Abstract:
Aggressive Giant Cell Tumour (GCT) in juxta-articular portion of the proximal humerus is difficult to treat. We are presenting a case of aggressive giant cell tumour in proximal humerus of twenty two yrs female its management with en-bloc resection of the tumour and reconstruction of proximal humerus with autologous avascular fibular graft clinical, radiological functional outcome after reconstruction.

Keyword: Aggressive GCT, en-bloc resection, avascular fibular graft,

BACKGROUND:
Juxta-articular aggressive giant cell tumour in head of humerus causes deformation of the articular surface and hence cannot be treated with simple curettage and bone grafting(1,2,6,7,8,9,10,12). In addition it has a higher incidence of recurrence(9,12). Hence en-bloc excision with a normal margin and replacement with avascular, autologous fibular graft can be done to ensure complete tumor resection preventing recurrence and restore reasonable shoulder movements(6,7,8,10,42,46,47). The fibula is a strong, long, tubular bone that can be used as a non-vascularized bone graft for restoration of mechanical continuity and efficiency of the limb after bone defects resulting from tumor resection (5,15-22,25-32). The purpose of this article is to evaluate the clinical, functional and radiological results of resection and reconstruction of humeral head using non-vascularized fibular bone graft(3,19,49-53)

CASE REPORT:
A 23 year female patient presented with complaints of pain and swelling over the left shoulder of 5 months duration. Pain was dull aching, progressive, not radiating, aggravated by shoulder movements, and relieved by taking rest. There was no history of trauma, loss of weight or appetite. There was no
history suggestive of infective pathology.
On examination, the patient had a diffuse
swelling over the left shoulder, extending from
just below the coracoid process to a point 10
cm below the joint. The swelling was warm and
tender. The tumour arising from the proximal
humerus had an irregular surface with ill-
defined margins and was bony hard in consist-
tency. There were no lymph nodes. Patient had
limitation of movements (5 to 10 degrees

pre-op x-ray (Fig.1)
Laboratory investigations revealed normal
blood parameters except for anaemia. Plain
anteroposterior x-ray of the left shoulder joint
showed a large ballooned out osteolytic lesion
in the epihyseal-metaphyseal region of the
proximal humerus, with total destruction of hu-
meral head, thinned out cortex with cortical
breaching, and wide zone of transition without
periosteal reaction(Fig.1). MRI of the lesion re-
vealed cortical breaching and extracompart-
mental nature of the tumor without any
neurovascular involvement.(Fig.2-A,2-B,2-C).
Radiologically the patient was diagnosed to be
suffering from a locally aggressive giant cell tumor (Enneking staging of benign tumours-III/
Campanacci stage-III-aggressive)(1-3,6-
13,19,46,47). The diagnosis was confirmed
with histopathological examination. Preopera-
tive chest x-ray and CT chest were taken to
rule out lung metastasis.

MRI(Fig. 2-A)

MRI - SAGITTAL (Fig. 2-B)
MRI - AXIAL (Fig. 2-C)

TREATMENT:
Considering the patient’s age, benign
nature of giant cell tumor with good
survival rate after complete resection,
presence of tumour on the non-
dominant limb and to avoid repeated
surgeries, an En-bloc resection of the
tumour and reconstruction of the hu-
meral head with ipsilateral non-
vascularised fibular graft was
planned.
Under general anaesthesia, through
the deltopectoral approach, the tu-
mour was exposed. The tumour was
well isolated from the surrounding
vessels and nerves after elevating
the muscles. The articular capsule
was incised and the surgical margin
was defined.
The tumour was resected with a safer margin of 5 cms (MRI plus a safe margin of 3-5 cm). Dissection remained extraperiosteal at all time in order to avoid spillage of tumourous tissue and a soft tissue cuff was excised along with the tumor taking care not to damage neurovascular structures. After excision, tumor bed was routinely treated with 5% phenol and 3% hydrogen peroxide to take care of the inadvertent spillage, if any (11,42).

Ipsilateral proximal fibula of about 15 cm was harvested and used as a free nonvascularised graft to bridge the defect(Fig.3-B). After preparation of the bone and soft tissue bed, the fibular graft was inserted into the medullary cavity of the humerus in press-fit and fixed with a 3.5mm cortical screw(Fig.3-A). The rotator cuff was reconstructed and sutured to the fibular graft(17,42,48,49,51). After surgery, the affected limb was immobilized in a sling in 20 degrees of abduction. Physical therapy for the hand, wrist, and elbow was started after surgery, and for the shoulder 4 weeks later. Four weeks after surgery, movements of the shoulder joint were started gradually.

RESULT:
Follow-up x-rays at 3rd month, 5th month(Fig. 4A-F) and at one year showed complete union with graft incorporation and consolidation. Enneking’s modified system of functional evaluation after surgical management of musculoskeletal tumours was used to evaluate functional outcome. This system’s rating takes...
Follow-up x-rays at 3\textsuperscript{rd} month, 5\textsuperscript{th} month (Fig. 4A-F) and at one year showed complete union with graft incorporation and consolidation. Enneking’s modified system of functional evaluation after surgical management of musculoskeletal tumours was used to evaluate functional outcome. This system’s rating takes into account active range of movement at the shoulder, pain, stability, deformity, strength in shoulder abduction, functional activity and emotional acceptance. At 1 year of follow up, the patient had 35 degrees of abduction (chiefly by scapulothoracic movement), 15 degrees of adduction, 30 degrees of flexion, 15 degrees of extension and almost full range of internal and external rotation. (Fig. 5 B-G). There was no evidence of local recurrence and CT chest was taken to rule out metasta...
DISCUSSION:
Giant cell tumor (GCT) of bone is a benign, aggressive tumor that typically is located in the epiphysis of long bones. Although GCTs are considered benign, their ability to destroy bone and metastasize makes surgery the standard treatment. The goals of surgery are to prevent recurrence by
completely removing the tumor and to maintain adjacent joint function. (1,2,7,8,13,14)
The Enneking staging system divides benign giant cell tumors into latent, active, or aggressive tumors. Latent tumors are asymptomatic and are usually discovered incidentally. They reach a stage of non-growth after a period of slow growth. Active tumors are mildly symptomatic and may be discovered if pathologic fracture occurs or if the tumor is associated with mechanical dysfunction. Active tumors usually grow steadily. Aggressive benign lesions grow rapidly and usually are symptomatic and tender on palpation (19,46,47).

G0 - Benign lesion
G1 - Low-grade malignant lesion
G2 - High-grade malignant lesion
T0 - A benign tumor - benign intracapsular, intracompartmental lesion
T1 - An aggressive benign or malignant tumor – an extracapsular, intracompartmental lesion
T2 - an extracompartmental lesion
M0 - No regional or distant metastasis
M1 - Regional or distant metastasis

The Enneking classification correlates the tumor stage with the excision margins as follows:

**Benign tumors (19,46,47)**

*Stage 1 tumors* - Intracapsular excision (or curettage) is adequate.

*Stage 2 tumors* - Extracapsular excision passing through the reactive zone is needed.

Stage 3 tumors - Wide margins of resection are required in stage 3 lesions (aggressive benign tumors). In areas that are not amenable to wide excision, marginal excision together with adjuvant treatment (eg, radiation therapy) may be acceptable.

Campanacci’s radiological grading method consisting of three grades:

Grade I - had a well-defined border of a thin rim of mature bone and bony cortex was intact. Grade II - lesions had relatively well-defined margins but there was no radio-opaque cortical rim. Grade III - lesions with fuzzy borders, suggesting a rapid, and possibly a permeative, growth of the tumor.

Campanacci Grades I and II GCTs, which are defined as having no extraosseous extension, routinely are treated with curettage and bone grafting. Grade III lesions involve penetration of the cortical bone and extension into the soft tissue and often are treated with segmental resection owing to concerns about recurrence.

Treatment options of aggressive giant cell tumour in proximal humerus (enneking stage III/campanacci stage III) include segmental resection of the tumour and reconstruction of proximal humerus with an osteoarticular allograft (5,16,28,49,50), endoprosthesi(4,23,48), or allograft-prosthetic composite (43,48). Intralesional procedures have a higher reported recurrence rate (9,54,55). Reconstruction with prosthesis has higher rate of deep wound infection, periprosthetic fracture, recurrent shoulder subluxation/dislocation, requires repeated surgeries, can cause early shoulder joint arthritis.

The aims of limb salvage surgery are to cure disease and to preserve limb function for the patient.
The aims are usually achieved by using a combination of limb salvage surgery and adjuvant therapy (15,20,48,51).

- The tumor margins are amenable to surgery.
- Only moderate soft-tissue extension is present.
- The neurovascular bundles are intact.
- Metastases are absent or amenable to curative treatment.

A safe surgical margin is the only way to minimize the rate of local recurrence. Regarding resection margins, optimal surgical margins are 6 cm of healthy bone around the bone margins and 2 cm of healthy soft tissue around the soft-tissue extent of the tumor.

Considering the age of this patient, benign nature of giant cell tumor, excellent prognosis for survival after complete resection, juxta-articular involvement of the humeral head, involvement of non-dominant side, en-bloc resection of the tumour and reconstruction of proximal humerus with non-vascularised, autologous fibular graft were planned. En bloc resection ensures complete tumour resection and prevents recurrence. (5,1517,22,28,30,49,50)

Reconstruction of the humeral head with fibular graft provides long term reasonable joint function, avoids prosthetic replacement and repeated surgical procedures, and gives reasonable shoulder movements. Good Rotator cuff reconstruction provides better post-operative rehabilitation and shoulder movements.

CONCLUSION

Giant cell tumor near the shoulder joint, if it is more than 5mm from the articular surface, enneking stage I & II and Campanacci stage –I and II can be treated with simple curettage and bone grafting. If it is less than 5 mm from the articular surface enneking stage III and Campanacci stage -III, it deforms the articular surface, restricts joint movements and recurrence rate is more after curettaging. Hence in younger patients with benign or locally aggressive tumors in juxta-articular region of proximal humerus of non-dominant side, en-bloc excision and reconstruction with avascular, autologous fibular graft can be done. It ensures complete tumour resection ,prevents recurrence, restores reasonable joint movements, avoids prosthetic replacement and repeated surgeries. Reconstruction of rotator cuff to the fibular graft provides better post-operative rehabilitation and shoulder function.

References:


