

Use of Intramedullary Nail and Ilizarov Ring Fixator to Achieve Fusion in Infected Total Knee Arthroplasty- A Technical Note with Case Report.

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INTRODUCTION

Infection in total knee arthroplasty is most serious complication. ¹ Among the various treatment modalities available, knee fusion is indicated when there is uncontrolled infection, resistant organism such as Staphylococcus aureus/gram negative bacilli, severe segmental bone loss, disruption of extensor mechanism, poor soft tissue envelop or patient immunocompromised^{2,3,4,5}. Intramedullary nail, plate or external fixators have been used to achieve knee fusion with variable results ^{2,6}. We have combined use of intramedullary nail and ring fixator to develop a new strategy in treatment of infected knee arthroplasty. Intramedullary nailing is the most successful method of achieving fusion ^{2,7}; however results are affected by severe bone loss, fulminant infection and unacceptable shortening. Combining intramedullary nailing with distraction osteogenesis using ring fixator will have certain advantages. Increase in blood supply to the limb in response to distraction osteogenesis will promote infection control ⁸. Improved primary stability and ability to adjust the amount of compression at fusion site will further promote union. Lengthening of the limb to counter shortening can be done to provide a more physiological gait. In this article, we have described the surgical method used for fusion by this modality.

The patient was 78 years old female. She was operated by total knee arthroplasty using cruciate sacrificing posterior stabilized prosthesis at another institute. Post operative duration for 6 months was uneventful. 6 months later, she complained of high grade fever with knee joint swelling and presented to us. Knee was aspirated and aspirate cultured to grow Staphylococcus aureus. She was debrided twice in 3 months along with appropriate antibiotic therapy as per the culture sensitivity reports. The discharge decreased but did not cease and a decision for single stage knee arthrodesis was taken at the end of four months post first debridement.

SURGICAL TECHNIQUE

Surgery was performed under antibiotic cover as per culture sensitivity reports. Tourniquet was not used in this procedure.

SURGICAL TECHNIQUE IN DETAIL

Preparation of the limb and positioning of patient

Spinal - epidural anesthesia was used with patient in supine position. The limb was prepared by scrubbing with a solution of betadine and beta scrub. Midline vertical skin incision was taken over previous TKA (Total Knee Arthroplasty) scar keeping the knee in 90° of flexion. Skin and the subcutaneous tissue were cut. Medial parapatellar arthrotomy was done to expose the joint.

DEBRIDEMENT AND IMPLANT REMOVAL

After opening the capsule, pus was drained and culture swabs were taken. Pus was found pocketed in suprapatellar pouch and popliteal fossa and was drained by applying local compression. Pathological synovial tissue was excised with the help of cautery, curette and nibbler and hemostasis achieved. Implants are generally loose due to infection; however use of osteotome and hammer to dislodge the implant was required in this case. An important point is to remove the cement completely, including from the medullary canal. The bone surfaces were extensively debrided and jet lavage with normal saline was given to remove any hidden infected material in surface of bone. Infected bony surfaces from both the femur and the tibia were removed by power saw to get healthy bleeding surface of viable bone. Bone surface was evaluated for percentage of the apposition possible. If required, superior surface of the tibia can be cut additionally with the power saw in right angle to the long axis of the bone to achieve maximum contact between femur and tibia surfaces, but this was not needed in this case

ARTHRODESIS

Long Küntscher nail was used as per the length and diameter of femoro tibial canals of patient which was measured length 65 cm and diameter 9 mm. The femoral bone was held with the bone holding clamp. Reaming of femoral canal was done under direct vision. Infected material inside the canal was reamed, curetted and washed out. The nail was inserted under image intensifier guidance in a retrograde manner inside the femoral canal. Hammer was used to advance the nail

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proximally and this was constantly monitored by an image intensifier. The nail was delivered out from the pyriformis fossa of femur. The hip was flexed, adducted and internally rotated across the pelvis while trying to deliver the nail proximally through the upper thigh. The upper end of nail was advanced till the distal end is completely into the femoral canal and knee can be extended to align the tibia and the femur. Tibia was then reamed, and curetted to remove the infected debris. The knee was then fully extended and the nail was hammered antegrade to enter the tibial canal under image intensifier guidance. The extent of the lower end of the nail was kept slightly more than 4-6 cm distal to the isthmus of the tibia. The final position of the nail was confirmed under image intensifier. After the application of the nail in full extension, the K wires and schanz pins were applied in tibia and femur as per the requirement of ring positioning later. With the help of image intensifier, we confirmed that the wires and pins were placed missing the nail. 160, 180 or 200 sized femoral rings and 160 or 180 sized tibio fibular rings were used according the girth of the lower limb and attached to the wires with help of the wire fixation bolts and nuts. Two rings were applied in the tibia, two rings in the lower femur and one Italian arch was applied most proximally in femur. This assembly was used for applying tension/compression at various areas of bones in various directions. The knee joint was kept in 0-2° flexion as antero posterior alignment while 0-4° of valgus alignment. Finally the rings were interconnected by vertical interconnecting rods of various lengths as per the need. Compression was applied to the fusion site using the ring assembly.

Corticotomy was done proximal to the knee joint-between two femoral rings for which multiple drill holes were created to weaken the particular bone area and final separation was done with the osteotome and hammer. Confirmation of the corticotomy was done by slightly loosening the rings and rotating the rings. The patella was then enucleated and morselised.

CLOSURE AND DRESSING

Thorough wash was given with jet lavage using normal saline. The patella bone graft was then applied in and around the arthrodesis site. Primary closure was achieved with negative suction drain. Finally the acute docking was done at the

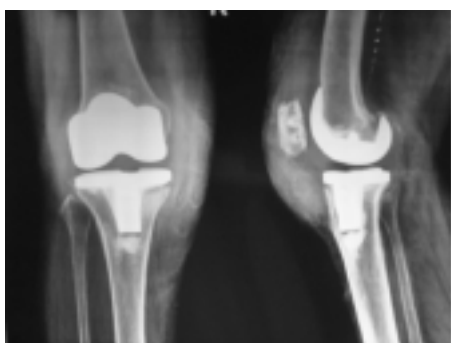


Fig. 1: Pre operative radiograph

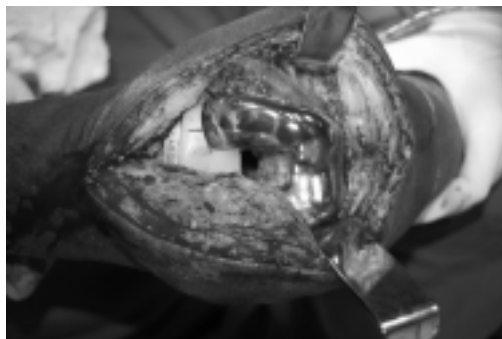


Fig. 2: Implants exposed



Fig. 3: Implant removal done



Fig. 4: Nail inserted in femur retrogradely



Fig. 5: Nail delivered out from upper end thigh

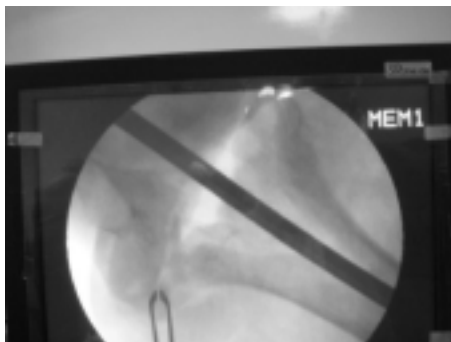


Fig. 6: Knee streightned and nail passed in tibia antegradely

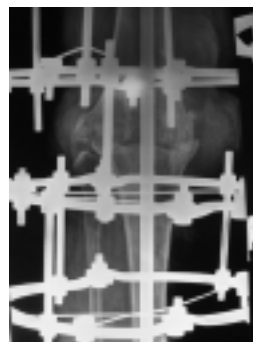


Fig. 10: Immediate post operative radiograph



Fig. 7: Bone grafting at arthrodesis site

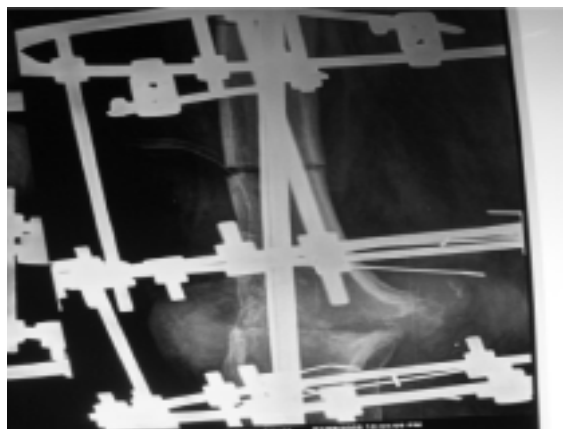


Fig. 7: Bone grafting at arthrodesis site



Fig. 8: Bone grafting at arthrodesis site (compression)



Fig. 12: Ring fixator removal done, nail in situ

arthrodesis site. The position of the knee and the rings were re- confirmed under image intensifier.

SURGICAL STEPS

Duration of surgery was 3.5 hours and intraoperative blood loss was 425 ml. Intraoperative culture sample was sent which showed staphylococcus organism. This was same as the preoperative culture finding. The antibiotic used intravenous ceftizoxime 1 gm thrice a day for 15 days. Then oral antibiotic was started as per the antibiotic sensitivity report and



Fig. 9: Closure of wound

antibiotic were given for further 15 days. The infection did not recur post operatively.

Patient was allowed to weight bear as per the pain tolerance on the second post operative day with walker support. The immediate post operative limb length discrepancy was 3.4 cm. Postoperative 7th day distraction at the corticotomy site was started at rate of 0.5mm/day. The purpose was to lengthen the limb and decrease the shortening to about 2 cms. This was to help the patient with ground clearance in swing phase while walking. Thus a lengthening of 1.4 cms in 28 days was needed in this patient. In distraction phase patient was called for 2 weekly follow up. On each follow up, a radiograph was done to show the arthrodesis site and corticotomy site bone regenerate. Change in the distraction rate was altered as per the quality of bone regenerate on radiographs. In this case, adequate regenerate was seen after a month and distraction was stopped on reaching the required lengthening. The bony fusion at arthrodesis site was not satisfactory at the end of first month and a 2 mm acute compression was applied at the arthrodesis site. Fusion was defined as appearance of bridging trabeculae through the arthrodesis site between minimum two cortices. This was achieved at the end of three months. At this stage the fixator was removed and above knee cylindrical cast was applied. Patient was allowed to walk with full weight bearing with cast on. The ankle exercises were started and within a month ankle had full range when compared to other side. Regarding radiological findings, there was no nail back outs or lysis around the nail. The knee were fixed in 4° of valgus and 1° of flexion.

At the final follow up, the patient achieved solid radiographic and clinical fusion. She was able to walk full weight bearing without any walking aid requirement. The magnitude of distraction was 14 mm and so the residual shortening was 20 mm. The fixator was removed at 3 months duration when radiograph showed fusion at minimum 3 cortices. The patient could adjust herself with the shortening and no shoe raise was required as compensation of the same.

Patient's pain and emotional evaluation were done by WOMAC, SF 36 and Knee Society Scores. The WOMAC score was 64/100 without stiffness and 55/100 with stiffness. SF 36 score was 64.44, SF 36 emotional sub score was 44.64, and Knee (pain) score was 43 while Functional knee score was 55.

SUMMARY

The knee arthrodesis is a good alternative method for controlling the infection at the total knee arthroplasty cases. This can achieve good infection control, adequate limb length and reduce union time. This might be technically demanding but has good clinical and functional results along with good acceptance of the procedure by the patient.

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