

An Analysis of Different Modalities of Surgical Management of Giant Cell Tumor of Distal Radius.

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ABSTRACT

Background: The distal end of the radius is one of the common sites of involvement in giant cell tumors (GCTs) with increased chance of recurrence. The objective of the present analysis was to study the modalities of management of the different types of distal end radius GCTs so as to reduce the recurrence rates and retain adequate function. **Methods:** A prospective study of 24 patients of GCT of distal end of radius treated by various procedures in our institute and followed upto 24 months to analyse complications and functional outcome based on The Musculo Skeletal Tumour Society Score. **Results:** In our series of 24 patients of GCT distal radius, 7 cases treated with curettage and bone graft 4cases were presented with recurrence, 1 with stiffness, and 2 with superficial infection. Out of 14 cases treated with Wide Resection and reconstruction with nonvascularized proximal fibula 4 cases appeared with recurrence, 2 showed non-union and 1 delayed union, 3 with wrist deformity, 7 with stiffness, 4 with carpal subluxation & 2 with donor site morbidity. In 3 patients treated with centralisation of ulna 2 case presented recurrence. **Conclusion:** A careful clinical and radiological assessment of distal radius GCT and judicious treatment plan is the key for successful outcome.

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

INTRODUCTION

GCT is comprise about 4-5 % of all primary bone tumour and about 20% of benign bone lesions. It most commonly affects individuals in the age group of 18 to 40years, with peak incidence in the third decade of life, being more usually found in women (1.5 - 2 : 1), being uncommon in children. It is more frequently found in South-eastern Asia populations.^[1]

The most frequently affected segments are, sequentially: distal femur, proximal tibia and distal radius. The radius distal epiphysis is affected in 10% of the cases.

Although classified as a benign neoplasia, multicentre involvement (1% of the cases) or metastasis to lungs and mediastinum (1-9% of the cases) may occur, usually associated to primary injuries located at the radius distal segment.

The lower end of the radius is the third common site to be affected. The distal radius plays a

significant role in the radio-carpal articulation and hence in the function of the hand. It is always a challenge to reconstruct the defect caused by excision of the distal radius tumors. The complex anatomy and the need to obtain acceptable functional outcome with good disease clearance creates a dilemma in the treatment of the GCTs of the lower end of the radius.

Various treatment modalities are advocated in the literature.^[2]

These include-

- Extended curettage, with or without reconstruction using autogenic bone grafts or polymethyl-methacrylate
- Resection and reconstruction with vascularized or nonvascularized proximal fibula (fibular head arthroplasty)
- Resection with partial/complete wrist arthrodesis (radio-scapho-lunate arthrodesis) using a strut bone graft
- Wide Resection and centralisation /translocation of ulna.
- Osteo articular allografts – ceramic prosthesis (Hatano et al) Bipolar hinged megaprosthesis
- Ilizarov method of lengthening of radius with associated corticotomy.

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Thorough curettage and complete excision is the single most important factor to prevent recurrence. There are few studies in the literature which have tried to analyze the treatment modalities with respect to the radiological grade of the distal radius GCT

Campanacci Grade 1 and 2 lesions usually do well with extended curettage alone or with bone graft or cement reconstruction. They also are found to have the best functional results. Campanacci Grade 3 lesions require resection of the entire lesion and reconstruction when the extraosseous soft tissue component is large.

We undertook a retrospective study of the surgically treated giant cell tumors of the distal radius to analyze the treatment patterns, the recurrence rates, the complications and the functional outcome. Most of the patients with GCT occur in young adults, in their most productive age. The purpose of treatment includes the full tumor removal and function preservation.^[4]

Wrist reconstruction, due to the topographic proximity from neurovascular and tendinous structures and to the limited coverage of soft parts, constitutes a challenge for surgeons. The techniques employed for that end should provide stability and joint mobility enough to meet the functional demand of the distal segment of the upper limb.

The results of reconstruction technique are strong, especially from a functional perspective, encouraging professionals to use it for treating lesions compromising radius distal segment.

Our aim was to study all the various modalities of surgical management to reduce recurrence of GCT of distal radius with normal functional wrist joint & to decrease complication due to surgery.

MATERIALS AND METHODS

The present study of “An Analysis of different modalities of surgical management of Giant cell tumour of distal radius” was undertaken in the Department of Orthopaedics, P.R.M Medical College, Baripada from Jan – 2017 to Jan- 2019.

During this period a total of 24 patients having GCT distal radius were treated by various surgical methods. Age of patients in the study ranged from 20 to 45 years (average, 31.4 years).

All patients were evaluated preoperatively with plain radiographs, computed tomography (CT) scan and magnetic resonance imaging (MRI) scans of involved wrist. Serum calcium, phosphorus and alkaline phosphatase were also determined to rule out hyperparathyroidism. Radiologically grading of the lesion was done by campanacci grading. 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.^[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.

All the patients in the study presented to the hospital belongs to campanacci Grade 2 and Grade 3. Curettage and bone grafting/cement has been done in 7 of the cases. We have done Wide Resection and Reconstruction by non vascularised proximal fibular auto graft in 14 of the cases. Centralisation of ulna has been done in 3 primary cases and 5 of the recurrent cases. Below elbow amputation has been done in 3 of the recurrent cases.

RESULTS

In the present study from 24 cases having Giant cell tumour distal radius followed up for 2yrs in Dept. of orthopaedics, SCB medical college, Cuttack. The following observation were made in the present study. Giant cell tumour generally occurs in skeletally mature individuals with its peak incidence in third decade of life. Less than 2% is seen open epiphysis. GCT of the small bones of the hand and foot occurs in slightly younger age group. The age of the patients in the series are ranged from 20 to 45 years (average, 31.4 years). - Out of 24 cases there are 10 male and 14 female. Usually there is a slight female preponderance seen in GCT distal radius. In my present series of 24 cases presented to the hospital 10 of the cases belong to Campanacci grade 2 and 14 of the cases belong to grade 3. Most of the cases presented to the hospital at a late stage due to ignorance and deviation towards quack and Conservative treatment.

Table 1: ?

Sl.no	Grade(Campanacci)	No of cases	%age
1	Grade 1	Nil	-
2	Grade 2	10	41.66
3	Grade 3	14	58.34
Total		24	100

From 24 cases 5 cases presented to the hospital with cortical breakage and pathological fracture. As the tumour is eccentric and expansile cortical breakage occurs, after a trivial trauma or by the nature of the tumour.

Table 2: ?

Sl.no	Pathological fractures	No of cases	%age
1	Present	5	20.83
2	Absent	19	79.16

Table 3:

	Types of biopsy	Grade of tumour	No.of cases	Result
1	Core needle biopsy	Grade2	2	1-GCT 1-ABC
2	Intralesional biopsy	Grade2+ Grade 3	5	4-GCT 1-CHONDROBLASTOMA
3	Excisional biopsy	Grade3	17	17-GCT

Table 4:

Sl no	Types of treatment	No. Of cases	%age
1	Curettage & bone grafting	7	29.17
2	Wide resection and Reconstruction by non vascularised proximal fibular auto graft	14	58.33
4	Centralisation of ulna	3	12.5
	Total	24	100

Table 5:

Method	No. of cases	recurrence	%age
Curettage & bone grafting	7	4	57.14
Wide resection and Reconstruction by non vascularised proximal fibular auto graft	14	4	28.57
Centralisation of ulna	3	1	33.33

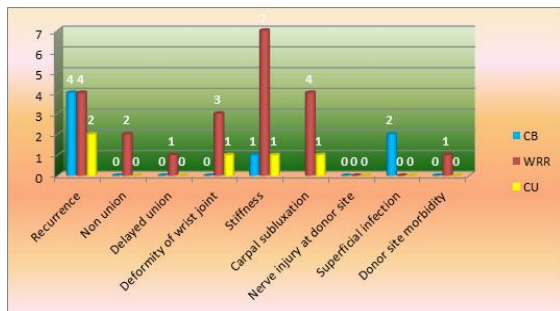


Figure 1: (Complications)

BIOPSY FOR DIAGNOSIS OF GCT-

The clinical presentation and the imaging studies were compatible with a diagnosis of a classic benign giant cell tumour of the bone.

MODALITIES OF TREATMENT-

Different modalities of surgical management has been done. Grade 2 tumour are treated with curettage and bone grafting and cement, grade 3 tumour are treated with wide resection and autogenous non vascularised proximal fibula and centralisation of ulna.

Majority of recurrences usually occur within the first two years, late recurrences are known and long-term surveillance is recommended in these patients. Even though the increasing grade from I to III is not a reflection of the biologic aggressiveness of the tumor, it has been sited increased rate of recurrence in Grade III lesions. This could be due to the difficulty in achieving complete clearance. Once the tumor has breached its normal anatomic boundaries and extended into soft tissue.

Curettage and bone grafting/bone cement- out of 7 cases treated with curettage & bone grafting there are 4 recurrences. The functional outcome is good in 3 cases and fair to poor in other cases after 2 yr follow up. Wide resection and Reconstruction by non vascularised proximal fibular auto graft-out of the 14 patients treated, there are 4 recurrences which is further treated by centralisation on ulna in 3 cases & amputation in one case after one year follow up. Centralisation of ulna- out of the 3 patients treated ,there are 2 recurrences which were further treated by amputation. 3 recurrence after wide resection and reconstruction has been treated by the same.

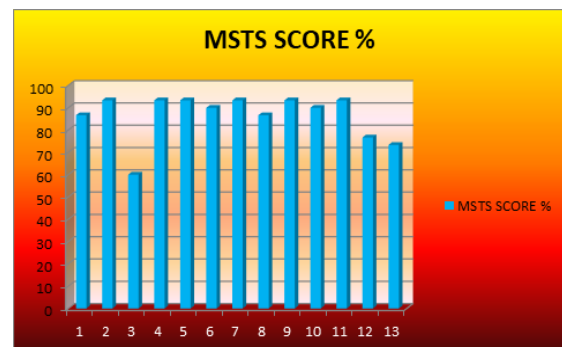


Figure 2: (Revised Musculoskeletal Tumor Society Score of Individual patients)

DISCUSSION

Difficulties in local control of GCT of bones as well as high rate of local recurrence following initial surgery have led the investigators to use

different surgical modalities for the treatment of GCT according to stage of the disease aiming at decreasing the rate of local recurrence with good functional and cosmetic results.

From the study most of the cases of GCT distal radius presented to the hospital at a late stage due to ignorance and deviation towards quack and conservative treatment.

From our study of 24 cases of GCT distal radius 5 (20.83%) cases presented to the hospital with cortical breakage and pathological fracture. As the tumour is eccentric and expansile cortical breakage occurs, after a trivial trauma or by the nature of the tumour.

Although thorough clinical examination and imaging studies are too much compatible with diagnosis of classic benign giant cell tumour, biopsy is mandatory to know the exact nature of the tumour and to confirm the diagnosis. We have done Core needle biopsy in 2 of the patients having grade 2 GCT. Intralesional biopsy is done in 8 of the cases, Excisional biopsy has been done 14 of our patients. We could not find any tumour of malignant nature.

Different modalities of surgical management has been done for our 24 cases of GCT distal radius, 7 cases (29.17%) are treated with Curettage and bone grafting and cement, 14 cases (58.33%) are treated with Wide resection and autogenous non vascularised proximal fibula and 3cases (12.55%) by Centralisation of ulna.

Another study made by Enneking, et al,^[4] resection-reconstruction arthroplasty for giant cell tumor of distal radius, 24 cases of GCT involving the distal radius operated by en-bloc resection of tumor followed by reconstruction of the gap with autogenous non-vascularized fibular graft with a minimum 2 years followup .The cases were operated from January 1993 to March 2007. Nineteen cases were Campanacci Grade III and five were Grade II recurrent GCTs following treated earlier with curettage and bone grafting/cementing. Most of the grade 2 tumour (campanacci) having intact cortex and articular margin, are managed by curettage and bone grafting and cementing whereas most of the grade 3 tumours having cortical destruction with soft tissue involvement are managed by en-bloc resection of tumor followed by reconstruction of the gap with autogenous non-vascularized fibular graft.

Majority of recurrences usually occur within the first two years, late recurrences are known and long-term surveillance is recommended in these patients. Even though the increasing grade from I to III is not a reflection of the biologic aggressiveness of the tumor, it has been sited increased rate of recurrence in Grade III lesions. This could be due to the difficulty in achieving complete clearance if the tumor has breached its normal anatomic boundaries and extended into soft

tissue. Our study has 4 recurrences out of 7 cases treated by Curettage & bone grafting, 4 recurrences out of 14 cases treated by Wide resection and Reconstruction by non vascularised proximal fibular auto graft & 2 recurrences out of 3 cases of gct distal radius managed by centralisation of ulna. Aithal VK et al,^[5] have stated that despite the high rates of recurrence reported in the literature after treatment of GCT with curettage and bone grafting, the results of their study suggest that the risk of local recurrence after curettage with a high-speed burr and reconstruction with autogenous +/- allograft bone is similar to that observed after use of cement and other adjuvant treatment.

In the study made by Vander et al the resection-reconstruction arthroplasty for giant cell tumor of distal radius on 24 cases of gct distal radius, they had only one recurrence (4.2%), that too, involving soft tissue. The lesion was treated with wide excision of the soft tissue mass.

Bone cement (PMMA) has an added advantage of being cytotoxic, has a thermal effect (hyperthermia may help extend the boundary of tumor kill), radiographic detection of recurrence is easier & immediate structural support and rapid weight-bearing ambulation.

In the study made by Bhan S,^[7] Giant cell tumor - distal end radius ,on 24 cases, complications as a result of the disease or the treatment modality did occur. There were six recurrences as outlined. Nonunion at the graft-host bone junction was observed in one case while one had a delayed union at the host bone-graft junction. The delayed union was seen in a case where a nonvascularized fibula was used for arthrodesis. The nonunion was in a case where nonvascularized ulnar strut was used for radio-carpal arthrodesis. Deformity was noted on follow-up in two cases. Stiffness of the fingers and salvaged wrist joint was seen in one case each. The other complications included superficial infection at iliac crest (n=1), carpal subluxation (n=1), posttraumatic fracture-dislocation of the radio (fibulo)-carpal joint (n=1), bony metastasis to ipsilateral clavicle (n=1) and implant-related pain (n=1).

There was also one case of superficial infection which was treated with prolonged course of antibiotics. Furthermore, one case of soft tissue recurrence seen which was managed with a repeat surgery and remained tumor free at latest follow up of 4 years.

In the study by Harness H,^[8] on 24 patients undergoing Resection-reconstruction arthroplasty for giant cell tumor of distal radius, the most commonly encountered complication found to be fibulo-carpal subluxation. 2 cases developed a subluxated wrist with pain and partial loss of function. Another 6 cases had radiological subluxation of the wrist and 2 cases had diastasis of the fibulo-ulnar joint. There was only one

recurrence (4.2%), that too, involving soft tissue the lesion was treated with wide excision of the soft tissue mass. None of the cases had delayed union or nonunion.

In the study done by Hatan H,^[9] on Giant cell tumor - distal end radius the functional scoring of the outcome for the 19 patients, using the Musculo Skeletal Tumor Society System was done. The functional score in this study ranged between 60-93% with the average being 78%. The patients treated with curettage and reconstruction and those treated for soft tissue excision had the best functional outcome with scores of around 82%. The patients who had undergone enbloc resection with wrist arthrodesis fared well with scores around 74%. The lesions treated with enbloc resection and proximal fibular replacement had the least functional scores which ranged around 69%

In a study by Sredge H et al,^[10] of 12 cases treated by, En bloc excision and autogenous fibular reconstruction for aggressive giant cell tumor of distal radius averaged at 91.38% MSTS SCORE with 5 excellent, 4 good and 3 satisfactory results. No patient was dissatisfied as far as shape of the wrist/cosmesis was concerned.

Activities of daily living (ADL) was measured and it shows good result in 3 patients & fair to poor in 4 cases treated by Curettage & bone grafting. Out of 14 cases treated with wide resection and reconstruction by non vascularised proximal fibular auto graft 7 has good and 7 had fair to poor outcome. 2cases out of 3 treated by Centralisation of ulna showed fair to poor outcome.

Therefore, in our study we consider that a surgical procedure should be carried out to preserve the joint function and good functional results in GCT of distal radius.

CONCLUSION

The main primary treatment of GCT distal radius is surgery, the type of which depends on preoperative evaluation which includes clinical evaluation that involves the site and size of the tumor in relation to surrounding structures, together with plain X-ray, CT scan and/or MRI as indicated and tissue biopsy to define tumor grade. Curettage alone results in high rate of local recurrence. On the other hand, curettage and adjuvant using bone cement or bone grafts give low rate of local recurrence. Resection is recommended for grade2 and grade3, extremely large lesions. Other modalities i.e. centralisation of ulna procedures are reserved for recurrent cases. Amputation is preserved for massive recurrences and malignant transformation.

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