

GIANT CELL TUMOUR OF DISTAL END RADIUS:VARIOUS TREATMENT PROTOCOL AND RESULTS

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ABSTRACT

Introduction: Giant cell tumor are benign aggressive type of tumor which account 20% of benign bone tumors and 6% of all bone tumors. GCT usually occurs at metaphysis of long bones and distal end radius is 3rd most common site after distal end of femur and proximal end tibia. Various treatment modalities are mentioned in literature from simple curettage to reconstruction or prosthetic replacement of distal radius.

Material and method: A prospective study of 26 patients of GCT of distal end of radius treated by various procedures in our institute and followed upto 24 months to evaluate complications and functional outcome based on The Musculo Skeletal Tumour Society Score.

Results: All patients had been followed strictly so no loss of follow up of a single patient. After 24 months of follow up functional score evaluated as 80% in patients treated as curettage with PMMA augmentation or iliac bone grafting, 73% in treated as resection with fibular autografting or ulnar translocation with osteosynthesis and 60% in those who are undergone as resection and centralization of ulna with osteosynthesis.

Conclusion: A careful clinical and radiological assessment of distal radius GCT and judicious treatment plan is the key for successful outcome in these lesions.

Keywords: Giant cell tumour, Distal end radius, Musculo Skeletal Tumour Society Score, Assessment

INTRODUCTION

Giant cell tumors (GCT) is a benign aggressive tumors of bone with features of local recurrence, potential for metastases and malignant transformation¹ and usually seen at the end of long bone after skeletal maturity.² Giant cell tumors accounts for approximately 6% of all bone tumors, 4% of all primary bone tumors and 20% of benign bone tumors.³ The distal end of radius is a relatively common site of skeletal neoplasm and is the third most common location(after the distal end of femur and proximal end of tibia) of giant cell tumor. The peak incidence is between 20-45

years of age.⁴ 70% of cases of GCT fall in this age group.⁵ It is rarely found in less than 10 years of age group. The tumor usually involved the metaphysis and the epiphysis, but is occasionally limited to the metaphysis, and in only 2% of patients is it adjacent to an open growth plate. The tumor occasionally invades the articular space involve ligament and synovial membranes. Extension to an adjacent bone through the joint occurs in 5% of the tumors. Less frequently, GCT occurs in the vertebrae (2-5%) and in the sacrum 10%.⁶

GCT of bone remain a difficult and

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challenging management problem because there are no absolute clinical radiological or histologic parameters that accurately predict the tendency of any single lesion to recur or metastasise.⁷

Various treatment modalities are advocated in the literature these include:

1. Extended Curettage⁸ with or without reconstruction using autogenic/ allogenic bone grafts or polymethylmethacrylate.^{9,10}
2. Resection and construction with vascularized or non vascularized proximal fibula (fibular head arthroplasty).^{11,12}
3. Resection with partial wrist arthrodesis(radio-scapho-lunate arthrodesis) using a strut bone graft.¹³
4. Resection and complete wrist arthrodesis using an intervening strut bone graft.^{14,17}
5. Resection and reconstruction techniques includes arthrodesis with different autografts.^{11,18-22}

In recurrence or local aggressive cases of GCT as well as in malignant lesions, resection and subsequent reconstruction of the distal radius is indicated.²³⁻²⁵ Reconstruction of the wrist after excision of the distal aspect of the radius is a challenge because of the high functional demands on the hand, the young age and relatively long life expectancy of many patient who have a get, the limited surrounding soft tissue ,and the proximity of adjacent nerve and tendons.

We undertook a retrospective study of the surgically treated GCT of distal radius to analyze the treatment protocol, recurrence rate, complication and functional outcome.

MATERIAL AND METHODS

A prospective study of 26 patients of GCT of the distal end of radius, treated from January 2010 to December 2012 in Gandhi Medical College and Hamidia hospital, Bhopal. These included the case treated primarily as well as the case with a recurrence. All the lesions were biopsy proven GCTs. The minimum follow up was 24 months

after the surgery.

All patients evaluated preoperatively with plain radiographs, computed tomography (CT) scan and magnetic resonance imaging (MRI) scans of involved wrist and with plain x-rays of chest. Serum calcium, phosphorus and alkaline phosphatase were also determined to rule out hyperparathyroidism.

Radiologically grading of the lesion was done by Campanacci grading.²³ Grade I is well defined border of a thin rim of mature bone and bony cortex was intact. Grade II lesion had relatively well defined margin but there was no radio-opaque cortical rim. Grade III lesion with fuzzy borders, suggest a rapid and possibly a permeative, growth of the tumour. All patients with grade I tumour are treated with extended curettage with bone grafting or PMMA to avoid more radical surgeries. Grade III tumours have been uniformly treated by autografts reconstruction in our institute. However the decision type of operative intervention in grade II was based on individual case with one of the important consideration being the subcortical bone stock likely to be available after curettage. Five types of procedure were performed in our institute:

1. Curettage with bone cementing (PMMA).
2. Curettage with autografting (Iliac bone grafting).
3. Resection of tumour and reconstruction with nonvascularized fibular graft with fixation by osteosynthesis.
4. Resection of tumour and reconstruction by centralization of ulna with osteosynthesis.
5. Resection of tumour and reconstruction with ulnar translocation and fixation with osteosynthesis.

At every 3 months, plain radiographs of forearm were repeated to see union, recurrence of tumour or graft related complication. After first year, follow up was at every 4 months till 24 months. A dynamometer was employed to measure grip strength and compared to opposite normal site. Grip strength was defined good if device

compresses more than 50%, fair if device compresses 33-50% and poor if devices compresses less than 33%. Similarly goniometer was used to measure range of movements and compared to opposite side.

The functional scoring of the outcome was done by using The Musculo Skeletal Tumour Society System.²⁶ This scoring system measures the function in the upper extremity of assigning points (0-5) under six different heading: pain, function, emotional acceptance, hand positioning, manual dexterity and ability of lifting weight. The functional score was expressed in percentage of the actual points scored out of the total 30.

RESULTS

A total of 26 patients were analyzed, there were 16 males and 10 females with 11 right sided and 15 left sided involvement of distal radius. The age distribution ranged from 14 years (youngest) to 53 years (oldest) with a average age of 27.47 yrs and median of 28 yrs (see Table 2). The commonest presenting symptom was swelling (n=14), followed by swelling and pain (n=11). Pain was the only presenting complaint in one case.

The lesion were graded radiologically as per the campanacci grading system. Only 9 of the lesion was grade I; while 10 were grade II and 7 were grade III.

Grade I lesion (n=9) was treated as:

Curettage and cementing i.e. poly methyl metha acrylate(PMMA) (n=4) and

Curettage and iliac bone grafting (n=5).

Grade II lesion (n=10) were treated as:

En bloc resection with fibular grafting with osteosynthesis (n=5),

En bloc resection with centralization of ulna (n=4) and

En bloc resection with ulnar translocation (n=1).

Grade III lesion (n=7) were treated as:

En bloc resection with fibular grafting with osteosynthesis (n=5),

En bloc resection with centralization of ulna (n=1) and

En bloc resection with ulnar translocation (n=1). (see Table 3)

The patient were followed up clinic-radiologically with the ranging from 18 months to 26 months with an average of 24 months. All patients were regularly kept in follow up so none of them lost follow up.

Complication as a result of the disease or the treatment modality did occur. There were 4 recurrent which were reoperated, one nonunion which was managed by bone grafting at the graft-host bone junction, 2 delayed union cured by 6 weeks above elbow cast, 3 infection which was cured by 6weeks period of antibiotics and one case of instability at wrist presented as a deformity of wrist in our study (see Table 4).The average range of motion were 50 degree forearm supination, 39 degree pronation, 46 degree palmar flexion, 31 degree dorsiflexion with combined movement of 166 degree. The average time of union was 3.25 months was observed in our study.

The functional score in this study ranged between 58-90% with the average being 77%. The patients treated with curettage and bone cementing or bone grafting has the best functional outcome with scores of around 80%. The patients who had undergone en bloc resection with wrist arthrodesis either by fibular graft with osteosynthesis or ulnar translocation with osteosynthesis found well with score around 73%. The lesion treated with en bloc resection and centralization of ulna had the least functional score which was 60%.

DISCUSSION

The ideal treatment for a GCT of distal end radius has been a topic of consternation for hand and wrist over world. Many different modalities of

treatment have been used over the years, each with its own perspectives and consequences. The radius is the major bone of the forearm. Its distal end is the major participants in the wrist joint whose function is quite essential to sustenance of a normal life style. Its removal from the bone will jeopardize function of the forearm, compromise ROM of wrist and cause instability of the wrist unless a reconstruction be undertaken to restore anatomy.

The clinical behavior of GCT is unrelated to histological or radiological grading,^{23,27} and thus the decision to either salvage or excise the tumorous bone is based on ability to achieve stability and function whatever may be the means used.¹⁰

Most authors agree that the completeness of the curettage and excision is the single most important factor to prevent recurrence.^{8,9,19} A Campanacci grade I and II GCT of distal radius is usually treated by curettage and reconstruction with either PMMA or bone graft. The recurrence is easier to be noticed with a cement reconstruction and it also gives immediate structural stability. The exothermic reaction of cementing cures is also supposed to increase the tumoricidal effect.¹⁹ However, there are recent reports throwing light on the cartilaginous degeneration arising there of. There are a lot of studies advocating proximal fibular replacement as the reconstructive option after distal radius excision. It has been found to have good functional result in the other series literature.^{11,28}

Ipsilateral fibular nonvascularised autograft reconstruction of the large defect created after resection of distal radius offers many advantages over procedures. It has low donor site morbidity, if any, with predictable and satisfactory functional results and is relatively free of major complications although minor complications occur frequently.^{21,29-36} In order to preserve some wrist motion partial arthrodesis with graft fixation only to the scapho-lunate portion of the carpal row, can be performed.

This method provides a stable and pain free wrist sufficient range of motion for daily life activities,^{12,17} wherefore it is recommended by Muramatsu et al¹⁷ especially for young patients.

Translocation of ulna to the distal radial defect with carpoulnar arthrodesis was performed in 2 patients reported on by Seradge,¹⁵ 6 patients reported on by Bhan and Biyani,¹⁶ 1 patient reported on by Lalla and Bhupathi³⁷ and 1 patient reported on by Turcotte et al.³⁸ The distal fusion was carried out to a slot between the scaphoid and lunate, and stabilization was achieved with a long Steinmann pin driver from the 3rd metacarpal and lunate to the medullary cavity of the proximal radius.¹⁵ The patients had good grip strength and forearm rotation without the proximal stump to cause or functional disturbance. Translocation of ulna is another procedure which has been frequently used with good result but may not give cosmetically acceptable results as there is narrowing of wrist and distal forearm giving hourglass appearance to limb.^{16,19,39}

Results similar to fibular grafting have been reported with allograft reconstructed by several authors.⁴⁰⁻⁴² Moreover, lack of availability of allograft and specialized bone bank facilities may prevent its frequent use.

We had observed one case of deformity of wrist due to instability of joint in our study which can compare with Aithal et al³² reported 3 amongst 30 and Maruthainar et al³³ reported 4 amongst 13 in their study. In our series another complication was non union in one of our patients which was treated with bone grafting and delayed union in two patients which also treated as conservative cast for 6 weeks.

We also had 15.38 % (n=3) case of superficial infection which was treated with prolonged course of antibiotics and more than Szabo⁴¹ study in which it was (11.8%), also compared with Mankin's and Bianchi's study.^{7,42} Overall complications were seen 42.30% in our series.

Table 1
Literature review of case series regarding
the management of GCT of distal radius

Author	No.	Type of Procedure	Time for Union (Months)	Complication Rate	Infection	Non Union	Instability	ROM	Results
Salenius et al (30)	6	Resection Arthroplasty	NA	0/6	-	-	-	<20% decrease	All Good
Vander Griend et al (19)	8	Arthroplasty-2 Arthodesis-6	NA	6/8=75%	0	0	1	Not Specified	
Aithal et al (32)	30	Arthroplasty	4-6.5 (5.2)	14/30=46.67				>65% in 7 35-64% in 7 <34% in 3 Fused wrist 3	Good 11 Fair 7 Poor 2 (Excluding Recurrence)
Chadha et al (31)	9	Arthroplasty	6	5/9 =55.56				DF - 40° PF - 30° Su - 45° Pr - 45°	
Szabo et al (41)	9				1 (11%)	0	0	DF - 52° PF - 26° Su - 67° Pr - 80°	
Bianchi et al (43)	12				0	1(8.3%)	7 (58.3%)	DF - 37° PF - 51°	
Kocher et al (40)	24				0	0	0	DF - 21° PF - 36° Su - 58° Pr - 72°	
Harness and Mankin(7)	15				0	2(13.3%)	2 (13.3%)	Not specified	

DF - Dorsiflexion, PF - Palmar flexion, Su - supination, Pr - Pronation

Table 2
Age wise distribution of patients

Age (years)	No. of patients
<10	0
11-20	5
21-30	11
31-40	7
41-50	2
51-60	1

Table 3
Performed procedures with functional outcome

I	Curettage and PMMA augmentation	N=4	80%
II	Curettage and iliac bone grafting	N=5	
III	Resection with fibular autografting with osteosynthesis	N=10	73%
IV	Resection with ulnar translocation with osteosynthesis	N=2	
V	Resection with centralization of ulna with osteosynthesis	N=5	60%

Table 4
Observed complications

Complications	No. of patients (%age)
Recurrence	4 (15.38)
Infection	3 (11.54)
Delayed union	2 (7.7)
Non-union	1 (3.85)
Instability of wrist (Deformity of wrist)	1 (3.85)
Total	11 (42.30)

CONCLUSION

The more localized lesion are best treated with curettage. Those with extensive cortical destruction and large soft tissue component usually need en bloc resection. We believe that although results of non vascularised fibular autograft reconstruction of distal radius show substantial loss of subjective results acceptable to most patients and comparable to all other available methods of such reconstruction. Campanacci grade III lesion may be treated with resection and appropriate stabilization if the bone stock permit. A careful clinical and radiological assessment of distal radius GCT and judicious treatment plan is the key for successful outcome in these lesion.

CASE 1



CASE 2



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