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Research Article

Distal Femur Replacement Mega prosthesis as A Salvage Measure in Non Malignant Conditions of the Knee Joint

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Abstract

Introduction: Distal femur replacement mega prosthesis is commonly used in reconstruction of malignant conditions. There are situations in elderly where reconstruction requires not only requires replacing joint surfaces but also adjacent bone. Usage of mega prosthesis in such conditions is infrequently described. We carried out the study to ascertain clinical and functional outcomes in above patients.

Material and Methods: Ten patients operated with distal femur replacement for nonontological conditions were evaluated. Mean age of the patients was 71.2 years. Mean values of Clinical scores, functional scores and range of motion were calculated and radiological evaluation was done.

Results: Mean follow-up period was 22.3 months. As compared to preoperative period, during follow-up, knee society score (KSS) improved from 15.50 to 69.90, Oxford knee score (OKS) improved from 10.40 to 29.20, range of motion (ROM) improved from 62.50 to 102.50. None of the patients had deep infection or thromboembolic complications. There were no signs of loosening on radiographs.

Conclusion: Mega prosthetic distal femur replacement is a safe and effective alternative to amputation or arthrodesis in elderly patients requiring complex reconstruction due to bone stock deficiencies. Long term studies with large cohort are required to look for complications associated with and longevity of such implants.

Keywords: Distal Femur Replacement; Mega prosthesis; Non Malignant Conditions; Elderly; Bone Stock Deficiency

Introduction

Total knee arthroplasty (TKA) is one of the most common orthopedic surgeries performed worldwide [1]. TKA has proved to be a successful and cost-effective treatment for improving pain and function in patients with advanced knee arthritis. There are situations in which not only joint surfaces have to be refashioned but also adjacent bone has to be replaced and thus preclude the usage of regular TKA prosthesis. Such conditions need Mega prosthesis more often than not. Mega prosthesis has majorly been used in malignant tumor conditions after advent of successful chemotherapy. It has been offered as a successful alternative to amputations [2]. They have also been recently used in conditions with poor bone stock such as periprosthetic fractures, recalcitrant nonunion of distal femur, revision TKA, and at times even in acute fractures in patients requiring early weight bearing [3]. They are an attractive option in such complex reconstructions. Other options available are arthrodesis and amputation, these may have negative impact on psychological and physiological wellbeing of the patient. The

mega prosthesis were initially available as Monoblock fixed hinge designs. They have been evolved to modular, rotating hinge platform design. This has increased the longevity and improved the functional outcome of these implants [2]. With increasing longevity, not only fragility fractures but also total number of total knee arthroplasty are on rise. We believe that the usage of mega prosthesis in revision and deficient bone stock cases will increase in future. We have done this study to ascertain clinical and functional outcomes of mega prosthetic replacement in nonmalignant conditions and define our indications.

Material and Methods

It was a retrospective study. Clearance was taken from institutional ethics committee. All patients operated with Distal Femur replacement mega prosthesis for non oncologic causes, and with minimum follow up of 6 months were included. Both primary as well as revision cases were included in the study. Clinical records were reviewed to find the primary indication of surgery and subsequent treatments, complications, repeat surgeries if any, and coexisting medical comorbidities. The patients were evaluated and the current knee society scores (KSS), Oxford knee scores (OKS), Range of motion (ROM) of knee were calculated and compared with those of the immediate preoperative period. The patients mobility with or without walking aid was also noted. The indication of mega prosthetic distal femur replacement was noted in all cases. Fresh anteroposterior and lateral radiographs of the patients were taken to detect signs of loosening/subsidence. All cases were evaluated for any clinical/radiological signs of infection. Biological markers such as hemogram, ESR, CRP were performed at follow up in all infected cases and in other cases which had clinical signs of infection. The data was expressed in terms of frequency distributions and mean ± standard deviation. The quantitative variables were expressed as mean ± standard deviation and compared across follow-ups using Wilcoxon signed rank test. A p-value < 0.05 was considered statistically significant. The data was put in MS Excel spreadsheet and statistical analysis performed using 'R' programming language.

Operative technique with tips and tricks

After combined spinal epidural anaesthesia, the limb was prepared and draped. All the surgeries were performed by a single surgeon and tourniquet was used. If there was a previous operative scar and it could be included without problem in further exposure it was used or else a standard midline skin incision was used. Standard medial parapatellar arthrotomy was used to expose the knee/ prosthesis/ antibiotic spacer because conversion of above to quadriceps snip for extensive exposure is easy. The parapatellar gutters were freed and tissues around patella were cleared. The older components/cements spacer/ implant for fracture fixation were removed at this stage. Adequate samples in cases of infection were sent for culture and sensitivity. The proximal level of resection in femur was decided from prior templating. Intraoperative assessment was done again to preserve maximum length of femur and keep both limb length equalised. The knee joint line was set using head of fibula as land mark. Distal femur was reamed in usual fashion and tibia was prepared using standard techniques. Rotation was set keeping line aspera as land mark and patella was evaluated intraoperatively during ROM to ensure proper tracking. The patella was not resurfaced because most of these patients were low demand elderly individuals with poor bone quality, removal of osteophytes if any and denervation was done. The length and size of implant was confirmed during trailing. Femoral component was cemented using PALACOS® R+G bone cement. Hand packing cementation technique was used with prior application of cement restrictor. Cemented long-stem modular tibial tray with a modular polyethylene liner was used. Wound was closed in layers over suction drain in gravity dependent mode.

Post operative protocol

Drain was removed 24 hours after surgery. Patient was mobilised on post operative day (POD) 1, weight bearing as tolerated was started with walker. Quadriceps and range of motion exercises were started simultaneously. Patients with infection received 2 weeks of IV antibiotic depending on prior culture report, IV ceftriaxone with Vancomycin was given if no organism was grown in stage 1 procedure. This was followed by [4] weeks of oral antibiotics as per intraoperative culture report. All other patients received 3 dosed of IV Ceftriaxone. Thromboprophylaxis with Conspiring 150 mg was given for 3 weeks in all patients. Stitch removal was done 2 - 3 weeks post-surgery.

Results

A total of 10 patients were found eligible for the study. All the 10 patients were available for follow-up and included in the study. Nine patients were female and 1 was male. The indication of mega prosthetic replacement (Figure1-5) were infected TKA as stage 2 procedure (30%), periprosthetic fracture femur (40%), non-union of distal femur fracture with OA knee (20%), and acute distal femur fracture with knee OA. Other than 2 patients with superficial necrosis of operated margins, there were no operated site complications.

The mean age of the patients was 71.2 + 10.35 years. Three (30%) patients were operated with Link (LINK® MEGASYSTEM-C®), rest 7 patients were implanted with Adler (ResTOR™) mega prosthesis. All 4 patients with periprosthetic fractures were classified Rorabeck type 34. Hemogram, Serum CRP and ESR was done in all cases which were revised for infection, they were found to be normal. None of our patients had signs of deep infection. The mean number of surgeries prior to metaproteins was 2.3 (range0 - 6). None of the patients required further revision surgeries. The mean follow up was 22.3 months (ranging from 6 months to 57 months). There were no thromboembolic complications in the patients.

Figure 1: Showing periprosthetic fracture femur treated with Open reduction and internal fixation with plating which failed

Figure 2: Showing above patient treated with open reduction and internal fixation with nailing , which too failed as seen in figure 3

Figure 3

Figure 4

Figure 5: Showing x ray of above patient revised with distal femur replacement with no signs of loosening

The mean preoperative Knee Society score (KSS) (Table 1) was 15.50, whereas mean KSS on latest evaluation in postoperative period increased to 69.90, the difference was statistically significant ($p < .05$).

	Preoperative	Follow-up	p value
Mean Knee society score	15.50	69.90	<.05
Mean Oxford knee score	10.40	29.20	<.05
Mean Range of motion	62.50	102.50	<.05

Table 1: showing comparison of KSS, OKS, and ROM in preoperative and follow-up.

The mean Oxford knee score (OKS) (Table 1) was 10.40 in the preoperative period which increased to 29.20 in the latest evaluation, the increase was statistically significant ($p < .05$).

The mean range of motion (ROM) (Table 1) in the preoperative period was 62.50 which increased to 102.50 in the in the postoperative period. The change was statistically significant ($p < .05$). 5 (50%) patients were still using walking aids to mobilize around.

Discussion

With the longevity of human life on the rise throughout the world, so is the incidence of degenerative conditions such as OA of the knee. TKA is also considered final answer to various other disorders causing end stage arthritis such as inflammatory disorders like Rheumatoid arthritis and Ankylosing spondylitis, pseudogout, chondrocalcinosis and post traumatic arthritis. Total knee arthroplasty is one of the most common Orthopedic surgery in United States with more than 80% patients satisfied post surgery [5]. The increased number of primary procedures has led to increased number of revisions. The causes of revision may be aseptic loosening, infection, periprosthetic fracture, instability, wear/osteolysis and other miscellaneous causes [6]. Revision surgeries demand special techniques and implants to tackle compromised tissues and bone stocks. Revision may often be performed using primary components. However, at times constrained, hinge, allograft composite prosthesis or even mega prosthesis may be required. The patients who require revision at this age may have very poor bone stock. Thus they have limited options of reconstruction. Arthrodesis preferably by ring fixator or amputation are other alternatives in such patients with poor bone stock, multiple comorbidities, and multiple prior surgeries. These procedures have long recovery period and have adverse psychological and physiological outcomes in such elderly patients. The use of mega prosthesis for non oncological indication is different when compared to their use in malignancy. The factors which compound the ease of surgery and lead to guarded outcomes are advanced age, previous surgeries, scar status and adhesion of tissues, multiple comorbidities, and probability of underlying infection. Also, implantation of mega prosthesis is intricate when compared to regular prosthesis. Thus, good preoperative workup including biological markers such as ESR, S. CRP, complete blood counts, serum protein levels, full length radiographs and ichnograms must be done before embarking on to definitive surgery. The usage and functional outcomes of mega prosthesis have been well described in malignancy [7,8]. However, there are few studies describing the outcomes in non oncological conditions [9,10]. At times metaproteins may be used in revision settings,non union of fractures, acute fractures in cases of elderly patients with poor bone stock. We conducted the study to look for both clinical and functional outcomes of using metaproteins in above situations. The improvement in KSS was statistically significant which is similar to the study by Holl., *et al*. [9] vaishya., *et al*. [11]. Our study showed statistically significant improvement in Oxford knee scores, thus confirming both clinical and functional improvement in patient outcomes. In spite of improved KSS and OKS scores in follow-up, 50% of patients were still using walking aids to mobilize around. This can be explained that most patients were elderly with poor functional status in preoperative period and having multiple medical comorbidities. Even in cases of acute fractures, early mobilization with full weight bearing can be achieved, making it a very attractive alternative in aged patients. In elderly, prolonged immobilization may lead to increased complications such as pneumonia, deep venous thrombosis, pulmonary thromboembolism, decubitus ulcers [12]. The disadvantage of using distal femur replacement against using other options allograft prosthesis composite is that it leads to revision of even tibial components which may be well fixed. Removal of same must be undesirable especially in non-infection situations. It leads to increased complexity of surgery. However, mega prosthesis negate the complications such as non union, resorption of allograft, delayed weight bearing and chances of transmission of infections associated with allografts, thus they are being used more frequently than before. The early mega prosthesis were often associated with early implant loosening due to high amount of stresses being directly transferred to bone implant interface and less rotatory freedom in the initial implant designs [2]. Most modern mega

prosthesis designs are rotating hinge design which lessen stresses at bone implant interface and thus less chances of loosening [13]. None of our patients had any signs of deep infection. This as in contrast to previous study [14] suggesting high rate of infection. This probably is due to rigorous protocols in our high volume arthroplasty unit and all the surgeries being performed by a single, most experienced surgeon in the center. We recommend the use of this prosthesis only in low demand, elderly group of patients in whom early mobilization is of prime importance. In younger population level the stresses at bone/cement/implant interface will be higher due to increased activity levels and that might lead to early component loosening.

Limitation of the study

Our study is retrospective, single center study, with small number of patients and short follow-up. If this cohort of patients is followed for a longer duration of time, probably frequency of complications such as loosening, infection will increase.

Conclusion

Elderly patients may need complex reconstruction for periprosthetic fractures, recalcitrant non unions of distal femur, infected TKA with poor bone stock and lastly acute distal femur fractures to promote early weight bearing. Distal femoral replacement is an attractive alternative to arthrodesis and amputation in above conditions in which regular or constrained prosthesis cannot be used. These patients have multiple comorbidities and low activity levels. Such patients often have poor bone stock which precludes usage of regular/constrained or even simple hinged prosthesis.

Mega prosthesis lead to statistically significant improvement in clinical (KSS) scores as well as functional (OKS) scores. Such elderly patients need to be out of the bed as soon as possible to prevent further complications of immobilization. However, prospective long term studies with a larger patient cohort is needed to assess the outcomes with usage of these implants in such patients. Long term studies can give the frequency of complications such as loosening and infection. Only then can mega prosthetic replacement be established as a definitive low morbidity procedure in such elderly, low demand patients.

Conflict of Interest

The authors declare that they have no conflict of interest and have received no payment in the preparation of this manuscript.

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