

REVERSE SHOULDER ARTHROPLASTY IN PROXIMAL HUMERUS GIANT CELL TUMOUR

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ABSTRACT**BACKGROUND**

Giant cell tumour is a locally aggressive tumour that occurs close to the joint of a skeletally mature bone. It usually affects young adults aged 18 to 40 years with a slight female preponderance. Proximal humerus is a rare site of involvement accounting for only around 4% of the disease. Campanacci grade 1 and 2 lesions where there is no extraosseous extension, treated with intralesional extended curettage, having a recurrence rate of 17% has been reported. Wide resection and reconstruction is reserved for Campanacci grade 3 tumour, where these are breach of cortical bone. Goal of surgery was to prevent recurrence by completely removing the tumour and reconstruction of proximal humerus tumour with wide resection and reconstruction results in poor functional outcome. Reconstruction of proximal humerus with an osteoarticular allograft, endoprosthesis or allograft-prosthetic composite are available but offers poor outcome. Here, in this study we have used reverse shoulder arthroplasty for reconstruction of proximal humerus giant cell tumours for good functional outcome.

MATERIALS AND METHODS

It was a retrospective, descriptive study which consisted of 30 patients (11 females and 19 males). Selection criteria of patients were patients with Campanacci grade 3 lesion and metastasis. All patients were operated under general anaesthesia positioned in beach chair position. Deltopectoral standard approach was used in all patients and whole of tumour was resected en bloc. Reconstruction of shoulder joint was done by reverse shoulder prosthesis (Depuy). Postoperatively, patients' shoulder was immobilised in an abduction splint for 1 week. Passive range of movements were started as per the patient's tolerance over the next 4 - 6 weeks. Patients were evaluated by Constant Murley Score, American Shoulder and Elbow Surgeon and Disability of Arm, Shoulder and Hand Score.

RESULTS

The mean follow-up period was 20 (range of 12 - 26) months. All patients were evaluated clinically. None of the patients had recurrence. The mean forward elevation was 80, mean abduction was 75, external rotation and internal rotation was 20. There was no evidence of loosening of components. All the patients were evaluated clinically. None of the patients had recurrence. Active shoulder abduction ranged from 40 to 110 degrees (mean 78.3 degrees). The mean functional Constant-Murley score was 71% (range from 38% - 88%). The Musculoskeletal Tumour Society (MSTS) score as proposed by Enneking averaged 81.2% (ranging from 61% - 90%). Patients with history of dislocation (2 patients) performed worse. Even patients with generalised tumour disease had a significant improvement in comfort and function, increasing their quality of life. Scapular notching was not seen in our cases.

CONCLUSION

Reverse shoulder prosthesis compared to other modalities of shoulder reconstruction after tumour resection provides a good range of movement, stability and patient satisfaction. Complication can only be better assessed with a long follow-up. But we believe reverse shoulder is the prosthesis for reconstruction of proximal humerus GCT resection. Young patient undergoing RSA require counselling of their post-operative limitation and functional capacities.

KEYWORDS

Giant Cell Tumour, Reverse Shoulder Arthroplasty.

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BACKGROUND

Giant cell tumour is a benign tumour of the bone that occur close to the joint of a skeletally mature bone.^[1]

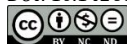
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It is locally aggressive, and its clinical behaviour is difficult to predict based on its microscopic appearance alone. It usually affects young adults aged 18 to 40 years with a slight female preponderance.^[2] Proximal humerus is a rare site of involvement, accounting for only around 4% of the disease. The most common site being around the knee (distal femur and proximal tibia) accounting for 50% - 65%.^[3] Grade 1 and 2 lesions where there is no extraosseous extension are treated with intralesional resection extended curettage with recurrence rate of 17% has been reported.^[4,5,6,7,8] The appropriate treatment for Campanacci grade 3 tumour are controversial. Grade 3 tumour are treated either by amputation or resection and reconstruction. Since the late

1970, limb salvage has replaced amputation as the mainstay of surgical treatment of bone tumour.^[9]

The goal of the surgery is to prevent recurrence by completely removing the tumour through R-0 resection and reconstructing the joint to preserve both elbow and hand functions, and to improve shoulder stability with as much function possible. Here, in this study to improve the functional outcome we have used rather a new option that is reverse shoulder arthroplasty for the reconstruction of proximal humerus. However, a prerequisite for this therapeutic option is the preservation of the axillary nerve and the deltoid muscle. Only few studies in the literature have evaluated the results of RSA after tumour resection as the number of patients remains limited. In this article, we evaluate the reverse shoulder prosthesis in the reconstruction of proximal humerus GCT post resection.

MATERIALS AND METHODS

It was a retrospective descriptive study between the year 2010 and 2016. 41 patients in our institution were treated for giant cell tumour of the proximal humerus. Among them 11 patients were excluded from the study. Out of the 11 patients, 7 had Campanacci grade 2 tumour and were treated by extended curettage and bone grafting. Rest 4 patients were having involvement of the deltoid, who later underwent amputation. Thus, our study included 30 patients (19 men and 11 women) who were an average age of 50 years (range from 29 - 61 years) at the time of operation. The dominant shoulder was involved in 18 patients. 9 patients had a light-manual labourer occupation, and 10 were heavy-manual workers. Radiographic imaging was performed on all patients preoperatively. X-ray of the local part and chest, Magnetic Resonance Imaging (MRI) of the local part to assess soft tissue involvement, neurovascular bundle status and any other systemic involvement. None of the patients had any distant metastasis at the time of operation. Diagnosis of the tumour was performed via a specimen obtained from a deltopectoral core needle biopsy. Inclusion criteria included patient with Campanacci grade 3 giant cell tumour of proximal humerus, no neurovascular involvement and Deltoid not being involved. All patients underwent en bloc resection of the proximal humerus with preservation of the deltoid muscle and the axillary nerve. In all patients, the rotator cuff was resected for oncological reasons. All resections were wide. The shoulder joint was reconstructed using long stem reverse shoulder prosthesis (Depuy). Full post-operative oncological screening was done at pre-set time intervals. At latest follow-up, we recorded the Constant-Murley score, the ability to work, MSTS and the visual analogue scale (VAS) score for pain.

RESULTS

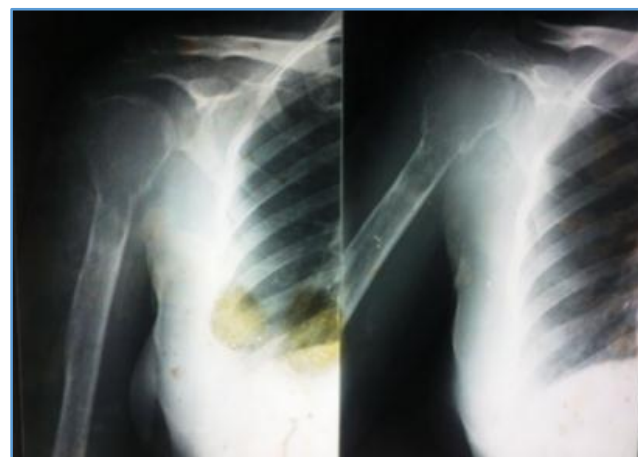
All the patients were evaluated clinically. The mean follow-up was 20 months (Range: 12 to 26). Active shoulder abduction ranges from 40 to 110 degrees with a mean abduction of 78.3. The mean functional Constant-Murley score was 71%, ranging from 38% to 88% in comparison to pre-op score of 36.5. There was considerable improvement in Musculoskeletal Tumour Society (MSTS) score as proposed by Enneking which averaged 81.2%, ranging from 60% to 91%. Patients with history of dislocation had poor results. In one patient, active external rotation was noted. The VAS pain

score was 1.1 ranging from 0 - 2 compared to the preop score of 4.6. This represented a dramatic improvement in quality of life.

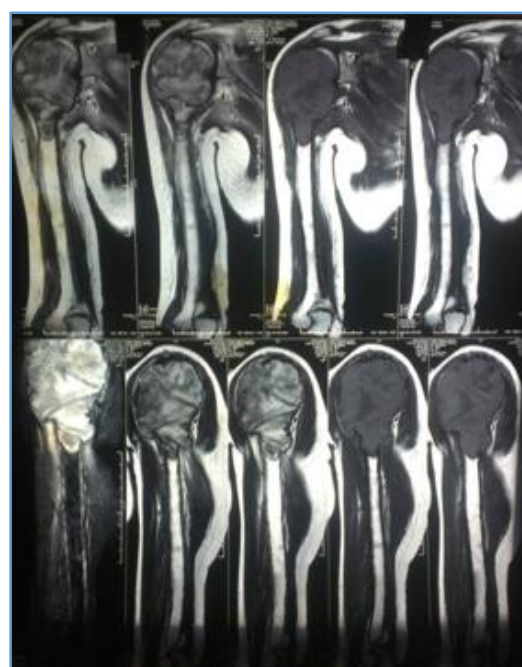
In addition to the clinical evaluation by the Constant-Murley and the MSTS scores,^[10] all patients were also evaluated radiographically and oncologically. No local recurrence was seen. In two cases, a thin non-progressive line of bone resorption was seen on the glenoidal side without any clinical consequences. Temporary dislocation was noted in two patients, which was reduced and splinting was done for 1 to 6 weeks. Instability was directly related to the level of resection. In these 2 patients, the tumour resection led to around 15 cm loss of bone diaphysis and deltoid was sutured to bone below. No patient had any loosening of humeral component. No patient had any atrophy of deltoid muscle. All screws had remained unchanged at the original position at the latest follow-up. One patient had an episode of superficial infection post-operatively, which was treated by antibiotics and got controlled.

Case Records

CASE 1.



Initial X-Ray



Initial MRI



X-Ray Immediate Post-Op



X-Ray after 1 Year

Sl. No.	Patient	Age	Sex	Side	Campanacci Stage	Height of Resection	Follow-Up (In Months)	Constant Murley Score Pre-Op	Constant Murley Score Post-Op	MSTS Pre-Op	MSTS Post-Op	Recurrence	Complication
1	Patient 1	29	F	R	3	12	26	40	78	36	91	NO	NONE
2	Patient 2	55	F	L	3	11	24	38	72	38	85	NO	NONE
3	Patient 3	44	M	R	3	14.5	23	28	38	31	60	NO	DISLOCATED ONCE
4	Patient 4	48	M	L	3	10	19	35	68	35	85	NO	SUPERFICIAL INFECTION
5	Patient 5	45	M	R	3	9	16	37	82	40	84	NO	NONE
6	Patient 6	61	M	R	3	11.5	12	42	88	38	78	NO	NONE
7	Patient 7	60	F	L	3	11	21	37	73	39	86	NO	NONE
8	Patient 8	30	F	R	3	10	19	40	70	39	90	NO	NONE
9	Patient 9	55	M	L	3	12	23	39	69	40	76	NO	NONE
10	Patient 10	54	M	R	3	10	24	37	72	39	77	NO	NONE
11	Patient 11	34	F	R	3	9	19	33	75	34	87	NO	NONE
12	Patient 12	61	M	L	3	11	26	40	73	39	84	NO	NONE
13	Patient 13	39	M	R	3	12	23	42	83	39	88	NO	NONE
14	Patient 14	58	F	R	3	12.5	15	37	68	40	89	NO	NONE
15	Patient 15	61	M	L	3	10	18	33	69	35	82	NO	NONE
16	Patient 16	42	F	L	3	15	16	29	66	31	63	NO	DISLOCATED ONCE
17	Patient 17	34	M	R	3	10.5	17	32	71	32	88	NO	NONE
18	Patient 18	59	M	R	3	11	18	35	74	36	90	NO	NONE
19	Patient 19	32	F	L	3	9.5	19	36	59	38	84	NO	NONE
20	Patient 20	57	M	L	3	8.5	22	42	84	40	88	NO	NONE
21	Patient 21	60	M	L	3	9	21	33	58	36	82	NO	NONE
22	Patient 22	54	M	R	3	10	17	42	88	39	86	NO	NONE
23	Patient 23	38	F	R	3	11	25	41	76	40	77	NO	NONE
24	Patient 24	55	M	L	3	11.5	14	38	71	36	84	NO	NONE
25	Patient 25	61	M	R	3	10	16	39	66	38	78	NO	NONE
26	Patient 26	66	M	L	3	10	23	30	55	31	79	NO	NONE
27	Patient 27	56	M	R	3	11	17	34	62	36	73	NO	NONE
28	Patient 28	60	M	L	3	10.5	21	32	57	33	71	NO	NONE
29	Patient 29	49	F	R	3	10	22	40	86	39	77	NO	NONE
30	Patient 30	44	F	R	3	9.5	24	36	80	35	75	NO	NONE

Table 1. Results

DISCUSSION

The controversial behaviour of the GCT has led to scepticism in the treatment aspect. A few decades ago, amputation was an option for proximal humerus blown out tumours. In the recent past, limb sparing surgery has gained popularity. It has

been shown to be more cost-effective than amputation.^[11] En bloc resection is a very reliable method of treating typical as well as aggressive tumours with preservation of the extremity and minimising the chance of recurrence. R-0 resection (Wide resection) offers a theoretical advantage of

lower recurrence risk by removing the entire tumour, but is associated with worse functional outcomes, especially in the context of the proximal humerus.^[12] Mittal et al (1987) reported that in their series en bloc resection yielded best results.^[13] In our series, all of the cases were Campanacci grade 3 tumours. Our primary aim was to achieve an en bloc resection with proper margin, which was assisted by pre-op MRI. We achieved R-0 resection in all of our cases, which was established by the fact that post-op biopsy reports showed 6 margin clearance.

Reconstruction of the proximal humerus after resection poses considerable challenge. There are many methods of reconstruction which include fibular grafting, osteoarticular grafts and prosthetic replacement. Fibular grafting is associated with poor results. Fracture and flail shoulder are the most common shortcoming with fibula grafting. With osteoarticular grafts, rejection and non-union are seen. Also, many centres are deprived from the facilities of Bone bank.^[14]

We have used Reverse shoulder arthroplasty for the reconstruction of proximal humerus. It is basically popular for treatment of Glenohumeral arthritis with rotator cuff arthropathy. Same principle of reverse shoulder was applied for the reconstruction of Glenohumeral joint after resection of the tumour mass. In our series, reverse arthroplasty for treating GCT of proximal humerus provided statistically significant increase in range of motion for anterior flexion and abduction. The mean anterior flexion was 72° and abduction of 78.3°. However, there was not much range of motion relating to external and internal rotation movements. These results are concordant with those published in the specialised literature, in which the improvements in anterior flexion and abduction occurred as a consequence of the implant design, which medialised and inferiorised the center of joint rotation, increased the moment of deltoid force and transformed the shearing forces that existed in the glenoid into compression forces.^[15,16,17] De Wilde et al achieved an active shoulder abduction and elevation ranged from 80° to 150° with a mean of 105° in his study, which was published in 2011.^[18]

2 years post-operatively recurrence was not observed in any of the cases included in our study. Most recurrences occur within the first 18 months after surgery and rarely after 3 years.^[19,20,21,22] Mean follow-up was 20 ± 5.3 months. De Wilde et al achieved a mean functional Constant-Murley score of 72.5%, ranging from 30% to 90%. The mean Constant score in our study improved post-operatively and was averaging 71% compared to preop score of 36.5%. The preop MSTS score was 37.06%. Post-operatively, the MSTS score jumped to 81.2%. The 'p' value is less than 0.0001 and statistically significant. Functionally and emotionally, all the patients improved a lot and it can be seen with the reduced VAS score which was averaging only 1.1.

Most of the patients are middle aged. So, questions may arise after the failure of the implant after certain age. As for this indication, the patient is going to outlive the prosthesis. The answer lies in the development of science regarding the prosthesis and also other methods can be done like spacers, arthrodesis, allograft reconstruction and many more after the failure of the reverse shoulder prosthesis.

CONCLUSION

Although, our experience in this specific field is limited and follow-up is still short, but we feel that achieving R-0 resection is of utmost importance in cases of GCTS to minimise the recurrence of tumour in future. Reconstruction by reverse shoulder prosthesis turn out to be a reliable joint reconstruction procedure in our study. There is a clear advantage of RSA over other modalities of treatment such as classical hemi- or total shoulder arthroplasty in limb salvage and joint reconstruction, especially in Campanacci grade 3 GCTS of proximal humerus. Patients have good active mobility of the upper limb without the risk of proximal migration of the prosthesis. The shoulder joint is stable during movement and strength is only mildly affected.

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