



## Recycled Diseased Bone and Morselized Bone Graft: A Unique Combination in the Treatment of Osteosarcoma

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### Abstract

Osteosarcoma of the distal tibia is a rare occurrence, and the treatment method often poses a dilemma to Orthopaedic Oncology surgeons worldwide. We introduce a unique combination of treatment modalities as a limb salvage technique for a patient diagnosed with osteosarcoma of the distal tibia.

Miss T, an 8 year old was diagnosed with Osteosarcoma of the distal tibia. We proceeded with excision of the diseased bone segment and recycled the excised bone via pasteurisation. She was then started on chemotherapy. However, she did not show signs of union, which prompted us to intervene surgically in a 3 stage procedure. The recycled bone fragment was removed, and a cement spacer was inserted temporarily. After a duration of 3 months, we removed the cement spacer and inserted morselized bone graft obtained from bone bank. She started showing signs of union, and her recovery was unperturbed. We believe this combination of treatment to be a successful treatment modality but requires careful and meticulous selection of eligible patients.

**Keywords:** Osteosarcoma; Limb Salvage; Pasteurization; Morselized Bone Graft

### Introduction

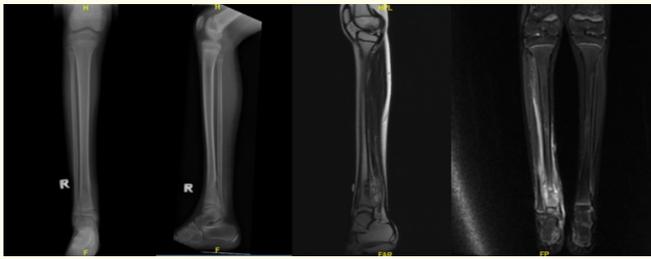
Primary malignant bone tumours of the distal tibia are rare. The advances in radiological imaging and the increased effective use of adjuvant treatment, both chemotherapy and irradiation, share the credit for increasing successful limb salvage surgery. With the advances of limb salvage surgery, reconstruction has been attempted using allograft, autograft, implanted prosthesis and composites. Recently a newer method of limb salvage surgery was introduced, which involves recycling of the resected segment by a variety of methods including autoclaving, freezing, pasteurisation, or extracorporeal irradiation. We present a case of a distal tibia osteosarcoma which was treated using the recycled diseased segment.

### Case Report

Miss T, an 8 year old girl initially presented to us at the age of 6, with complaints of pain and swelling over the right ankle. After extensive workup she was diagnosed to have right distal tibia osteosarcoma with lung metastasis. She underwent surgery which involved wide resection with recycling of the diseased segment. For this patient, the method of processing of the diseased segment that was used was pasteurization. We opted to choose this method as it has its own set of advantages, some of which are the convenience and easy accessibility this method, as well as avoidance of spread of infection and allogenic reactions which can be associated with allografts [1]. This method also did not incur any added cost to the patient. Additionally, the surgical time was only prolonged by a duration of 30 minutes. Above all, using the patient's own recycled bone provides an exact anatomical match which cannot be obtained with other methods.

The diseased segment was pasteurized at eighty degrees Celsius, for a duration of 30 minutes. Surgery was uncomplicated and she did not suffer from any immediate or acute post-surgical complications. She was referred to the paediatric oncology team and was started on chemotherapy, which she completed a year after her surgery.

She was seen in the outpatient clinic at a 3 monthly interval to reassess for union and recurrence. Regular radiographs of the affected limb were taken. Although there were no signs of recurrence, there was also no evidence of bony union. Due to the complication of non-union, a decision for further surgical intervention was agreed upon.



**Figure 1:** Initial radiographs and magnetic resonance imaging (MRI) scans of Miss T's right ankle.

She was planned for a second surgery, a 2-stage procedure. The first stage which was done fourteen months after the initial surgery, which involved removal of the previously recycled bone, with a cement spacer insertion. The second stage of the 2-stage procedure was done 3 months later which involved removal of the antibiotic cement spacer and insertion of morselized bone graft. Both procedures were uneventful, and she was discharged well. Currently there are signs of consolidation and union at the affected site.



**Figure 2:** Post-operative radiographs of Miss T after second stage surgery.

## Discussion

Traditionally, amputation has been the treatment of choice for the treatment of osteosarcoma, as it yielded satisfactory functional outcomes with the use of appropriate prosthesis [2]. With latest advances in chemotherapy and surgical techniques, limb salvage surgery has proven to have similar survival rates and disease-free periods that equal those achieved with amputation [3]. It also has the added benefit of better psychological acceptance and intact body image. That being said, reconstruction or limb salvage surgery around the ankle is challenging due to the limited amount of soft tissue and also difficulty in obtaining adequate fixation [3]. The ideal reconstruction of the defect created after en-block resection of the tumour is still debated.

Our patient was an 8 year old girl with distal tibia osteosarcoma, diagnosed at stage 4. We choose the method of pasteurisation to reuse the patient's own diseased segment and reconstruct the resultant bony defect after the resection of the tumour. Unfortunately, her recovery was tainted with a known complication of this method, non-union.

Non-union in a patient like this can be caused by many factors. In this particular patient, she was started on chemotherapy following her surgery, which is known to affect bone healing. This may not be the only factor hindering the process of bone healing in this patient. Though unfortunate, failure of union was not unexpected as a study done in 2014 comparing various sterilization methods states that the percentage of union in pasteurized bone is only 66.7% [4]. This is attributed to the destruction of bone collagen matrix and intrinsic proteins by extreme heat during the pasteurization process.

The complication of non-union steered us to proceed with multiple surgeries. We first inserted antibiotic cement ensuring that any indwelling infection would be eradicated and then proceeded with morselised bone graft. Thankfully, the patient showed signs of bony union which was monitored with serial radiographs during her follow up. Why she did not achieve union earlier could be explained with the reasons stated above. However, we were able to salvage the situation with morselised bone graft, converting the whole procedure into a 3 part surgery. This combination yielded a positive outcome and can be used in the future for similar patients. She has currently achieved full union of the bony defect and is able to ambulate.

Each method of reconstruction has its own set of pitfalls. There is a huge financial burden incurred with endo prosthetic replacements with an added risk of infection and implant loosening. Allografts requires bone banking which involves substantial amount of time, money and expertise [5]. Distraction osteogenesis on the other hand requires multiple surgical procedures and is time consuming. Because of the above-mentioned pitfalls, recycled bone graft remains a viable option.

Non-union in this method of reconstruction is a known complication. That being said, we do strongly believe that it still does remain a viable surgical option. However, there is still room for improvement when deciding the methods of processing as this has a bearing on the rate of union.

## Conclusion

Distal tibia osteosarcomas are a rare entity and they are challenging to manage due to the above-mentioned reasons. There are various surgical options available and the decision as to which route should be embarked on should be made after careful evaluation of each individual patient.

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