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Ortho–Plasty in Secondary Valgus Knee Arthritis with Tibial Stress Fracture

Dr Sitsabesan Chokkalingam[1]*, Dr Shibu Sumanth[2], Dr P Gopinath Menon[3]
SRIHER (Sri Ramachanda Institute of Higher Eductaion and Research), Porur Chennai, Tamilnadu, India.

***Corresponding Author:**
Dr. Sitsabesan Chokkalingam. DNB , FRCS Tr & Orth (Edin)
SRIHER, Porur Chennai

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Abstract

Valgus knee constitutes 10% of cases undergoing Total knee replacement (TKR). Ranawat's grade 3 valgus knee with tibiofemoral angle >20 degrees accounts for only 5% of cases. Causes of valgus arthritis knee is well known. Secondary valgus knee due to long leg arthritis with contra lateral leg shortening is uncommon. Double valgus with intra and extra articular deformity with tibial shaft stress fracture is even more challenging. Addressing lateral bone defect, lateral soft tissue contracture, incompetent MCL, and maltracking patella are the inherent challenges faced compared to their varus counterpart with additional risk of peroneal nerve palsy. Our aim is to present this unclassified type of severe secondary valgus arthritic knee with a tibial stress fracture in a geriatric age. She had dual valgus deformity and had a successful single stage surgical treatment following the concept of Ortho-Plasty. Our case study would highlight the intraoperative modifications in simplifying the complex valgus total knee replacement.

Keywords: Ortho-plasty. Primary TKR and plate osteosynthesis, Severe valgus knee; Stress fracture tibia, Valgus osteoarthritic knee

Introduction

The valgus arthritis knees constitute only 10% of total knee replacement cases. Ranawat's Grade 3 valgus deformity accounts for only 5% of cases [1]. Valgus knee associated extra-articular tibial stress fractures can occur in elderly patients. Stress fracture were classified [7] as impending, complete, and non-union. Valgus knee with double deformity will worsen the hip knee ankle axis (HKA) and remains a challenge for TKR. Pre-operative stress views in the presence of stress fracture is impractical. 3Dprint of the deformity in pre operative planning is an option but will not assess the ligament component. Treatments of both stress fracture and knee arthritis is mandatory to regain mobility. Corrective osteotomy for extra articular deformity and staged TKR has been reported in the literature [3] but with poor outcomes and the added risk of nonunion to the osteotomy site. Single-stage replacement [5,7,10] of arthritic surface and stable restoration of limb alignment allows faster recovery and favors fracture healing. Computer assisted or robotic-assisted could be an alternative option for conventional TKR but availability and affordability issues are inevitable. The "Ortho-plasty" concept includes prior plate fixation of the tibial stress fracture followed by TKR with the stemmed tibial implant. It corrects and stabilizes the extra-articular deformity and enables to perform the conventional TKR.

Case Presentation:

67 years old lady presented with complaints of pain over her right knee for 3 years with an inability to walk for 6 weeks duration without any history of trauma. She had left hip hemiarthroplasty for an osteoporotic hip fracture 5 years earlier, at an outside hospital. Failed vertical offset restoration resulted in shortened left lower limb with relative lengthening by 5 cm of the right lower limb. Over a period of 5 years

she developed secondary valgus arthritis of her right knee and remained an indoor ambulator. She went completely bedridden for 8 weeks prior to her admission. Examination revealed high BMI morphology with 20 degrees valgus malalignment of the right knee. She had signs of severe tri-compartment knee arthritis, with swelling and tenderness over the upper part of the leg. The range of movements was grossly limited due to pain with intact distal common peroneal nerve function and vascularity. X-rays showed the dual problem of valgus arthritis and diaphyseal stress fracture (Fig.1a,1b,1c,1d).

Figure 1:

(1a) Valgus arthritis Right knee, stress fracture proximal 1/3rd middle 1/3rd junction of the tibia

(1b) Stress view- tri-compartmental arthritis but intact competent MCL. The tibiofemoral angle measured 25 degrees (Ranawat's grade 3 valgus knee deformity)

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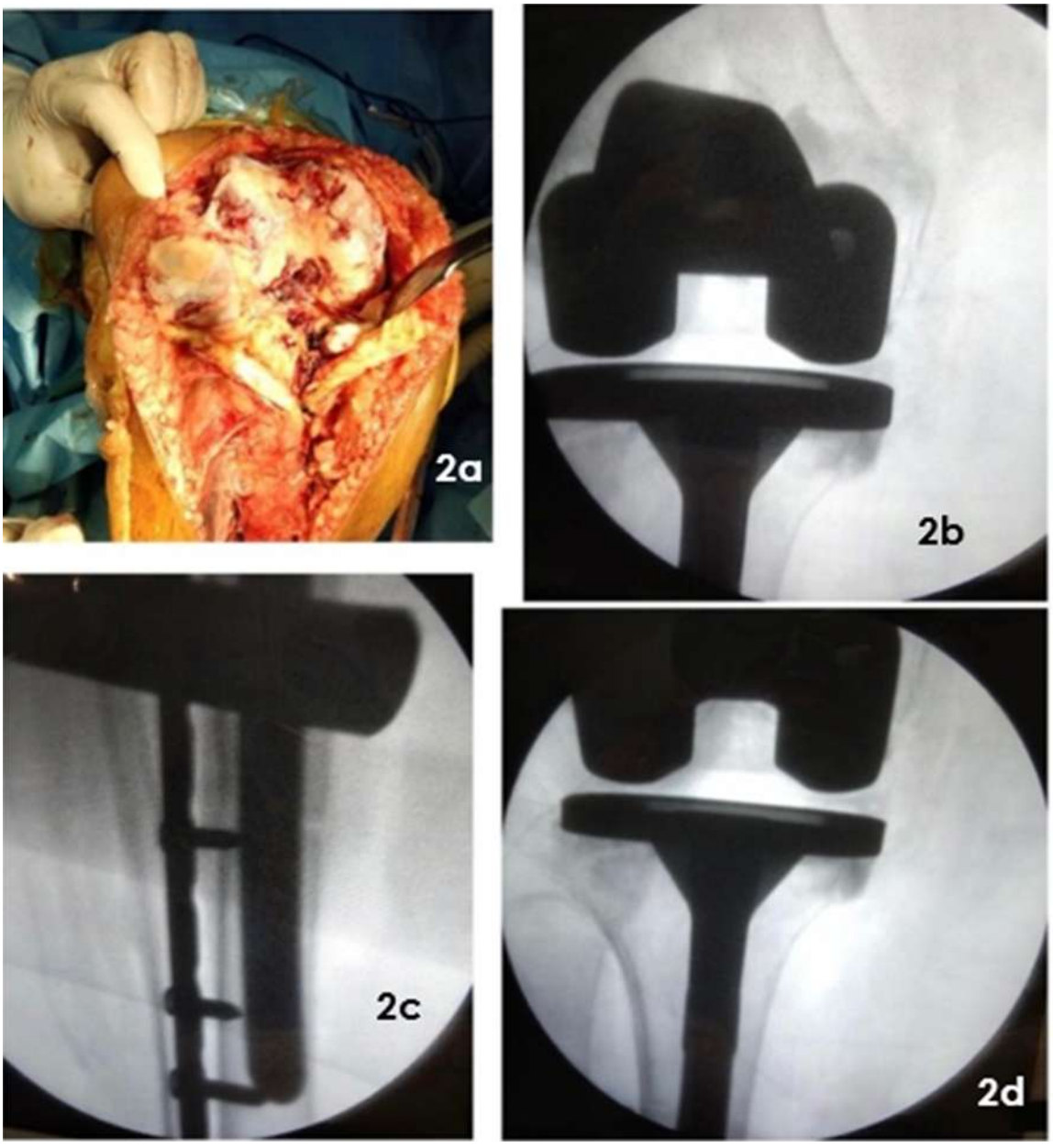
(1c) Posterior slope and extent of posterior osteophyte complex.

1d) Clinical picture- valgus knee.

Severe Osteopenia and Sarcopenia were added comorbidities. Single-stage Ortho-plasty concept was planned that involved prior fixation of the fracture to perform the conventional TKR. Under anesthesia, Knee examination showed reducible stress fracture, partly correctable intra-articular valgus deformity with a maltracking patella. An extended midline incision allowed exposure of tibial stress fracture on its lateral side. Prior to medial parapatellar arthrotomy, plate fixation restored stability and alignment of the tibial segment in addition to correction of the extraarticular valgus deformity.

Figure 2a = Intra operative worn out lateral femoral condyle

Figure 2b, c,d = Intra operative post fracture fixation and replacement



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It enabled knee flexion to do perpendicular tibial bone cuts using an extramedullary jig. Femoral condyle on the lateral side was worn out significantly. (Fig 2a) The femoral side preparation included 3-degree valgus and 5-degree external rotation for posterior stabilized knee (PFC – PS) implant. In view of the severe degree of valgus deformity and a planned tibial extension a posterior substituting knee was chosen and appropriate box cut was made. Tibial side sizing and canal preparation were feasible after plate fixation and the unicortical screws enabled canal preparation for the stem extension. After appropriate posterolateral soft tissue release and posterior osteophyte complex removal, trial reduction was done with stem extension on the tibial side. Cemented semi-constrained posterior substituting knee with cement on the tibial plate and uncemented tibial stem extension was used to by pass the stress fracture site. (Fig :2b,2c,2d). Preexisting Tibia vara and lower tibial stress fracture prevented the ideal stem extension length (2x tibial width) due to the straight stem offset . Plate fixation facilitated the use of 150 mm stem extension that crossed the fracture site.

Results:

The patient has been followed up for 2 years. She regained back her mobility after extended rehabilitation (fig:5). Clinically VAS score for knee pain is 2/10, and the Oxford Knee Score has shown significant improvement. (1to30). X-rays showed healed stress fracture (Fig:4) with restoration of HKA axis and well-fixed components position with her clinical ROM (5-110) degrees.

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Figure 4: 2 years follow up- fracture healed and well placed TKR components.

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Figure 5: Frame aided indoor mobility, but needs the walker in view of her left hip pathology.

Discussion

In the elderly population shaft of the tibia accounts for the uncommon site of stress fractures. In the valgus arthritic knee, the weight-bearing stress concentrates medially over the meta-diaphyseal region of the proximal tibia. [5,10]. This stress could also be compounded by advanced valgus arthritis and osteoporosis. The biomechanical factor (coronal plane alignment) is critical in its etiology and healing of the stress fracture. Diagnostic delay due to lack of suspicion and non-availability of full-length radiographs could lead to worsening deformity, delayed healing of stress fracture, and wheelchair-bound life.[5]. Osteoporosis assessment with bone mineral profile and treatment of underlying metabolic disorders of the bone is essential for its successful outcome.

Non-operative option worsens knee stiffness, and osteo sarcopenia and does not reduce or resolve the symptoms of osteoarthritis. The surgical options available includes fixation and TKR as a staged [7] procedure but this method is challenging for rehabilitation. The TKR in the valgus knee aims at a balanced stable knee after a combined lateral soft tissue release and intra-articular bony resection [4]. In combined valgus knee with tibial stress fracture, reduction and stabilization corrects extra-articular deformity and reduce the overall HKA deviation. The single-stage procedure with long stem TKR will bypass the fracture site and helps in addressing both, arthritis and the stress fracture. The stem extension helps in restoring the alignment and fracture healing through its load-sharing mechanism. The ideal stem length is to span twice the tibial diameter distal to the fracture [7, 9] but literature has no clear consensus of opinion on the length of tibial extension. In preexisting Varus tibia ideal long stem could impinge at the distal end on the medial cortex. It may predispose to stress raiser effect and periprosthetic

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fracture. TKR with plating and bone grafting of the stress fracture offers rotational and axial stability to the construct, enhances the stress fracture healing with an option of optimizing the tibial stem length.

Conclusion:

We conclude that tibial stress fracture with severe valgus arthritic knee deformity is rather a challenging problem. Treatment by ortho-plasty concept simplify the complexity of TKR, restores tibial mechanical axis, achieves fracture healing with a simultaneous reduction in arthritic pain and improved early weight bearing mobilization.

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