

Reconstruction after Wide Excision of Primary Bone Tumors

Adnan Abdilmajeed Faraj

Department of Surgery, College of Medicine, Kirkuk University

Abstract:

Introduction: Aggressive behavior of primary bone tumors can occur with benign, intermediate and malignant tumors. There is a debate regarding the type of surgical intervention. The current retrospective study examines the outcome of excision, bone graft and fixation surgery.

Patients and Methods: Nine patients with different types of primary bone tumors were treated by wide excision of the lesion under C arm guidance, replacing the defect with freeze dried allograft (two patients), synthetic bone graft (one patient), autogenous structured iliac or tibial or fibular bone graft (6patients). The current series tumor staging was II-A in 5 patients and II-B in four patients; according to Enneking's classification.

Results: Mean follow-up period was 2 years. The result was good in 7 patients with no recurrence of tumor with bone graft healing, and a satisfactory function of the limb. One patient had A damintinoma of the tibia, despite several operations, the tumor recurred.

Conclusion: Using different types of bone graft, and implants after excision of primary tumor with a safety margin; will restore the function and is associated with a good outcome.

Key words: Primary, Tumor, Bone, Bone graft, Surgery

Introduction:

Primary bone tumors are not common compared to secondary skeletal metastasis. There is a spectrum of conditions which looks like bone tumors and some behave in an aggressive way like aneurysmal bone cyst. Atypical fibro-osseous lesions, usually in the proximal femur, are a common consultative diagnostic problem. This is due to the fact that they contain a variety of patterns individually reminiscent of fibrous dysplasia, fibroxanthoma (non-ossifying fibroma), myxofibroma, lipoma, cyst, bone infarct, Paget's disease, and, occasionally, chondroma⁽¹⁾ (Figure 1).

The primary bone tumors are staged according to the musculoskeletal tumor society (Enneking system). The grade of the tumor (low or high) and location and extent of the lesion (intra or extra-

compartmental), and the presence or absence of metastasis, determines the stage⁽²⁾.

The management of these lesions is often surgical. There is no consensus however in regards to the type of operation. Amputation is indicated for patients who present with pathological fracture and for small children who will develop limb length inequality with enbloc excision, and for patients with stage II-B (high grade-extra-compartmental-no metastasis). When the tumor is high grade, intra-compartmental with no metastasis, it is stage II-A⁽³⁾.

After enblock excision of lesions about the knee, the joint can be reconstructed by custom prosthesis, arthrodesis, and rotation-plasty. Resection arthrodesis is utilized by some surgeons for lesions

about the knee, other choose to use arthrodesis when the primary lesion produce a large extra-osseous mass projecting into quadriceps mechanism (stage II-B) adjacent to the knee joint. The usual operative treatment of such a lesion requires an extra-articular resection including the extensor mechanism with trans-medullary margin 7 cm distant to the closest extension of the lesion. Some surgeons prefer to reconstruct the limb using custom made prosthesis^(1,2,3).

Recurrence rate is higher following limited excision, curettage with adjuvant therapy when compared with en bloc resection⁽¹⁾. It is observed that recurrence and soft tissue extension of the tumor strongly increases the risk of local recurrence after surgery. Recurrence rate of the tumor following surgery is not related to the age, sex or location⁽⁴⁾.

The current paper discusses the outcome following resection of the tumour, filling in the gap with bone graft and fixation.

Patients and Methods:

Nine patients presented with primary bone tumors (intermediate malignant tumor), treated in Azadi Teaching Hospital and the private sector between September 2008-December 2013. There were four male and five female patients in this series with mean age of 29 (range of 6-47). The main symptoms were pain and swelling. The indications for surgery were: to obtain a biopsy for diagnosis, relieve pain and excise the tumor in an attempt to prevent fracture and stop the spread of the disease. The biopsy was taken through an open wound. Open biopsy with care to avoid dissemination of tumor is considered to be more informative than needle biopsy. Staging of the disease

was done for the malignant and locally aggressive tumors. The current series tumor staging was II-A in 5 patients and II-B in four patients; according to Enneking's classification. Oncological consultation and preoperative chemotherapy was started for only six patients. Three patients did not require chemotherapy.

Computerised tomography (helical), MRI scan in addition to plain radiographs and hematological studies, were carried out. The principles of the surgical intervention were to completely excise the bony lesion with a wide margin, filling in the defect with bone graft or bone substitute, in order to achieve biological healing. C arm was used to identify the safety margin. Internal fixation was carried out as appropriate using different armamentarium in order to stabilize the bone and allow movement. One patient has had sciatic nerve palsy incurred during previous attempts to remove the osteosarcoma. (Table 1), (Figure 2,3).

Results:

Medical records, radiological pictures and histological reports were reviewed at a mean follow-up period of 2 years (0.5-3). The assessment was carried out and included clinical examination, radiological and hematological investigation aiming at identifying any recurrence (or spread) of the disease. The ranking of the outcome measure used was as showed in (Table 2). There were no recurrence of the giant cell tumor, one patient lost the movement of the wrist (fusion), this procedure was undertaken because of the soft tissue extension of the tumor after two previous bone graft operations. The results were good in all apart from a case of recurrence of Adamantionma, in the proximal part of tibia, this was

because of the nature of the tumor, biopsy excluded osteosarcoma. A case of a stiff knee (allograft replacement of

osteosarcoma), required manipulation under anesthesia.

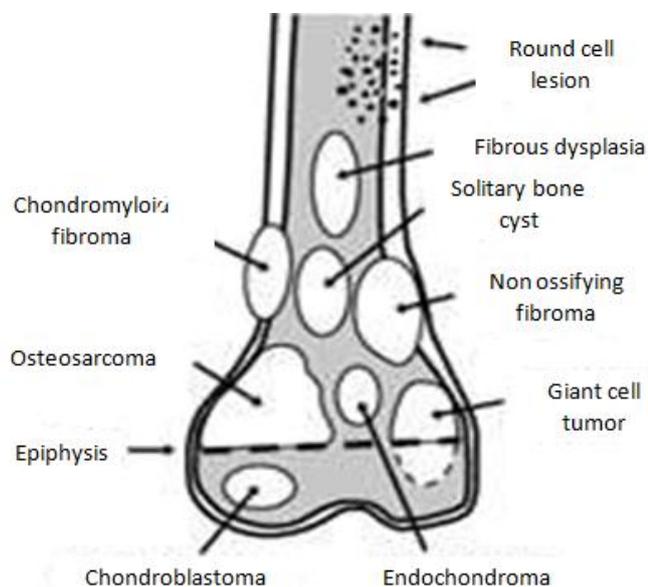


Figure (1): Graphic demonstration of various bone lesions and tumors.



Figure (2): Plain X-ray of giant cell tumor of the lateral distal humerus. (A) before treatment (B) after being treated with excision and iliac bone graft and screw fixation.

Table (1): Showing the procedures performed and the outcome.

Age, sex	Diagnosis- stage according to Enneking's classification	Operation	Outcome	Follow-up-years
15F	Osteosarcoma of the left femur, II-B	Excision, iliac and fibular bone graft, locking plate	Good	1
47F	Giant cell tumor of left lateral condyle of left humerus, II-A	Excision, iliac bone graft, screw fixation	Good(healed, no recurrence, normal range of movement)	1.5
28M	Giant cell tumor of right lateral condyle of femur, II-A	Excision, iliac bone graft, locking plate	Healed, no recurrence	9 months
46F	Recurrent Giant cell tumor of right distal radius, II-B	Excision of distal radius, artificial bone graft, locking plate, wrist fusion	Fair (stiff wrist, no recurrence, no pain)	1.5
45F	Giant cell tumor of distal femur (right), II-A	L-plate, excision, iliac bone graft	Good	2
24M	Giant osteochondroma of the left humerus, II-B	Excision and tibial on-lay bone graft	Good (no recurrence, regained function of shoulder)	2
28M	Adamantiona, recurrent, II-B	Excision of tibia, allograft, tibia nail	Poor, cystic lesion at the proximal end awaiting amputation	2
32M	Recurrent parosteal osteosarcoma of left femur, II-A	Excision of the shaft, allograft, nailing	Good (no recurrence, problems with distal healing of the graft)	3
6F	Recurrent aneurysmal bone cyst of the left proximal femur, II-A	Complete excision, synthetic bone graft, locking plate	Good (healed, no recurrence, no pain)	2

Table (2): Ranking of the outcome measures.

Rank	Outcome measure
Good	No recurrence, bone integration, no hardware problems
Fair	No recurrence, bone integration, hard ware problems
Poor	When there is either recurrence and/or failure of bone integration.

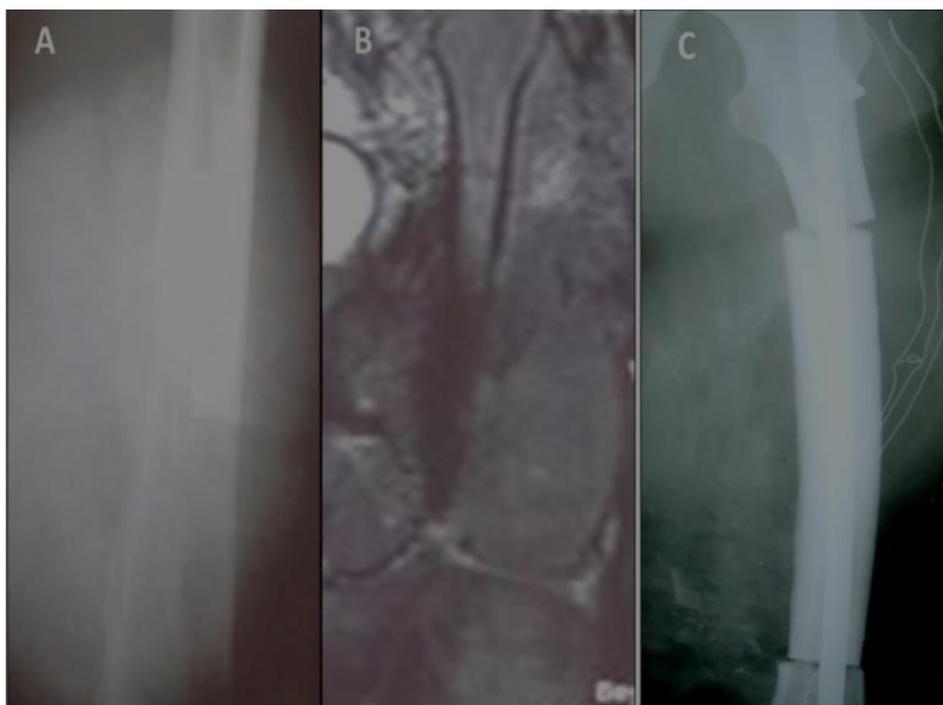


Figure (3): A case of recurrent paraosteal osteosarcoma. (A) AP radiograph and (B) MRI scan of the left femur before surgery and (C) after surgical treatment by excision of femur, allograft and intramedullary nail.

Discussion:

The ideal replacement for large bone defects is one that behaves as the missing bone did; that is, it should be viable, non-immunogenic to the host, and able to provide sound structural support. This is not always feasible. Minimal resection to preserve function and decrease the need for using bone replacement technique, has been combined with adjuvant to reduce the chance of recurrence; this however is not often the case ⁽⁴⁾.

In Mankin's series, 106 patients were treated with wide resection and allograft replacement. In the 45 with adequate follow-up, (74%) had successful transplants, (13%) had infections, (10%) required bracing and (10%) had pathological fractures ⁽⁵⁾.

In the current study, a wide margin excision of the tumor was carried out with the use of C arm in the operating theatre used as a guide; every attempt was made to ensure a wide margin

excision was not unnecessarily wide. Recurrence however occurred in the case of Adamantionma despite resection, allograft replacement and fixation. The nature of the bone tumors and tumour like conditions is unpredictable. The number of patients in this study is low, the other limitation of this study is the fact that there different types of bone tumor included. Compared to Mankin's series; in the current study, however, and compared to, there was no fracture or infection in this series ⁽⁵⁾. The case of Adamintioma however recurred and the patient is waiting for amputation. Synthetic structured bovine bone graft was used in one case of this series; this was associated with delayed healing.

When the bone is resected with a safety margin, the defect is filled in with structured synthetic bone graft or cadaveric allograft. The drawback of autologous bone graft however is donor

site morbidity. These bone grafts are avascular and may fracture; vascularised bone graft seems to be successful, the procedure is however, daunting to perform ⁽⁶⁾, this technique has not been used in the current study. Bone cement is not a substitute for bone graft; it should not be used in place of bone graft, because of lack of integration and the need to exchange with bone graft in the younger patients. The outcome of surgery also depends on the size and aggression of tumor; there seem to be a role for chemotherapy prior to surgery to shrink the size of the tumor ⁽⁷⁾.

In conclusion, when arthroplasty or amputation is not suitable, wide local excision of primary bone tumour followed by reconstruction using autologous bone graft and internal fixation using intramedullary nail, plate and screw fixation of the bone continues to be associated with good functional and long-term outcome. It is preferred to use structured iliac autologous bone graft because the graft contain viable cells. A specialized bone tumor unit and bone tumor register would be helpful in the management of this tumor by experienced and specialized surgeons in Iraq.

References:

- [1]. Van der Heijden L, Dijkstra PD, Campanacci DA, Gibbons CL, van de Sande MA. Giant Cell Tumor With Pathologic Fracture: Should We Curette or Resect? *Clin Orthop Relat Res.* 2012 Aug 2;67-72.
- [2]. Enneking WF et al: A system for surgical staging of musculoskeletal sarcoma. *Clinical Orthopaedics.* 1980; 153:106-120
- [3]. Johnston JO: local resection in primary bone malignant tumors. *Clin Orthop* 1980; 153:73-80
- [4]. Heijden LV, Sande MA, Dijkstra PD. Soft tissue extension increases the risk of local recurrence after curettage with adjuvant for giant-cell tumour of the long bones. *Acta Orthop.* 2012 Aug 10. [Epub ahead of print].
- [5]. Mankin HJ et al. Osteoarticular and intercalary allograft transplantation in the malignant tumors of bone. *Cancer* 1982; 50:613-630.
- [6]. Doi K, Hattori Y. Vascularized bone graft from the supracondylar region of the femur. *Microsurgery.* 2009; 29:379-84.
- [7]. Abe S, Tateishi A, Ogawa K, Ganey GG, Nakano H. Long-term local intensive preoperative chemotherapy and joint-preserving conservative surgery for osteosarcoma around the knee. *Orthopedics.* 2001 Jul; 24 (7):671-6.