Pathological fractures in bone sarcomas

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With the advent of successful chemotherapy regimes, improved imaging techniques and a greater understanding of the behaviour of bone sarcomas, limb salvage surgery has become the standard treatment for local control of most sarcomas (Eckardt et al. 1987, Gebhardt et al. 1989, Ivins et al. 1989). To ensure complete removal of the sarcoma, the lesion plus a "wide margin" of bone and soft tissue must be resected (Simon et al. 1986, Simon 1988).

Traditional contra-indications to limb salvage have included:

1) involvement of major neurovascular bundle,
2) biopsy site complications,
3) involvement of functional motors,
4) skeletal immaturity,
5) pathological fracture.

Most contraindications are now considered 'relative' rather than 'absolute', with new microvascular transplant techniques, growing prostheses and allograft adding to the armamentarium of existing techniques available to the reconstructive surgeon. Pathological fracture remains a difficult problem, but is not necessarily an absolute contra-indication to limb salvage (Jaffe et al. 1987, Scully et al. 1996). The incidence of pathological fracture in osteosarcoma has been estimated at 10% (Coley and Pool 1940, Jaffe et al. 1987).

Fracture occurs when bone is weakened as a result of sarcoma permeation or cortical destruction, as a result of biopsy, or secondary to radiotherapy. In the case of sarcoma, the haematoma is potentially seeded with malignant cells, throughout its extent. There is also potential for metastatic spread of tumour cells that enter the vascular system through ruptured venules and arterioles.

With current chemotherapeutic and radiotherapeutic regimes, there does not appear to be a decrease in survival as a result of pathological fracture in osteosarcoma (Scully et al. 1996) however pathological fracture, complicating sarcoma less responsive to chemotherapy, for example, malignant fibrous histiocytoma, may well result in a reduction of survival. Pathological fracture does not alter the proposed adjuvant regime, but may change the timing of surgery and hence require some rearranging of neo-adjuvant and adjuvant courses.

Treatment

Treatment of the local disease in cases of pathological fracture in proven bone sarcoma, has traditionally required amputation at a point above the most superior aspect of the haematoma (Coley and Pool 1940, Jaffe et al. 1987).

In cases of lesions presenting as a pathological fracture, a routine oncological work up is necessary, including imaging of the lesion and chest, routine haematology and biochemistry. Following staging, a biopsy must be performed. There should be a careful consultation with an experienced pathologist and radiologist prior to biopsy material being examined, as fracture haematoma and callous may have similar histological appearances as osteosarcoma. Following biopsy, standard treatment as detailed below is commenced.

The first priority of management of pathological fracture is stabilisation of the limb. In the setting of malignant sarcoma, internal fixation is not possible as any surgery will only add to the spread of haematoma and hence malignant cells. Plaster casting and traction are therefore methods employed to stabilise fractures whilst further therapy is undertaken.

Routine chemotherapy regimes are begun, and the lesion is staged. Thallium scanning and PET scanning, should be employed in an effort to gauge a potential response to chemotherapy. Regular plain radiographs are taken to ensure maintenance of position and stability of the fracture. Fracture healing may occur during neo-adjuvant chemotherapy, and this has been shown to lend a favourable prognosis (Jaffe et al. 1987).

Following neo-adjuvant chemotherapy treatment, the lesion is re-staged with particular attention being paid to the anatomic extent of the lesion and haematoma. If the lesion and haematoma can be safely resected with a standard oncological wide margin, then limb salvage is possible.

Amputation at the level above the proximal extent of the haematoma, may often be necessary. Consideration must be made to the initial displacement, stability and site of the pathological fracture, prior to embarking on a course of neo-adjuvant chemotherapy, as it may be plainly necessary to proceed immediately to amputation. It is not known whether fracture displacement and instability leads to a worse prognosis.

Despite adequate staging and chemotherapeutic response, there does appear to be a greater local recurrence risk in patients of pathological fractures, than those without (Scully et al. 1996). This will therefore result in a worse outcome (Glasser et al. 1992, Simon 1989).

Conclusion

Pathological fractures through bone sarcomas represent a devastating complication. Prognosis seems to be worsened, both because of increased risk of local recurrence following limb salvage surgery and also as a result of increased risk of metastatic spread of the tumour. With modern therapeutic regimes and fracture stabilisation techniques, although more difficult, limb salvage surgery may be entertained as a possible means of treating the local tumour.

References

Coley G L, Pool J L (1940). Factors influencing the prognosis in osteogenic sarcoma. Ann Surg 112: 1114-28.

Eckardt J J, Eilber F R, Grant T G, et al. (1987). The UCLA experience in the management of stage IIB osteosarcoma: 1972-83. In: Limb salvage in musculoskeletal oncology (Ed. Ennekin W F). Churchill Livingstone, New York, pp 314-326.

Gebhardt M, Goorin A, Traina J, et al. (1989). Long term results of limb salvage and amputation in extremity osteosarcoma. In: New developments for limb salvage in musculoskeletal tumours (Ed. Yamamuro T). Springer Verlag. New York, pp 99-109.

Glasser G B, Lane J M, Huvos A G, et al. (1992). Survival, prognosis and therapeutic response in osteogenic sarcoma. Cancer 69: 698-708.

Ivins J, Taylor W, Golenz H (1989). A multiinstitutional cooperative study of osteosarcoma. New developments for limb salvage in musculoskeletal tumours, pp 61-9.

Jaffe N, Spears R, Eftekhari F, et al. (1987). Pathologic fracture in osteosarcoma. Impact of chemotherapy on primary tumor and survival. Cancer 59 (4): 701-9.

Scully S P, Temple H T, O'Keefe R J, et al. (1996). The surgical treatment of patients with osteosarcoma who sustain a pathologic fracture. Clin Orthop (324): 227-32.

Simon M A (1988). Limb salvage for osteoarcoma. J Bone Joint Surg [Am] 70(A): 307-10.

Simon M A (1989). Limb salvage for osteosarcoma. In: New developments for limb salvage in musculoskeletal tumours (Ed. Yamamuro T). Springer. New York, pp 71-2.

Simon M A, Aschliman M A, Thomas N, Mankin H J (1986). Limb-salvage treatment versus amputation for osteosarcoma of the distal end of the femur. J Bone Joint Surg [Am] 68 (9): 1331-7.