

Case report**THE USE OF MEGAPROSTHESES FOR RECONSTRUCTION OF LARGE SKELETAL DEFECT OF LOWER END FEMUR: A CASE REPORT****Shukla MK¹, Bajpai H², Varyani A²**

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Abstract

In the case of primary malignant tumors, extensive metastatic disease, major trauma or end-stage revision arthroplasty, the orthopaedic surgeon often has to deal with the need to reconstruct large skeletal defects, or replace bone of low quality. In the past years this was frequently impossible, and the only solution was amputation of the extremity. Later, the introduction of custom-made endoprostheses capable of reconstructing large skeletal defects, also known as megaprostheses, allowed for sparing of the extremity. The functional outcome after reconstruction with megaprostheses is often very satisfactory and the patient can enjoy a good quality of life.

Key Words: Megaprostheses, Reconstruction, Skeletal defect, Lower end femur.**Introduction**

The rationale behind their use subsequently led to application even in revision arthroplasty with great loss of bone stock, as well as in trauma surgery, for extremely comminuted fractures with poorly vascularized fragments, where traditional osteosynthesis cannot be applied.^{1,2}

Limb salvage surgery includes all of the surgical procedures designed to accomplish removal of a malignant tumor and reconstruction of the limb with an acceptable oncologic, functional, and cosmetic result. In the recent past, most sarcomas were treated by amputation.^{3,4}

MEGAPROSTHESES

Tumor endoprostheses in their beginning came usually in custom-made monoblock form made of cast steel alloys (eg vitallium). Material evolution continued to titanium and cobalt-chrome-molybdenum alloys while in the meantime experimenting with various acrylic polymers, which though failed prematurely and were abandoned. In general, the requisites for a successful implant design are resistance to corrosion, high

biocompatibility and resistance to fatigue fractures as well as potential for osteointegration and soft tissue in-growth.

A megaprosthesis is a large metallic device designed to replace the excised length of bone and the adjacent joint [**Fig:1**].

Modular designs are available for the most common uses in the femur, tibia, and humerus that allow the surgeon to assemble the prosthesis intra—operatively to accommodate the needs of a particular patient.

The prosthetic joint must be of a modified hinge design to substitute for the stability normally provided by the capsular and ligamentous structures that were sacrificed by the resection. The prosthesis is normally fixed to the host bones with polymethylmethacrylate cement. Special attention is paid during closure to ensure that the prosthesis is fully covered by a healthy soft tissue envelope.^{5,6}

The advantage of a megaprosthesis is that they are available “off the shelf” in a wide range of sizes and features to suit many reconstructive needs. Fixation with cement gives immediate stability and allows rapid mobilization of the patient following surgery.⁷

USE OF MEGAPROSTHESES

Literature is quite sparse on reports regarding treatment of traumatic bone defects or recurrent non union.



Fig. 1: Figure showing a modular megaprosthesis system for distal femur or proximal tibia resection (RESTOR, Adler Mediquip Pvt Ltd, India). Note that numerous components linked to assemble the complete prosthesis. The modularity allows the implant to be matched to the defect as well as to the bone in which it is to be implanted.

Generally, in the lower extremity, proximal and distal femur reconstructions have better functional results as compared to proximal tibia reconstructions.

Limb and Implant Survival after Reconstruction with Megaprotheses

Limb survival and implant survival are terms used alternatively in various reports and defined according to varying outcomes, like amputation, aseptic loosening, any reoperation or operation with resection of the prosthesis, last clinical follow-up.

Major Complications

Typical mechanical complications that are reported in the literature are aseptic loosening, fatigue fractures of the stems, bushing failure as well as failure of the attachment of the soft tissues to the prosthesis. Mechanical complication rate between 5 and 48% are reported in various studies, and aseptic loosening was the leading cause in early reports.

Major non-mechanical complications are infection, wound necrosis.

Modern modular megaprotheses have allowed for limb preserving surgery being the gold standard in oncologic orthopaedic surgery, as they facilitate efficient reconstruction of large skeletal defects, combined with high limb salvage rate.

Case Report

A 22 year old male patient presented to us with history of road traffic accident with gap of 23 cm in lower part of femur. The patient had taken treatment at various institutions and was advised amputation of the limb, he was also treated with knee spanning kuntscher nail, but patient was again not satisfied. X-ray of limb was taken in our institute and we decided to go for limb salvage surgery. We had many options like **Distraction histiogenesis** with ilizarov ring external fixator application, **Autograft + Allograft** placement along with knee arthodesis or **Megaprotheses** application.

Our aim of management was to provide stable, painless, functional knee as patient was a young

fellow married one month back. So we decided to go for Megaprosthesis application. We had follow-up of patient since 8 months. Patient was doing well with his daily activities. The patient had no pain, no discharge, ambulation with help of one stick and range of motion from 0° to 90° as we fixed the patellar ligament which was also injured at time of Trauma. The Patient is in regular follow up at our department and no complaint of any kind is there either mechanical or Non - mechanical complications.[Fig:2 – Fig:6]



Fig 2: Pre-OP photograph showing loss of distal femur segment of 23 cm.



Fig. 3:- Photograph Showing Knee Spanning Kuntscher Nail Done Elsewhere.

Fig 3: Photograph showing knee spanning kuntscher nailing done elsewhere



Fig 4: Anteroposterior and lateral views of kuntscher nail



Fig 5: Pre-OP photograph showing megaprosthesis with fixation of patellar



**Fig :6 Post operative photograph showing femur :
Posterior view of megaprosthesis**

Discussion

Currently, every patient with a malignant tumor of the extremity should be considered for limb salvage if the tumor can be removed with an adequate margin and the resulting limb is worth saving^{2,3,8-9}.

A limb worth saving needs an acceptable degree of function and cosmetic appearance with a minimal amount of pain, and needs to be durable enough to withstand the demands of normal daily activities. Balancing these sometimes conflicting requirements is what makes limb salvage surgery a complex, difficult, and rewarding process⁸.

The main goal of megaprotheses is to achieve disease control as effectively as amputation would and salvage the limb in a durable and functional way. It seems though that literature is more concentrated on reporting patient and limb survival and complications rather than functional outcome postoperatively.

In a way, when malignancy treatments are evaluated the instinctive and initial focus lays on survival length. It is probably after the achievement of substantial increase in survival that questions arise regarding the quality of life. Complication rates are also probably thought to reflect one aspect of that parameter. In most studies the MusculoSkeletal Tumor Society (MSTS) score is used as measure of functional outcome. It is a widely validated tool that

comprises of six sections, descriptively grading from 1 to 5 pain, general function, emotional acceptance and specific function for upper (hand positioning, dexterity, lifting ability) and lower extremity (walking ability, gait, supports). In most studies the result is expressed as a percentage and the literature presents results ranging quite consistently between 60-88%¹⁰⁻¹².

Results can also be categorized according to the indication for surgery (tumor surgery or not), as soft-tissue resection is not the case for non-oncological operations¹³.

Few studies that concentrate on the use of megaprotheses after trauma focus on the proximal femur and knee, and include severely comminuted periprosthetic fractures. The reported results also show good functional outcome after surgery¹⁴⁻¹⁶.

Conclusion

Modern modular megaprotheses have allowed for limb preserving surgery being the gold standard in oncologic orthopaedic surgery, as they facilitate efficient reconstruction of large skeletal defects, combined with high limb salvage rate. They also offer valuable solutions in the case of major trauma or end-stage revision of standard endoprotheses.

They do have a relatively high complication rate, approximately 10-times the one observed in regular arthroplasty. This is mainly due to non-mechanical events, as improvements in the design of the implants have apparently reduced the rate of mechanical complications. In addition, the functional outcome after surgery appears to be very satisfactory, offering a good quality of life to the patient.

Research should focus mainly on the elimination of non-mechanical events, such as infection, wound dehiscence and tumor relapse, whereas there are also some mechanical drawbacks present even in modern designs, such as the attachment of soft tissues to the prosthesis. However, additional improvements and advances in the field are awaited in order to further improve the results of surgery.

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