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Case Report

An unstable knee with gross varus deformity treated with unconstrained total knee replacement with long tibial stem: a case report

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ABSTRACT

Severe varus deformity of the knee poses a technical challenge in balancing the flexion and extension gaps. Bone defects are a challenging problem encountered with severe varus deformity of knee during primary total knee arthroplasty (TKA). In this case report we have achieved good stability and alignment with unconstrained posterior stabilised TKA in unstable knee with severe varus deformity and with significant bone loss without preferring constrained options as these have concerns for longevity and difficult revision surgery. 72 years male had complaints of severe pain, swelling, deformity in both knees since 1 year and bed ridden from 6 months. History of similar complaints from past 10 years. Physical examination revealed severe varus deformity, diffuse swelling, tenderness, restricted range of movements, crepitus in bilateral knee joints. Pre anaesthetic check-up revealed patient was known coronary artery disease, on pacemaker since 7 years so anaesthetist advised to go for staged total knee replacement. Total knee replacement using unconstrained posterior stabilised implants with a long tibial stem was done, extreme varus deformity was corrected, osteophytes loose bodies removed, posteromedial tibial bone defect was repaired with cement and screw construct. It is concluded that in extreme varus deformity of the knee, if proper step-wise release is done, we can balance the knee without using constraint implants. Bone defects can be reconstructed using cement or augment. In this case, we used cement and screw construct, and the results were satisfactory. The increasing amount of evidence that supports the use of long-stem total knee replacement for complex knee osteoarthritis (OA) presentations is strengthened by this case report. While an extended period of observation is required to assess the longevity of implants.

Keywords: Bone defects, Cement, Unconstrained, Varus deformity

INTRODUCTION

Total knee arthroplasty (TKA) is the gold-standard intervention for end-stage, painful osteoarthritis of the knee, especially when varus deformity exceeds 20°.[1] In most primary TKAs, precise soft-tissue balancing restores symmetric ligament tension in both flexion and extension, yielding reliable stability and durable functional outcomes.[2] When residual laxity persists despite extensive releases, surgeons may elect more constrained implants to counteract instability; however, increased constraint raises stresses at the bone–implant interface, accelerating polyethylene wear and heightening the risk of aseptic loosening and implant failure.[3] Severe varus knees often present with large, posteromedial, asymmetrical tibial defects typically peripheral and uncontained that hinder accurate component positioning and reduce prosthesis–bone contact area, jeopardizing primary fixation.[4] In developing regions, delayed patient presentation frequently exacerbates these defects to magnitudes akin to revision arthroplasty scenarios.[5] A range of augmentation techniques has been described to manage tibial bone loss,

including tibial component lateralization, cementing with or without screw reinforcement, metal augments, impaction bone grafting, structural allografts or autografts, custom implants and highly porous tantalum cones or sleeves.[2,6-8] Each option offers unique biomechanical advantages, yet consensus is lacking on the optimal strategy for massive, uncontained posteromedial defects encountered during simultaneous bilateral TKA. The purpose of this case report is to detail our surgical approach for addressing extensive posteromedial tibial defects in simultaneous bilateral TKA for severe varus deformity, emphasizing implant choice, augmentation methods and early functional outcomes. In the present case report we have done posterior stabilized total knee arthroplasty with long stem implants with proper soft tissue balancing without use of constrained implants to prevent long term loosening and subsequent failure as occurs in constrained implants.

CASE REPORT

A 72 years old male presented with severe pain, swelling, deformity of both knees from 1 year. He was bed ridden, unable to walk and not able to perform his daily routine activities from 6 months. He was suffering with the similar complaints from past 10 years but now it had aggravated. Patient had a history of coronary artery disease and pacemaker installation 7 years back. On examination patient had a gross varus deformity, suprapatellar pouch fullness, tenderness over the both knee joint line, severe crepitus, instability. X-ray revealed Kellgren-Lawrence grade 4 osteoarthritis with 28^0 varus deformity in right knee and 25^0 varus deformity left knee Figure 1.

Preoperatively lateral distal femoral angle (LDFA) and medial proximal tibial angle (MPTA) on X-ray was calculated to be 105^0,80^0 respectively. Knee injury and osteoarthritis outcome score for joint replacement (KOOS JR score) was assessed for this patient as 20/100 which signifies severe pain, stiffness, affection for activities of daily living. Plain radiograph and computed tomography (CT) of both knees shows Kellgren-Lawrence Grade 4 OA i.e., large osteophytes, loose bodies, severe subchondral sclerosis marked joint space narrowing, proximal tibia posteromedial bone defect Figure 2.

Based on these clinical and radiological findings we planned for primary complex total knee arthroplasty with back up of all implant designs from unconstrained to constrained. We had done staged arthroplasty by advice of anesthetist. Under combined spinal epidural anaesthesia with a tourniquet pressure of 280 mmHg through medial parapatellar approach knee was exposed. Osteophytes and loose bodies were removed, posterior cruciate ligament released and notch was cleared. Distal femoral cut was taken with a 5 degrees intramedullary jig and tibial cut was taken with extramedullary jig 7 mm on lateral side. Extension gap assessed. Sizing of distal femur was done using posterior referencing system anterior, posterior, chamfer cuts were completed. Flexion and extension gaps were checked for symmetry. Posteromedial tibial defect identified Figure 3. Approximately sized tibial tray was kept over the resected tibial surface, mild lateralization of tibial tray was done and its rotation checked with the help of an external alignment rod. Notch for tibial keel was made. Tibial medullary cavity was reamed to the largest possible extent for the stem component. About 2 cm posteromedial metaphyseal tibial defect seen below tibial tray and classified as grade 1 according to Anderson orthopaedic research institute AORI classification Table 1.

Figure 1: Right lower limb full length X-ray shows hip knee ankle axis with gross varus of 28°.

Figure 2 (a and b): Preoperative X-ray of right knee anteroposterior and lateral views.

Figure 3: Intra operative pictures of posteromedial tibial defect of right knee. Blue arrow shows posteromedial tibial defect with tibial tray trial.

Figure 4: Post operative X-ray Scanogram shows well aligned femoral and tibial components and restored mechanical axis.

Figure 5: Post operative X-ray of right knee. The extreme varus was corrected, osteophytes cleared on femoral and tibial side, posteromedial bone loss filled with cement and stabilized with screws.

Figure 6: Clinical post operative picture. Patient in standing position with no deformity in both knees.

Defect base was perforated with 2.5 mm drill bit and three 3.5 mm titanium cortical screws were fixed to support tibial tray. Final tibial component was cemented only in the metaphyseal region. While the shaft remained, press fit uncemented, cement was filled in posteromedial defect below tibial tray, femoral component was cemented. Adequate size of tibial insert was selected and the knee was checked for stability, range of motion and patellar tracking. Patella denervation was done with cautery and wound was closed in layers. There were no intraoperative or post operative complications. Post operative X-ray whole limb with hip knee ankle axis reveals good implant position, correction of posteromedial defect with screw and cement construct, good alignment, deformity correction Figure 4, 5.

LDFA and MPTA were calculated to be 93 and 88 degrees respectively. Postoperatively, the patient was started on injection enoxaparin sodium 40 mg subcutaneous till discharge from hospital and then shifted to oral 10 mg rivaroxaban for three weeks as deep vein thrombosis prophylaxis.

The patient was encouraged to do bedside sitting on postoperative day one and full-weight bearing walking was started on postoperative day one onwards with a walker. Sutures were removed on postoperative day 21. The patient followed up in our outpatient department (OPD) at 3 weeks, 6 weeks, 3 months and 6 months postoperatively. Postoperatively, there was considerable improvement in the pain, stability, range of movement of the right knee, alignment of the knee and activities of daily living, lower limb mechanical axis restored. At six-month follow up the KOOS JR score improved to 85/100 as depicted in Figure 6.

Table 1: Andersons orthopaedic research institute (AORI) Classification of bone defect.

Type 1	**Intact metaphyseal bone with minor defects. Managed with cement with or without screws as well as impaction bone grafting.**
Type 2A	Damaged metaphyseal bone with damage to one condyle. Managed with wedge or block augmentation.
Type 2B	Damaged metaphyseal bone with damage to two condyles
Type 3	Majority of the metaphyseal bone is deficient

DISCUSSION

Total knee arthroplasty (TKA) revisions are most commonly driven by infection and mechanical loosening. Early component loosening often reflects improper mechanical balance, which may be exacerbated by severe preoperative deformities such as varus alignment[1]. Patients presenting with pronounced varus deformity experience higher rates of aseptic tibial component loosening than

those with milder deformities.[2,3] Gap-balancing techniques become increasingly challenging as varus severity increases, with flexion gap laxity and collateral ligament deficiency complicating symmetric soft-tissue tensioning. When soft-tissue constraints prove inadequate, more constrained implants such as constrained condylar knee (CCK) designs offer enhanced stability.[1] Key indications for constrained systems include: deficient medial or lateral collateral ligaments, bone loss jeopardizing component support, inability to achieve balanced flexion and extension gaps

However, increasing constraint may transfer higher stresses to the implant bone or cement–bone interface, potentially accelerating loosening and reducing implant survivorship.[4] Thus, high-constraint prostheses should be reserved for cases with clear soft-tissue or bony indications. Tibial stems augment load distribution in osteoporotic or severely deformed knees. Reported benefits include: reduced radiographic signs of aseptic loosening, lower revision rates compared with unstemmed tibial components.[10-13]

In elderly patients with poor bone stock, a long tibial stem acts as a load-sharing device, mitigating early mechanical loosening and facilitating realignment in severe varus deformity. Large posteromedial tibial defects commonly accompany severe varus deformity. Excessive bone removal below 1 cm from the joint line decreases cancellous support and risks detaching key soft-tissue insertions (iliotibial band, pes anserinus, patellar ligament, posterior cruciate ligament).[3]

Reconstruction options include: cementoplasty with or without screw reinforcement structural bone grafting, metal augments or custom implants. In this case, a 2 cm posteromedial defect was managed with cement and two cancellous screws to restore support under the tibial baseplate. Each strategy-prosthesis selection, stem extension and defect reconstruction must be tailored to deformity severity, bone quality and soft-tissue integrity to optimize long-term TKA outcomes.

Clinical message

Unconstrained knee implants with stem extensions can achieve adequate stability, balancing and lower limb alignment even in cases of severe varus deformity, thereby avoiding the need of constrained implants.

CONCLUSION

Step-wise soft-tissue release can reliably restore coronal balance in extreme varus knees without resorting to constrained implants. Significant tibial bone defects may be managed effectively with a cement-and-screw construct, yielding satisfactory early clinical and radiographic results. This report bolsters current evidence supporting long-stem total knee arthroplasty in complex osteoarthritic deformities. Longer-term follow-up and larger series are needed to confirm implant durability and functional outcomes.

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