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Late Emir HH Sheikh Sabah Al-Ahmad Al-Jaber Al-Sabah

R.I.P
SHEIKH SABAH AL-AHMAD AL-JABER AL-SABAH
THE EMIR OF KUWAIT
1929-2020

Late Emir HH Sheikh Nawaf Al-Ahmad Al-Jaber Al-Sabah and Crown prince HH Sheikh Meshal Al-Ahmad Al-Jaber Al-Sabah

Late Emir His Highness welcomes the Minister of Health and members of the Gulf Federation for Cancer Control (GFFCC)

Late Dr. Abdulrahman Abdullah Al-Awadi, Dr. Rasheed Hamad AlHamad and Dr. Khaled Ahmed Al-Saleh

Kuwait Emir HH Sheikh Nawaf Al-Ahmad Al-Jaber Al-Sabah and Crown prince HH Sheikh Meshal Al-Ahmad Al-Jaber Al-Sabah headed a meeting for Kuwait Foundation for the Advancement of Sciences (KFAS)
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Abstract

Aim: To study bone sarcoma patients who underwent limb salvage surgery with an inappropriate biopsy site and their surgical management.

Materials and methods: There were 28 patients with bone sarcoma who underwent limb salvage surgery from 2015 – 2019, among them 4 patients had inappropriate biopsy scar. They were analyzed with respect to modification of incision, extent of flap elevation, difficulties in exposure of neurovascular structures, reconstructive methods and post-operative wound morbidity.

Results: In all cases biopsy was done in outside hospital. One patient had open biopsy, remaining all were core needle biopsies. Out of the 4, three patients had distal femur lesion and one patient had proximal tibial lesion. Patient with proximal tibial lesion had biopsy site placed anteriorly over tibia. Patient underwent proximal tibial resection with anteromedial incision. Remaining three patients had distal femur lesion. One patient had pathological fracture with internal fixation done with lateral incision, and biopsy site placed medially. During surgery lateral incision was taken to include internal fixation scar with the distal end curved medially and extended over leg after including the biopsy site. One patient had distal femur lesion with laterally placed biopsy site, surgery done with lateral approach and medial gastrocnemius flap used to cover the prosthesis. One patient had anteriorly placed biopsy site, so after including the inappropriate biopsy site the lateral incision was curved medially and extended over leg. Two out of these four patients had skin necrosis; one patient had partial thickness skin necrosis and the other full thickness skin necrosis which was managed conservatively.

Conclusion: In case of limb salvage surgery, skin incisions should be planned taking extent of lesion and biopsy scars into account. Good knowledge of vascular supply and incisions required if and when surgery is planned helps in selecting proper site for biopsy.

Keywords: Bone sarcoma, limb salvage surgery, biopsy site

Introduction

Amputation had been the standard method of treatment for most bone sarcomas, but 1980s witnessed the development of limb salvage surgery for most malignant bone tumours. Today, limb salvage surgery is considered safe for approximately 90% of patients with extremity malignant bone tumours. Advances in orthopedics, bioengineering, radiographic imaging, radiotherapy, and chemotherapy have contributed to safer, more reliable surgical procedures.

Modularity of prosthetic design allows intraoperative flexibility based on the final amount of tissue resected. A rigorous rehabilitation program can be initiated immediately after implantation, allowing early joint range of motion and weight bearing.

Chemotherapy in osteosarcoma became popular with multi institutional osteosarcoma study which confirmed the increased rate of relapse free survival in high grade osteosarcoma patients who received chemotherapy. Further POG 8651 trial showed no difference in adjuvant vs neoadjuvant chemotherapy resulting in more widespread use of neoadjuvant chemotherapy, because this approach allows more time for surgical planning and also allows one to assess the extent of histologic necrosis in response to neoadjuvant chemotherapy.
Proper diagnosis is imperative for the appropriate management of musculoskeletal tumours, and biopsy is a critical step in the diagnosis of bone and soft tissue tumours. Biopsy tissue can be obtained through a fine-needle aspiration, a core-needle biopsy, or an incisional biopsy. The goal of biopsy is to obtain diagnostic tissue while minimizing morbidity, limiting potential tumour spread, and avoiding interference with future treatments. The diagnostic accuracy should be the most important parameter in determining the choice of the biopsy technique. A poorly performed biopsy could become an obstacle to proper diagnosis and may have negative impact on future treatments.

Material and Methods

There were 28 patients with bone sarcoma who underwent limb salvage surgery from 2015 – 2019, among them 4 patients had inappropriate biopsy scar. Medical records of 4 patients with an inappropriate biopsy site were analyzed with respect to modification of incision, extent of flap elevation, difficulties in exposure of neurovascular structures, reconstructive methods and post-operative wound morbidity.

Steps of surgery:

For medial approach, a curvilinear incision is made starting from junction of the middle and distal third of thigh, medial to Sartorius muscle going caudally medial to patella up to few centimeters distal to tibial tuberosity. Care should be taken that the incision does not lie over the bone, as skin over it has precarious blood supply, resulting in high incidence of flap necrosis. Flap raised subfacially till rectus femoris. In between vastus medialis and Sartorius, sub sartorial canal entered, femoral vessels identified. Geniculate branches are ligated and cut. Bone is cut with proximal 5cm margin and distally knee joint and 1cm of tibial condyles excised. Circumferential margin to the lesion should be given taking care to leave adequate thickness of flap cover. Prosthesis is inserted and secured with bone cement. If need arises, medial gastrocnemius flap can be used for soft tissue cover.

For lateral approach incision is taken along a line from greater trochanter to lateral femoral condyle. Vastus intermedius and vastus lateralis fibers are divided in the direction of fibers to reach the bone.

Results

In all cases biopsy was done in outside hospital. One patient had open biopsy, while the remaining had core needle biopsies. Mean age is 33.6 years. Out of the 4, 3 were female patients and 1 male patient. Three patients had distal femur lesion and one patient had proximal tibial lesion.

Case 1: 18–year–old male patient presented with osteosarcoma right distal femur. Patient had history of fracture right femur with open reduction and internal fixation done with scar on lateral side of thigh. Patient was given 6 cycles of Adriamycin and cisplatin chemotherapy and total femoral resection with CMP reconstruction. Lateral Skin incision was taken such that the biopsy site on the medial side of lower end of thigh was included, by getting the lower end of the incision curved across the thigh from lateral to medial side.

This medial curvature of the incision further helped in complete excision of medial soft tissue involved by tumour. Post-operative period was uneventful and the patient developed lung metastasis after 36 months and is on palliative chemotherapy.

Case 2: 55–year–old female presented with osteosarcoma left distal femur. Open biopsy was done with incision placed on lateral side and diagnosed as osteosarcoma left distal femur. Patient was given 4 cycles of chemotherapy then distal femoral resection with CMP reconstruction was done with lateral incision which after including the inappropriate biopsy site was curved to medial aspect of thigh and extended over the leg. Soft tissue defect was covered with medial gastrocnemius flap. Postoperative period was uneventful and is on regular follow up.

Case 3: 23–year–old female presented with osteosarcoma right proximal tibia with biopsy site over anterior aspect of tibia. Post 4 cycle chemotherapy patient underwent right proximal tibial resection with CMP reconstruction with anteromedial incision to include the biopsy site. Post operatively patient developed marginal necrosis of the skin with blebs near upper part of tibia which healed with conservative management. Patient had prosthesis infection after 9 months of surgery for which above knee amputation was done and developed lung metastasis after 35 months and is on palliative chemotherapy.

Case 4: 63–year old female presented with osteosarcoma left distal femur with biopsy site placed anteriorly. Patient underwent 4 cycles of chemotherapy with distal femoral resection and CMP reconstruction. Lateral Incision was taken which after including the inappropriate biopsy site was curved to medial aspect of thigh and extended over the leg. Post operatively patient developed marginal necrosis of the skin near upper part of patella which healed with conservative management.
Discussion

Multidrug neoadjuvant chemotherapy, popularized first for patients with osteosarcoma by Rosen in the late 1970s, helps control systemic disease by attacking micro metastases, dramatically increasing overall survival rates\(^1^5\). Neoadjuvant therapy also “sterilizes” the reactive zone around the tumour by destroying microscopic disease at the periphery of the primary lesion, thus facilitating resection. Additionally, in some patients with a relative contraindication to limb salvage, such as a pathologic fracture in the upper extremity, the use of chemotherapy with a favorable response may allow limb salvage to be considered\(^9\).

There are four basic principles of limb salvage procedures: (1) Local recurrence should be no greater and survival no worse than with amputation. (2) The procedure or treatment of its complications, should not delay adjuvant therapy. (3) Reconstruction should be enduring and not associated with a large number of local complications requiring secondary procedures and frequent hospitalizations. (4) Function of the salvaged limb should be better than that of amputated stump, although body image, patient preference, and lifestyle may influence the decision\(^1^0\).

As mentioned in the steps of surgery, medial approach helps in getting vascular control easily with limited exposure and a good vascularized skin cover. If vascular resection and reconstruction are preoperative possibilities, the superficial femoral and popliteal vessels are directly exposed. A lateral incision would result in difficulty in exposure of neurovascular structures. Similarly, incisions crossing over across the limb are associated with increased chance of necrosis due to precarious blood supply.

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**Figure 1: Incision used in case 4.**

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<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18</td>
<td>55</td>
<td>23</td>
</tr>
<tr>
<td>Sex</td>
<td>M</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Malignancy</td>
<td>Osteosarcoma</td>
<td>Osteosarcoma</td>
<td>Osteosarcoma</td>
</tr>
<tr>
<td>Site of tumour</td>
<td>Distal femur</td>
<td>Distal femur</td>
<td>Proximal tibia</td>
</tr>
<tr>
<td>Biopsy site</td>
<td>fracture fixation with lateral incision and biopsy done medially</td>
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<td>Anterior</td>
</tr>
<tr>
<td>Surgery done</td>
<td>Total femoral resection with custom mega prosthesis reconstruction</td>
<td>Distal femoral resection with custom mega prosthesis reconstruction</td>
<td>Proximal tibial resection with custom mega prosthesis reconstruction</td>
</tr>
<tr>
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<td>Lateral incision curved medially at lower end</td>
<td>Lateral incision curved medially at lower end. Medial gastrocnemius flap used to cover defect</td>
<td>Anteromedial incision</td>
</tr>
<tr>
<td>Complications</td>
<td>uneventful</td>
<td>uneventful</td>
<td>Partial thickness (only epidermis) Skin necrosis</td>
</tr>
<tr>
<td>Follow up</td>
<td>Lung metastasis after 36 months</td>
<td>uneventful</td>
<td>Uneventful</td>
</tr>
<tr>
<td>Present status</td>
<td>Alive on palliative chemotherapy</td>
<td>alive</td>
<td>alive</td>
</tr>
</tbody>
</table>

Table 1. Comparison of patient characteristics
Indications for the lateral approach in distal femur lesions:

- All revision cases
- Total femur reconstructions
- Primary distal femoral tumours requiring cross-pin stem fixation to achieve a stable reconstruction
- Biopsy scars

Relative contraindications to a limb salvage effort include major neurovascular involvement, very immature skeletal age, infection, lack of reconstructive (e.g., very distal anatomic location) or soft tissue coverage options, contamination secondary to biopsy technique and complications, inability to obtain oncologically acceptable margins, and pathologic fracture. The most common reason to recommend amputation is major neurologic involvement by the tumour\textsuperscript{11}.

General guidelines regarding the biopsy of musculoskeletal tumours are (a) Bone and soft tissue tumours are usually heterogeneous. So, multiple samples are required to establish a diagnosis. (b) This procedure does not promote metastatic dissemination but can spread tumour cells locally and so increase the risk of local recurrence. For this reason, it must be assumed that the biopsy tract may be contaminated and thus should be resected during the definitive surgery. (c) Therefore, it is mandatory that the biopsy must be made with the planned surgical incision site, so that it will be included with the surgical specimen. (d) Moreover, the biopsy tract must not violate more than one anatomic compartment and must be away from the neurovascular bundle\textsuperscript{12}.

If a core needle bone biopsy were to pass through tissues outside the planned incision plane, the surgical procedure may have to be altered to include the potentially contaminated tissue in the resection. Less attractive alternatives for the patient would consist of either a wider irradiation field (if the tumour is radiosensitive) or a greater chance of local tumour recurrence at the biopsy site. LSS procedures were designed to allow removal and replacement of the tumour-containing bone while leaving intact the major neurovascular and myotendinous structures needed to maintain limb function. Patient outcome will suffer unnecessarily if additional, functionally important structures must be resected owing to a poorly planned biopsy approach\textsuperscript{13}.

A multicenter study conducted by the Musculoskeletal Tumour Society\textsuperscript{12} in 1996 showed that inappropriately performed biopsies of musculoskeletal tumours posed a significant clinical problem. In a review of 597 cases, the authors found that 19% of patients with musculoskeletal tumours had encountered problems with initial image-guided and open biopsy that forced the orthopedic oncologic surgeon to perform more complex resection or order additional chemotherapy or radiation therapy\textsuperscript{12}. Perhaps the most striking finding in this study was that
Bone sarcomas with an inappropriate biopsy site, Subbiah Shanmugam, et. al.

Poorly planned biopsies led to unnecessary amputations in 5%–8% of patients12. The authors concluded with a recommendation that biopsies of primary musculoskeletal sarcomas be performed only at institutions with active orthopedic oncologic surgery programs because of deficiencies in knowledge and training among the general radiology and surgery communities.

In our study we had to change the incision in 4 patients (3 patients with distal femur lesion and 1 proximal tibia lesion) to include the inappropriate biopsy site in present incision, all patients were managed successfully without any major wound morbidity.

In our study 1 patient had prosthesis infection after 9 months of surgery and 2 patients had lung metastasis and are on palliative chemotherapy. According to literature prosthesis infection is seen in 4 to 30 % of cases14 and five-year survival rate is 28 to 76 %15.

Conclusion

In limb salvage surgery, skin incisions should be planned taking extent of lesion and biopsy scars into account. Good knowledge of vascular supply and incisions required if and when surgery is planned helps in selecting proper site for biopsy.

References