vertebrae and may yield improved results without any substantially increased risk of spinal cord damage. But this needs clinical evaluation.

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