CASE REPORT

Limb Salvage Surgery in Paediatric Distal Femur Osteosarcoma with Partial Cortical Resection and Coraline Silicon Bone Substitute-Case Report.

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Each author of this article fulfilled ALL 4 Criteria of Authorship:

1. Conception and design of case report
2. Drafting the manuscript or revising it critically for important intellectual content.
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ABSTRACT

Osteosarcoma is the most common malignant bone tumor of Paediatric and adolescent age. Historically radical treatments were opted but with advances in diagnosis and neoadjuvant chemotherapy limb salvage has now become possible in most of the cases. In this case report we presented an 8 year old girl who was diagnosed with osteosarcoma of the distal femur. She was treated successfully with neoadjvant chemotherapy followed by limb salvage surgery using partial resection of medial femoral cortex with lateral cortex remains in continuity and poraline silicon bone substitute for filling the defect. She is disease free after 3.5 year and walking pain free on her limb.

Keyword: Bone substitute, Limb salvage, Neoadjvuant, Osteosarcoma

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INTRODUCTION

Osteosarcoma is the most common osteogenic bone tumor of Paediatric and adolescent age representing 12% of Paediatric and 1% of adult neoplasm.[1,2] Historically amputation and disarticulation was the treatment of choice but recent advances in diagnosis and neoadvant chemotherapy has made limb salvage surgery feasible and possible.[3]The functional outcome of limb salvage surgery versus amputation for treatment of osteosarcoma has been shown to be similar by some authors[4] while others have shown better outcome of limb salvage as compared to amputation and recommended limb salvage for osteosarcoma.[5] Different options have been adopted for limb preservation surgery after tumor resections ranging from endoprosthesis, allograft reconstruction and liquid nitrogen treated autograft bone reconstruction.[6]

In this case report we described a unique technique of limb salvage surgery for osteosarcoma of distal femur in an 8-year-old girl who underwent neoadjuvant chemotherapy, wide local resection with partial cortical resection and filling of the defect with bone substitute.

CASE REPORT

An 8-year-old girl presented to our hospital with biopsy proven right sided distal femur high grade osteosarcoma. MRI of the lower limb showed neoplastic mass arising from distal femur breaching medial femoral cortex (Fig I) and involving the surrounding soft tissues. Patient metastatic work up showed two indeterminate left lower lung nodules. At the time of presentation patient had soft tissue involvement and limb salvage surgery was seemed to be difficult. Patient case was discussed in multidisciplinary team (MTD) and patient was referred for neo adjuvant chemotherapy. Patient underwent two cycles of EUROMA neoadjuvant chemotherapy and again reevaluated for local disease with MRI limb and bone scan and CT chest for metastasis disease. MRI showed decrease in soft

tissue mass as compared to the previous MRI while CT lungs continued to show indeterminate lung nodules in left lower segment. Patient was again discussed in MDT where decision had been made to do video-assisted thoracoscopic surgery (VATS) for lung lesion and limb salvage surgery to control the local disease. However limb salvage surgery had certain challenges in this patient. Patient was only 8-year-old and mega prosthesis would not be suitable for her and implant with adjustable length was costly not readily available in our country. Biological reconstruction with liquid nitrogen were not introduced in our institution. We decided for hemi cortical resection of the distal femur and filling of the defect with bone substitute.

After informed written consent from parents patient underwent VATS and tissue were sent for histopathology which showed only fibrotic tissue and no cancerous cells. One week after VATS patient underwent limb salvage surgery. Distal femur was approached from medial side and biopsy tract was excised by using elliptical incision. Neurovascular structures were dissected. They were not involved by the tumor. Tumor was excised with wide margin along with partial resection of the distal medial femur cortex and soft tissue excision while lateral femur cortex remained in continuity with proximal and distal bone. After resection marrow was sent from proximal and distal end to frozen section to check for any malignant cells but was negative. Defect which was created after bone resection was filled with Coraline silicon containing hydroxyapatite synthetic bone substitute. Since the defect was less than two third of the circumference of the bone no implant was used for stabilization.(Fig.II-III) Patient leg was placed in right above knee cast for two weeks after which cast was removed and range of motion at the knee was started. Post operatively the patient had intact neurovascular status and no functional deficit was noted. Patient was kept non-weight bearing for 4 weeks initially followed by weight bearing as tolerated for another 4 weeks and then allowed full weight bearing. All the excised tumor mass was sent for histopathology after end bloc resection and the report showed that all the margins were tumor free and the sample had 100% necrosis. Patient was again discussed in MDT and after two weeks 4 cycles of adjuvant chemotherapy were administrated.

Patient remained in closed surveillance and regular follow up after limb salvage surgery. Local recurrence was monitored with MRI of the extremity and metastatic disease with CT scan chest for every 3 months initially for two years and then at 6th months for one year. The last follow up visit of the patient was at 3 and half year post surgery and she had no recurrence. She was full weight bearing with normal range of knee motion. She had 20 degree of valgus angulation of distal femur (Fig. IV) which may need distal femoral osteotomy once growth is completed.

While publishing this case report prior written permission had been obtained from parents of the patient and ethical review board of our institution.

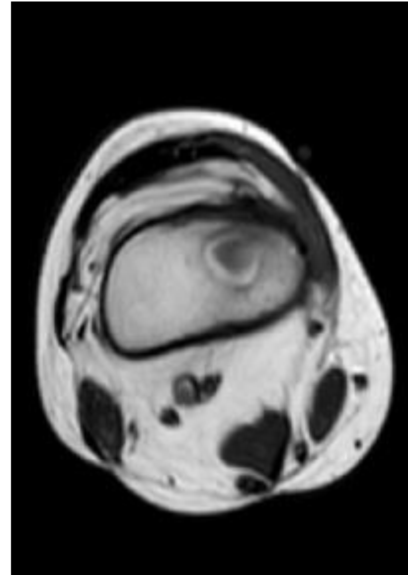

Fig I. Axial image of MRI with contrasrt showing osteosarcoma in medial femoral cortex

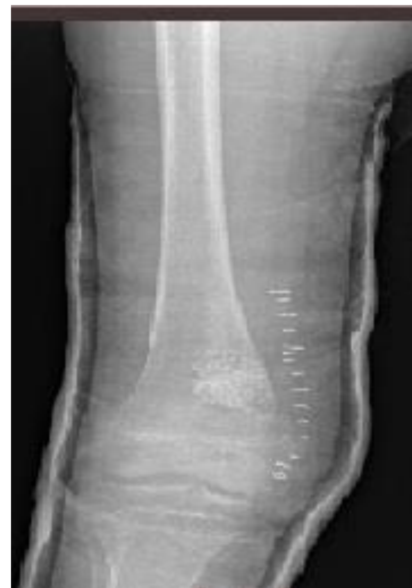

Fig II: Immediate post operative AP view radiograph showing medial hemicortical resection with bone substitute in place.

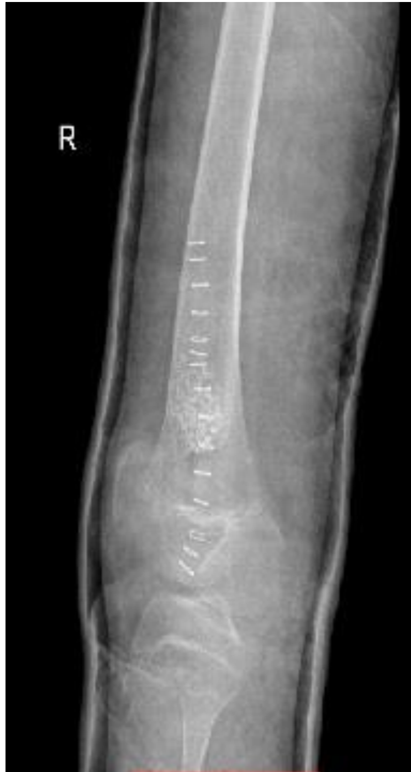

Fig III: Lateral radiograph of the knee showing bone graft in placed

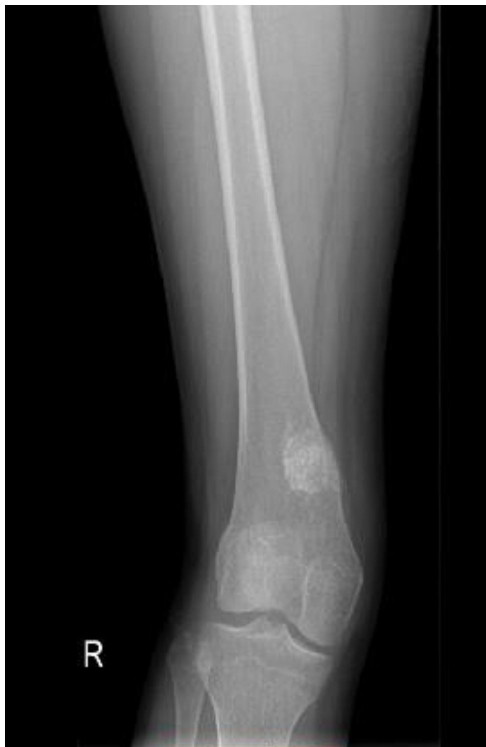

Fig IV: Recent AP view radiograph of the knee showing incorporated bone substitute with slight valgus deformity.

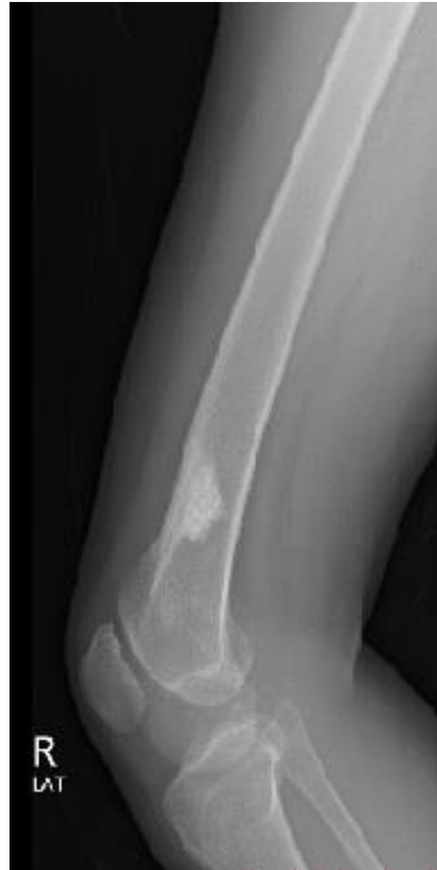

Fig V: Recent radiograph of the knee lateral view showing bone substitute incorporation

DISCUSSION

We presented a unique technique of limb salvage surgery for osteosarcoma of the distal femur in which only partial cortical resection was performed and bone graft substitute was used to fill the defect. In a patient of 8-year-old child limb salvage surgery with mega prosthesis is not possible with standard prosthesis available in our country. Use of growing mega prosthesis in children has encouraging results but they are costly, technically demanding and had complication.[7]In young children with osteosarcoma limb salvage surgery with allograft bone reconstruction is also an option with the added advantage of avoiding donor site morbidity and graft availability in different shapes and sizes.[8] But use of allograft is not without risk and complications like transmission of the disease to the host, nonunion, fracture of the graft and limb length discrepancy have been reported.[9]In our case allograft could not be used due to non-availability of allograft bank in the country.

Another promising progress in limb salvage surgery in pediatric osteosarcoma is use of liquid

nitrogen treated bone for reconstruction in which patient own resected diseased bone is treated with liquid nitrogen which results in death of tumor cells after which it can be used for reconstruction. It is an alternative to the allograft and prevents transmission of infection form the donor to the host.[10] Liquid nitrogen has been an option for reconstruction in resource constrained environment but it is not without complications like fracture, delayed union, nonunion and its use in the operating room can be potentially hazardious.[11]

Another option of reconstruction in pediatric population is the use of vascularized fibula for bone defect. It has the advantage of vascularity and prevention of disease transmission but disadvantage of donor side morbidity, surgical expertise and increased surgical time. Moreover vascularized fibula is associated with complication like fracture, infection and nonunion.[13] We could use vascularized fibula in our case if we opted for complete resection of the distal femur and in that case stability provided by fibula would not be allowing for immediate weight bearing. Furthermore distal physis would also be affected and might result in limb length discrepancy.

Some studies also favored complete tumor resection and distraction osteogenesis. This procedure has the advantage of avoidance of donor site morbidity and simultaneous correction of the limb length discrepancy but this technique has long duration and compliance, nonunion and stiffness are the potential complications.[14]

Our treatment protocol was unique and we could not find similar case reports in the literature. Our described treatment resulted in preservation of physis which had prevented possible complication like limb length discrepancy. We had eliminated the potential risk of infection associated with metal work. Preservation of bony architecture enabled us to start early knee range of motion and weight bearing. There was no risk of nonunion in our case but presence of calcium bone substitute was of concern and might prevent detection of tumor recurrence. Another disadvantage of our technique was that it cannot be applied for tumors of large sizes with extensive bone and soft tissue involvement.

CONCLUSION

Paediatric distal femur osteosarcoma can be treated successfully with limb salvage surgery using partial cortical resection and Coraline silicon bone substitute in selected cases. The approach must be multidisciplinary. Role of neoadjuvant and adjuvant chemotherapy and regular follow up is of paramount importance.

Conflict of Interest: None
Grants/Funding: None

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