|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
Volume 2, Issue 5; September-October: 2018; Page No. 37-50
Research Article

ANALYSIS OF GIANT CELL TUMOUR OF BONES: ITS PATTERN, VARIOUS TREATMENT MODALITIES AND THEIR RESULTS

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Article Info: Received 16 August 2018; Accepted 19 September. 2018
Cite this article as: Pandey, A., Goyal, P., , Maravi, D. S., & Uikey, S. (2018). ANALYSIS OF GIANT CELL TUMOUR OF BONES: ITS PATTERN, VARIOUS TREATMENT MODALITIES AND THEIR RESULTS. *International Journal of Medical and Biomedical Studies*, *2*(5).
DOI: https://doi.org/10.32553/ijmbs.v2i5.35
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Source of support: Nil

ABSTRACT:

Background: *Giant cell tumour is a benign aggressive tumour of bone accounting for* 5% *of* all primary bone tumours *with feature of local recurrence, potential for metastasis and malignant transformation and usually seen at the end of long bones after skeletal maturity.* The incidence of lung metastases from a histologically-proven GCT ranges from 1% to 9%. The recurrence rate after intralesional curettage without adjuvant therapy is reported to be up to 50%. *Extended curettage with use of adjuvents is the treatment of choice for treating the most GCT of bones.*

Material and method: 25 patients presented with GCTBs included.In all patients standard plain anteroposterior and lateral radiographs of the involved extremity were done.MRI of involved extremity was done in 19 cases. Diagnosis confirmed by biopsy and histopathological examination. The treatment of GCT is directed towards local control without scarifying joint function. This has been traditionally achieved by intralesional curettage with autograft reconstruction by packing the cavity of excised tumour with iliac cortico-cancellous bone. **Results:** We have treated 25 patients of GCTBs. Females (15) were more commonly affected than male (10). Most common site for GCT was around the knee joint mostly in proximal tibia (6 out of 25). Average range of motion of knee joint was 60 to 112 degree and in wrist joint it was 0 to 45 degree of palmar flexion and 0 to 30 degree of dorsi flexion. **Conclusion:** We believe that removal of most of tumour mass by extended curettage is very essential step in preventing recurrence and achieving good functional outcome in future.

Key words: giant cell tumour of bones, autograft, extended curettage

INTRODUCTION:

Sir Astley Cooper first described osteoclastomas, now called giant cell tumor of bone (GCT)[1,.] *In 1940, Jaffe defined GCT as a neoplasia arising from the supporting connective tissue of the marrow, made up of ovoid stromal or spindle-shaped cells interspersed with multinuclear cells*[2]*.Giant cell tumour is a benign aggressive tumour of bone accounting for 5%* of all primary bone tumours[3] *with feature of local recurrence, potential for metastasis and malignant*

transformation[4] and usually seen at the end of long bones after skeletal maturity[5].The incidence of lung metastases from a histologically-proven GCT ranges from 1% to 9%.[6,7,8,9].The recurrence rate after intralesional curettage without adjuvant therapy is reported to be up to 50% [10,11,12,13.14].*Located eccentrically in the metaphysic and epiphysis of a long bone. It commonly affects distal end of Femur, proximal end of Tibia and distal end of Radius.*

It is occasionally reported in small bones of hand and foot[15], spine[16] and pelvis[17]. The typical appearance is a lytic lesion with a well-defined but nonsclerotic margin that is eccentric in location, extends near the articular surface, and occurs in patients with closed physes. Our goals of treatment are to achieve satisfactory removal of the tumour for oncological control of disease to prevent local recurrence and distal metastasis in future and preservation of good functions of affected limb as disease involve articular area. In our institute Hamidia Hospital there are many patients of GCT of bone come for treatment referred from various other primary and secondary care centre usually in very late stage. In this stage first and most important priority is to correctly diagnose the disease by means of biopsy and treating as early as possible to preserve optimum function of involved joint so that patient can perform their daily routine activity. At present extended curettage with use of adjuvents is the treatment of choice for treating the GCT of bones. As there is limited literature is available as for treatment of GCT with limited facilities in tertiary centre in medical colleges we hope that this study must help to develop standard guideline for treatment of GCT with limited facilities treating poor patients.

MATERIAL AND METHOD

The subject of the study were patients who presented with Giant cell tumor of bone of different extremity in different patients on clinical and radiological examination later on diagnosis confirmed by histo pathological examination.

A prospective study of 25 such cases who were treated in department of orthopaedics, Hamidia Hospital Gandhi Medical college Bhopal from august 2015 to july 2017 with respect to their clinical and radiological presentations and their response to treatment.

After written informed consent all patients underwent a detailed history and thorough clinical examination before their radiological evaluation. Patients were inquired about the site and duration of swelling/mass where it was rapidly enlarging in size or if it followed a trauma and whether there was any systemic symptoms. The tumour was assessed with regards to its size, consistency, fixity to adjacent structure and skin, compressibility distal neurovascular status and for any distant metastasis.

Inclusion criteria:

1. Age group 15year to 50 year

2. Patients without pathological pathological fracture

3. Radiographic features Characteristic of GCT and confirmation by needle aspiration cytology or open Biopsy

Exclusion criteria:

1. Tumour with pathological fracture

2 Patient with secondary tumour

3. Patients with other comorbid conditions not fit for any surgical procedure.

In all patients standard plain anteroposterior and lateral radiographs of the involved extremity were done. Giant cell tumour was studied with its site, size, centric or eccentric typical soap bubble appearance and presence or absence of cortical erosion, pathological fracture and articular surface involvement.

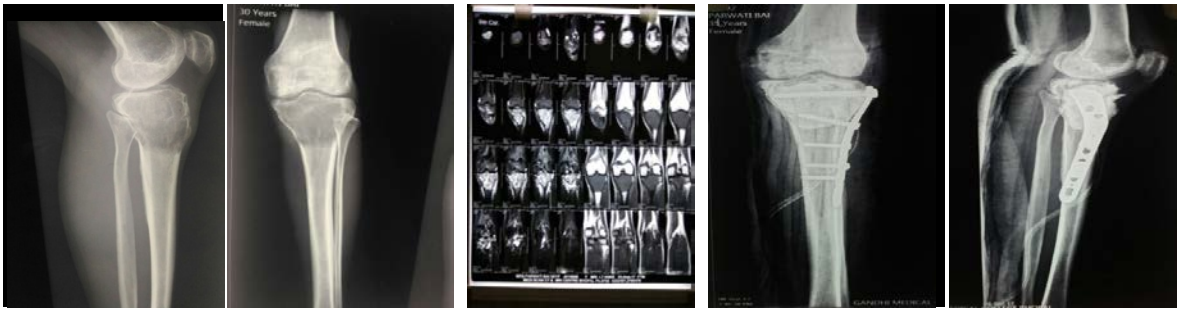
Magnetic Resonance Imaging of involved extremity was done in 19 cases. T1 and T2 weighted sequences were obtained in sagittal, coronal and axial planes. Additional sequences were done when needed. As for as plan of treatment is concern to know about extent of

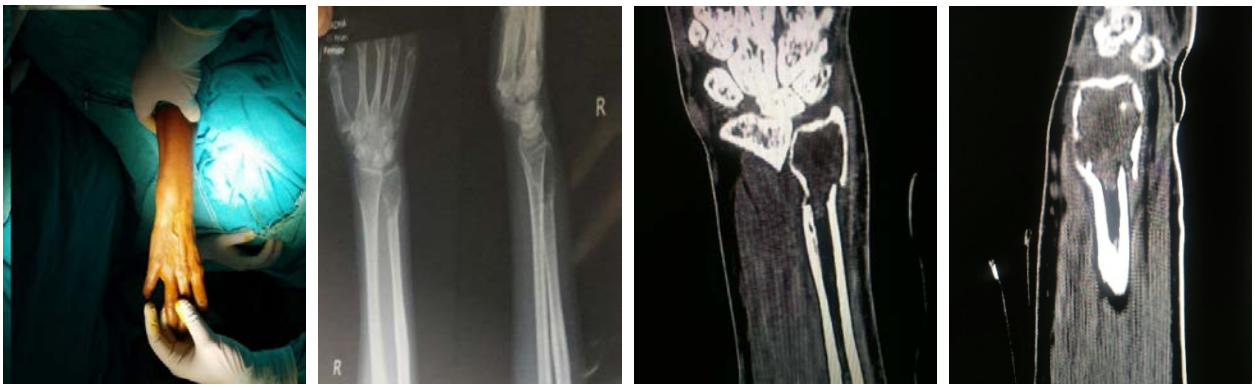
tumour and involvement of soft tissue including neurovascular structure and find out any skip lesions in bone.

An attempt was made to study the tumour as its site, origin, extent, involvement of surrounding structures skin, subcutaneous tissue, deep fascia, muscles and neurovascular bundles. Heterogenus hyperintensity on T2W and Hypointense on T2W image. Blood fluid levels and septations were seen within lesion. Endosteal scalloping, cortical breeches, zone of transition were identified.

Computer tomography was done in 7 cases. Bone scan was done in 1 case to identify any metastatic lesion as giant cell tumour was found in unusual site distal tibia and proven as giant cell tumour on histopathological examination.

Fine needle aspiration was performed in only 18 patient, in 1 patients hemorrhagic smear was reported in other 17 patients diagnosis of Giant cell tumour was confirmed.Open biopsy was performed from periphery of tumour mass after complete clinical, haematological and radiological evaluation before definitive operative procedure and send for histo-pathological examination.





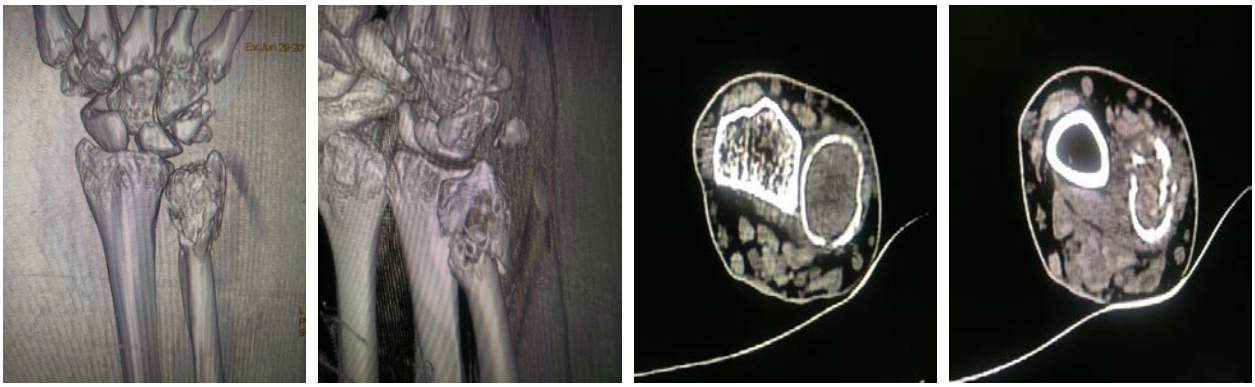
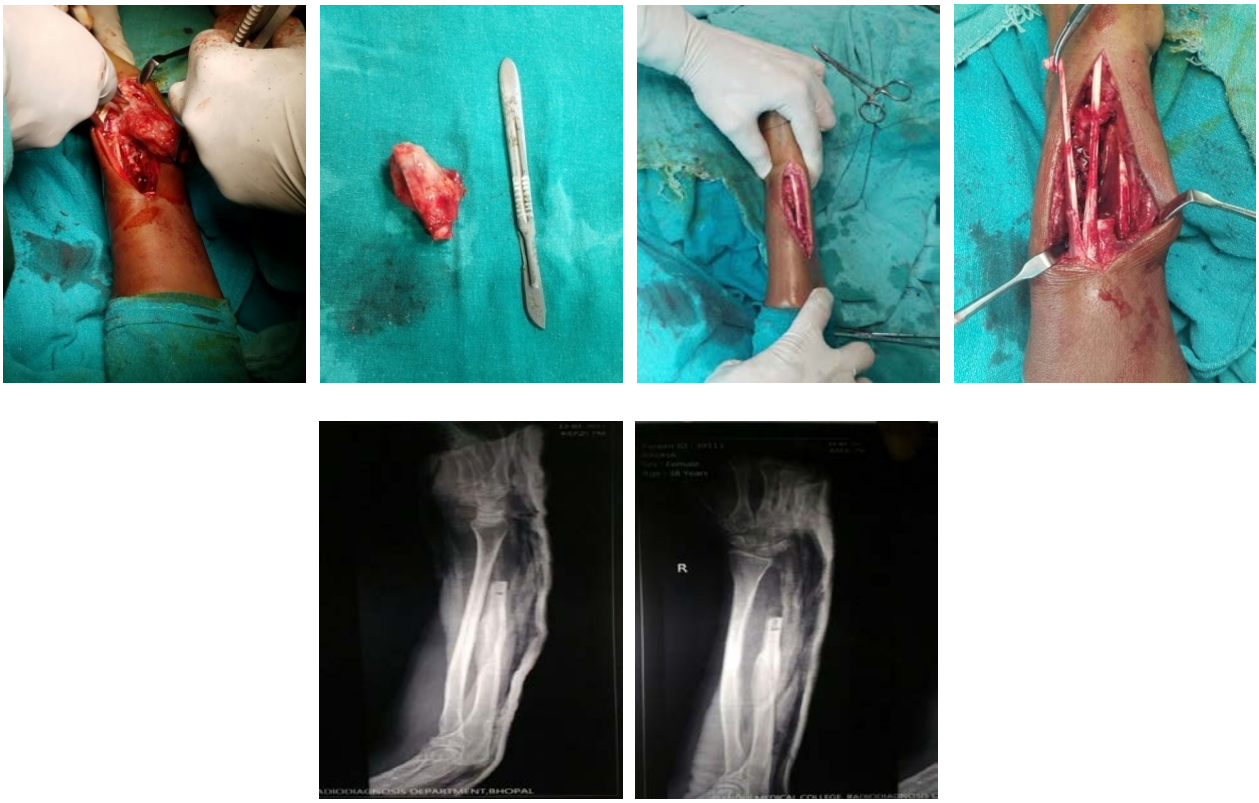


Figure 1: GCT proximal tibia



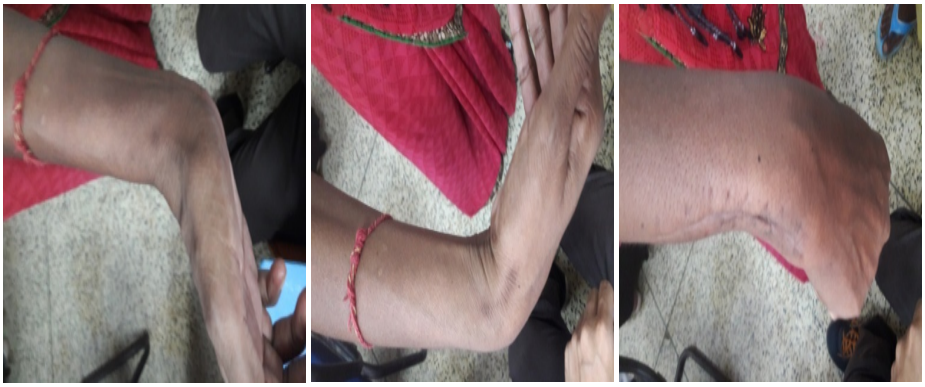


Figure 2: GCT distal ulna

Various modalities of Treatment

In our series total 25 patients of GCT of bone were treated. 10 patients are male and 15 patients are female. Treatment was according to site and severity of tumour. Our patients are treated by following modalities of treatment:-

1. Intralesional curettage
2. Extended curettage with bone grafting
3. Extended curettage with bone cementing
4. Excision with centralisation of ulna
5. Turn-o-plasty
6. Amputation
7. Resection of tumour and reconstruction of joint

The treatment of GCT is directed towards local control without scarifying joint function. This has been traditionally achieved by intralesional curettage with autograft reconstruction by packing the cavty of excised tumour with iliac cortico-cancellous bone. Regardless of how thoroughly performed intralesional excision it

will always leave microscopic tumour cell in the bone and causes high rates of recurrences, in our series 4 patients presented with recurrence of tumour.

We have treated all 25 patients in our institute after confirmation of biopsy report. All were treated by different surgeon of our department in Hamidia Hospital. Splint was applied in weight bearing joints to prevent pathological fracture. 24 patients were operated under regional anaesthesia and one patient with GCT scapula was operated under general anaesthesia. All patients were informed about procedure and there possible complications and prognosis in future.

Out of 25 patients 5 patients had Giant Cell Tumour of distal femur. In all these 5 patients standard extended curettage was performed and Structural allograft is laid in the subchondral region and overlaid with a layer of gel foam, and the rest of the cavity is filled with polymethylmethacrylate bone cement (sandwitch technique)[18]

In 3 patients fixation was achieved with DFLCP, in other 1 patient fixation was achieved by Cannulated cancellous screw and in 1 patient Turn O Plasty was done .

Out of 25 patients 6 patients had Giant Cell Tumour of Proximal Tibia. . In all these 6 patients extended curettage was performed and bone grafting with bone cementing was done in the form of sandwich technique as performed in case of GCT distal femur. Structural support was provided by PTLCP fixation in 3 patients and CC screw fixation in 2 patients. In one patient fibula of same side was used to provide structural support. No comorbidity occur in 1 year follow up after fibular grafting. With the standard approach of proximal tibia almost same surgical technique was used in GCT of proximal tibia.

Of 25 patients 5 patients had Giant Cell Tumour of Distal Radius. All patients were treated by wide excision of tumour till safe margin. To achieve stability of wrist joint in 4 patients centralization of ulna was done and fixed with LCP in 3 patients and with ulnar nail in 1 patient. In 1 patients only wide excision was done and and distal most end was attached with tendon of Flexor carpi ulnaris to prevent prominence of distal remaining part of radius and to stabilize the wrist joint.

4 patients had Giant Cell Tumour of distal Ulna. All were treated with en bloc resection of the distal ulna including healthy proximal bone

One patient had Giant cell tumour of fibular head was treated with wide excision of tumour till safe margin. No signs of common peroneal nerve injury were noted in this patients

One patient had Giant Cell Tumour of Scapula which was treated with subtotal Scapulectomy.

Two patients had Giant Cell Tumour of distal tibia and 1 treated with below knee amputation as there was extensive soft tissue involvement including neurovascular structure with standard approach of below knee amputation and primary closure was done and other one patient was treated with curettage and bone grafting with bone cementing with ankle arthrodesis.

Clinical assessments regarding pain, instability, recurrence, hand grip strength and functional status were done at regular intervals of three-six months. The range of movement at wrist joint was measured with a goniometer and grip strength was assessed in comparison with the opposite hand.

The Musculoskeletal tumour society score developed by Enneking[19] was used to assess functional results. This system involves six factors for upper and lower extremities.

1. Pain

2. Function and

3. Emotional acceptance

(are factors for both upper and lower limbs)

Typical factors for the lower limbs

1. Support,

2. Walking ability and

3. Gait

Typical factors for the upper limbs

1. Hand positioning

2. Dexterity and

3. Lifting ability

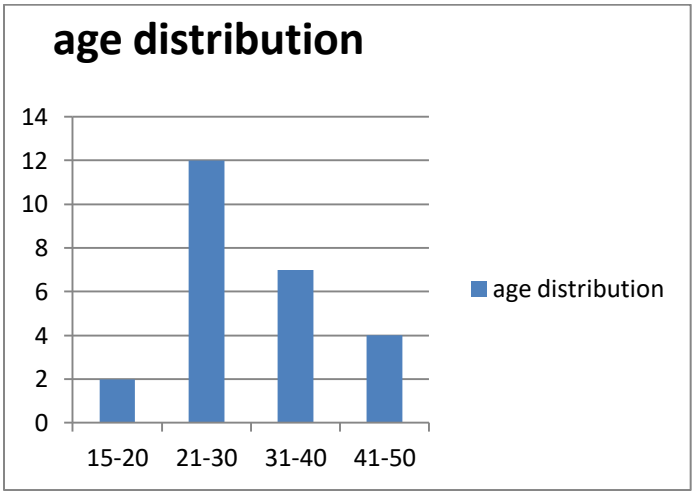
A maximum of five points for each factor results in a maximum score of 30 points. Functional analysis was performed at the most recent follow-up visit. Functional evaluation was not available for two patients one received primary amputation due to severe aggressive lesion and one received secondary amputation after local recurrence.

Results

We have treated 25 patients of Giant cell tumour of bones. Age group of 21 to 30 was mostly (12) affected in our series. Females (15) were more commonly affected than male (10). Most common site for GCT in our series was around the knee joint mostly in proximal tibia (6 out of 25). Early postop complication was infection at surgical site occurred in 5 patients in our series. Joint stiffness was late complication found in 5 patients. Average range of motion around knee joint was 60 to 112 degree. Around wrist joint it was 0 to 45 degree of palmar flexion and 0 to 30 degree of dorsi flexion. There was no valgus instability or peroneal nerve injury in case of GCT of fibular head after excision. Patient with GCT of scapula was able to perform abduction up to 90 degree and full range of adduction flexion and extension at shoulder joint. The patient with GCT of distal humerus had almost full range of motion at elbow joint ranging from 5 to 110 degree of flexion. One patients with GCT of distal tibia was able to walk with full weight bearing only there was joint stiffness as patient was treated with ankle arthrodesis. Overall result was excellent in 16 %, good in 56% , fair in 8 % and poor in 12%.

Table I: Age distribution

AGE(years)	TOTAL	PERCENTAGE
15-20	2	8
21-30	12	48
31-40	7	28
41-50	4	16
Grand total	25	100



Graph 1: The age distribution ranged from 15 to 50 years. Most of the patients were of the age group 21 to 30 (48%). Average age of presentation was 31.76 years.

Table II: Gender distribution

SITE	MALE	FEMALE
Distal femur	2	**3**
Proximal tibia	3	**3**
Distal radius	**1**	**4**
Distal ulna	**1**	**3**
Distal tibia	**1**	**1**
Fibular Head	**1**	**0**
Scapula	**0**	**1**
Distal Humerus	**1**	**0**
Total	**10**	**15**

Female predominated in our study. 15 patients were female out of 25 patients (60%)

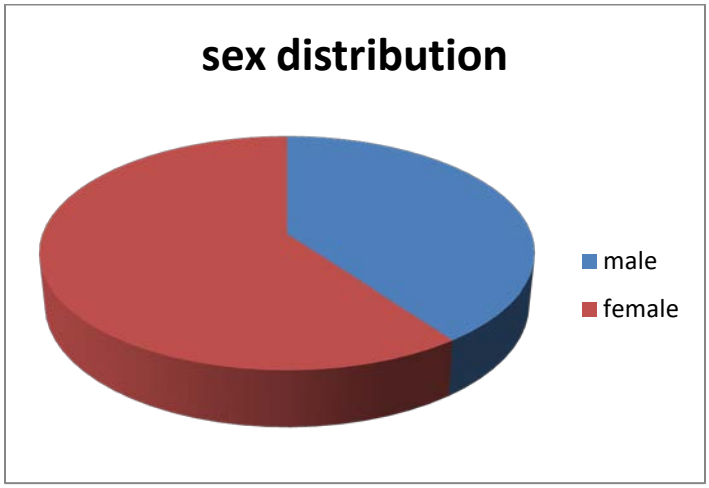
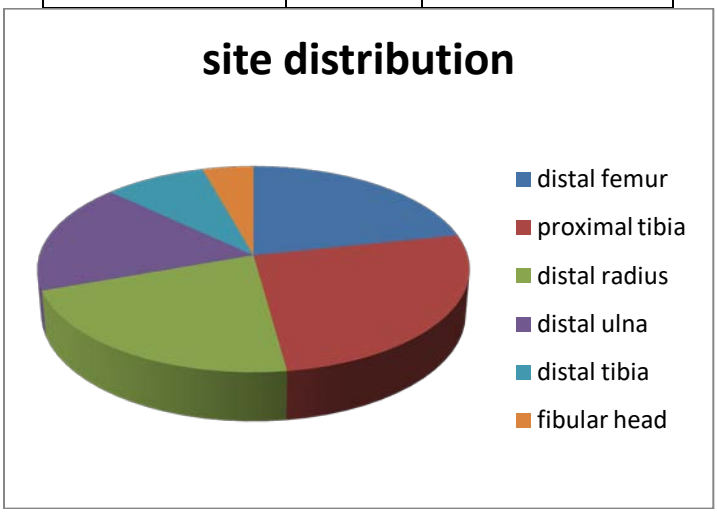


Table III: Site distribution

SITE	TOTAL	PERCENTAGE
Distal femur	5	**20**
Proximal tibia	**6**	**24**
Distal radius	**5**	**20**
Distal ulna	**4**	**16**
Distal tibia	**2**	**8**
Fibular Head	**1**	**4**
Scapula	**1**	**4**

Distal Humerus	**1**	**4**



Most common site in our study was proximal tibia (24%) followed by distal femur (20%) and distal radius (20

Table IV: Treatment modalities

SITE	Total no cases	PROCEDURE	Adjuvant	Average MSTS Score	Recurrence
Distal Femur	1	Curettage Bone cementing	Cement	27.8	Nil
	2		Cement		
	3		Cement, phenol		
	4		Cement, phenol		
	5		Cement		
Proximal Tibia	1	Curettage Bone cementing	Cement	19.5	2
	2		Cement		
	3		Cement		
	4		Cement, phenol		
	5		Cement		
	6		Cement		
Distal Radius	1	Excision	None	20.8	2
	2		None		
	3		None		
	4				
	5				
Distal Ulna	1	Excision	None	25	Nil
	2				

	3				
	4				
Distal Tibia	1	Curettage Bone cementing	cement	24.5	Nil
	2	Below knee amputation	None		
Scapula	1	Excision	None	26	Nil
Distal humerus	1	Curettage	None	28	Nil

Table V: Complications

S. No.	Complications	No of patients
1	Post op infection	5
2	Wound dehiscence	1
3	Joint stiffness	5
4	Recurrence	4

Discussion

According to M. Szendröi [51] nearly 50% of cases occur in the region of the knee, but other frequent sites are the distal part of the radius, the proximal humerus and fibula, and the pelvic bon. A GCT starting from the metaphysis has been described in skeletally immature patients at an open growth plate. In our series, the most common site of predilection was also around the knee joint most commonly in proximal tibia(24 %)and second most common site was distal femur (20%), GCT of distal radius 20 %,distal ulna 16 %,distal tibia 8 %,fibular head 4 %,scapula 4 % and distal humerus 4%.Most patients were in their third decade of life. In our study there was a slight Female predominance (60%). The main clinical symptoms are non-specific, local swelling, warmth, and pain radiating independently of weight-bearing. Pathological fracture is the first sign in approximately 15% of cases. The duration of symptoms varies between two to six months and by then, in one-third of cases, the size of the tumour exceeds 50% of the diameter of the affected bone, it has destroyed the cortical bone and reached the subchondral region.

According to LIANG-KUANG CHEN et al [52] radiographically, GCTs appear as solitary radiolucent or expansile radiolucent lesions without bony sclerosis or periosteal reaction. There may be little periosteal reaction and faint trabeculation. MRI is useful in determining the extent of marrow and cortical bone thinning or destruction, joint involvement, and soft tissue extension. GCTs produce low to intermediate signals on T1-weighted spin echo images and intermediate to high signals on T2-weighted images.

According to Costantino Errani et al[53] the best treatment should insure local control and maintain function. The recommended curettage technique involves the opening of the bone through a large cortical window that allows

visualization of the entire tumor cavity. After curettage is achieved, the cavity is deepened with the use of high-speed burrs. We used phenol in some patients and cement in all patients in GCT of distal femur and proximal tibia as an adjuvant. Adjuvants presumably remove the tumor cells which remain after curettage because of their thermal (liquid nitrogen, methylmethacrylate) or chemical (phenol, hydrogen-peroxide, alcohol) effects. After tumor evacuation, the cavity can be left unfilled or it can be filled with cement or bone grafting.[54,]

According to Costantino Errani et al [53] recurrence rate was 16% in patients having curettage, but it was lower after a curettage and the association of phenol, alcohol and cement (12.5%). Resection with wide margins is usually reserved in these cases: aggressive stage 3 tumors, when bone destruction is extensive with large soft tissue mass and it is no possible to preserve the joint, or when sacrifice of bone would provide better tumor control and minimal functional impairment such as for tumors located in the proximal fibula and distal ulna.

O'Donnell et al.[55] highlight a higher risk of recurrence when the tumor is located in the distal radius rather than distal femur or proximal tibia. The quality of the bone at that site and the proximity to other small bones of the carpus and the ulna make the complication rate of the tumor or the treatment greater than in other sites. In our series 2 out 5 patients of GCT distal radius. was presented with recurrence and all were treated with below elbow amoutation.

In our series curettage with bone grafting was enough for preventing recurrences. Only 2 out of 13 patients treated with curettage and cementing were presented with recurrenc after average 9 month after surgery and 2 patients out of 10 treated with wide excision presented with recuurence after around 9 month of surgery.

In study of Balaji Saibaba et al[56] intralesional curettage and reconstruction with the sandwich technique achieved a low recurrence rate (2.8%) and good functional outcome (92.3%). In our series good functional outcome in case of GCT around knee joint was 85 %..

In study of Dr SaikatSau et al[57] at last follow-up, the average combined range of motion was 100.5° (supination, pronation,dorsiflexion, palmar fl exion, ulnar deviation and radial deviation) with range varying from 60° to 125°. Using the modified system of the Musculoskeletal Tumour Society[8] the mean functional score was 93.2 (ranged from 83 to 96). The average union time was 7 months (range 4 to 12 months). Non-union occurred in 1 case and was treated by additional bone graft from the iliac crest and full union was achieved at 12 months. Graft resorption occurred in another case that was managed by wrist arthrodesis using intercalary fibular graft and iliac crest bone graft. Localised soft tissue recurrence was encountered in another case after 3 years and was managed by a local excision of the nodule with the removal of the plate as the graft was fully united. This patient was followed for another 2 years and achieved good functional results with no complications. A total of 3 secondary procedures were required. In our series average combined range of motion was 95 degree with range from 57 to 121 degree. We were not used any fibular or iliac graft for reconstruction, in all 5 cases we excised the tumour mass with safe margin and recurrence was noted in 2 patients. In 1 patient with recurrence of GCT second procedure was performed and tumour was again excised with taking safe margin and in another patient with recurrence below elbow amputation was performed.

We have treated 2 patients of GCT of distal tibia 1 patients had locally aggressive lesion involving soft tissues and neurovascular bundle and thatswhy treated by below knee amputation and another patient with GCT of distal tibaia was treated with extended curettage with bone cementing and ankle arthrodesis with no functional limitation and patient was able to perform her daily routine activity with full weight bearing.

Conclusion

The small localized lesion is best treated with curettage. Those with extensive cortical destruction and large soft tissue component usually need en bloc resection. We believe that removal of most of tumour mass by extended curettage is very essential step in preventing recurrence and achieving good functional outcome in future. A carefull clinical and radiological assessment of GCT of bone and judicious treatment plan is the key for successful outcome in these lesion. The main purpose of our study after proper surgical management of GCT patients is to achieve optimum functional activity without any recurrence in future.

ACKNOWLEDGEMENT

No dissertation can be completed without the help of many individuals. Hence thanks and gratitude are owed to all of them for help in various ways in the completion of this dissertation.

I owe my deepest sense of gratitude and extend my sincere thanks to Prof. Dr. S. Gaur, M.S, Mch., Professor and Head of Department, Department of Orthopaedics, Gandhi Medical College, Bhopal for giving me the opportunity to do this research and for providing invaluable guidance throughout this study. His invigorating suggestions have inspired me to delve deeply in significant entities and to sort grains from the chaff. His dynamism, vision, sincerity and motivation have deeply inspired me throughout the period of residency.

It is with great beatitude and profound feeling of indebtedness I acknowledge the inestimable help of my teacher Prof. Dr. Deepak S. Maravi, M.S, Professor Department of Orthopaedics and Dr. Suresh Uikey, Assisstant Professor Gandhi Medical College, Bhopal. His vision and sincerity have deeply inspired me. It has been his untiring support and constant guidance that this work of research was possible. His righteous principle, disciplined attitude, his systematic and analytical approach has always kept me on the right track whenever I seemed to falter.

I express my heartfelt thanks to Prof. Dr. Ashish Gohiya, M.S Ortho, Professor, Department of Orthopaedics, Gandhi Medical College, Bhopal for his constant motivation and support.

I am thankful to Department of Pathology, Prof. Dr. Reeni Malik (MD. patho), Professor, Department of Pathology and Prof. Dr. O.P. Singh, Professor and Head, Department of Radiotherapy.

I affectionately thank my parents and family for their abundant love, endurance support, innumerable sacrifices and unceasing encouragement that has moulded me into a person I am today.

I am deeply thankful to my colleagues and friends Dr. Yash Agrawal, Dr. Vinay Oddam, Dr. Pratyush Goyal, for their genuine support in times of crisis.

Last but not least, I express my deep sense of gratitude and debt to all the patients and their families, who have always been a constant source of inspiration to me, every patient, despite their agony and pain kindled a light of faith and better future in my heart.

Dr. Anil Kumar Pandey

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