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A rare case of bilateral periprosthetic fracture of medial condyle of tibia after total knee arthroplasty

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Abstract
Introduction: Bilateral periprosthetic fractures of medial condyle of tibia after total knee arthroplasty are of rare incidence, as evident from previous literature. The risk factors include morbid obesity, low bone mass or osteopenia, prolonged use of corticosteroids or even trivial trauma leading to stress fractures.
Case Report: We reported a case of bilateral periprosthetic fracture tibia after primary total knee arthroplasty in a patient with severe varus knees and morbid obesity. X-Ray [AP view of knee] and orthoscanograms revealed the fracture; SPECT CT showed evidence of aseptic inflammation and component loosening [Type 1B fracture; Felix Classification]. Revision arthroplasty was done with an augmented long-stem implant and the patient was discharged after a normal postoperative phase on the 10th day. Knee movement at 6 months was 0-120 degrees with satisfactory outcome scores on follow-up.
Discussion: The incidence of bilateral periprosthetic fractures of tibia after primary knee arthroplasty are of rare occurrence, and often associated with severe varus malalignment and morbid obesity. Obesity leads to excessive joint overloading, and together with varus malalignment may lead to component loosening, requiring revision arthroplasty.
Conclusion: Even though bilateral periprosthetic tibial fractures are rare, immediate diagnosis and treatment is necessary, if associated with varus knees and morbid obesity after primary total knee arthroplasty. Reduction of weight is mandatory before primary total knee arthroplasty to improve the functional outcomes and reduce the incidence of revision arthroplasty.

Keywords: Periprosthetic fracture tibia, morbid obesity, revision total knee arthroplasty, long-stem augmented knee implant

Introduction
Periprosthetic fractures after total knee arthroplasty [TKA] may be found in the femur, tibia, patella; of which stress fractures around the tibial implant are relatively rare [1]. Supracondylar fracture of femoral component are reportedly the commonest in occurrence, followed by fractures of the patellar implant.
Risk factors associated with periprosthetic tibial fractures after TKA could be, increased age for primary TKA, long-term use of corticosteroids, obesity, stiff knees after TKA, osteopenia or low bone mass and neurological disorders [2, 3]. Periprosthetic stress fractures of tibia are related to rheumatoid arthritis, advanced osteoarthritis, post-traumatic deformity and pyrophosphate arthropathy [4]. However bilateral tibial periprosthetic fractures of tibia have been rarely reported so far, as evident from previous literature [1].

Case Report
A 66 year old female patient with bilateral knee osteoarthritis [Kellgren Lawrence grade 4 changes] and BMI of 43.1 [morbid obesity], had undergone bilateral total knee arthroplasty [TKA] under spinal anesthesia. The implant used was fixed bearing posterior stabilized cruciate sacrificing the cemented type of knee implant. The patient was mobilized with a walker and discharged normally on the 10th postoperative day. But on the 3rd postoperative month the patient complained of severe persistent pain around the knee after a trivial accident while stair climbing and gradual swelling around the knee. Routine clinical examination in the OPD revealed bilateral severe varus knees [20 degrees], [Figure 1], with reduced knee mobility.
X-Ray knee, AP view in standing position [Figure 2A], showed a bilateral periprosthetic fracture of medial condyle of tibia [Type 1B, Felix classification], [1]; standing long leg

films/orthoscanograms showed similar fractures with enhanced varus deformity of the lower limb [Figure 2B+2C]. SPECT CT findings in this patient showed bilateral periprosthetic fracture tibia, with increased blood supply around the prosthetic joint and radioactive tracer pooling with features of aseptic inflammation [Figure 3A+ 3B]. Evidence of component loosening was also found on SPECT CT Scans [bone scintigraphy], [Figure 4], which required revision arthroplasty.

Revision arthroplasty [TKA] was performed with TC3 mobile bearing prosthesis with a 30mm Tantalum cone with adjuvant stems [cemented] and metallic bone augments for additional stability [Figure 5]. The postoperative phase was normal with no signs of infection or neurological deficit [Figure 6A]. The patient was mobilized independently and discharged on the 10th postoperative day. Follow-up was done for 6 months using the Knee Society Score, Oxford Knee Score, Lower Extremity Functional Scale; which showed normal outcomes of revision TKA, and the patient reported with knee flexion of 0-120 degrees at 6 months [Figure 6B]. Since the patient had morbid obesity, weight reduction was advised by diet monitoring and active physiotherapy, to improve the outcome of revision TKA.

Ethics committee Approval was obtained prior to commencement of the study. The patient gave verbal and written consent to participate in the study.

Fig 1: Patient with bilateral severe varus knees presenting with periprosthetic fracture tibia after primary TKA.

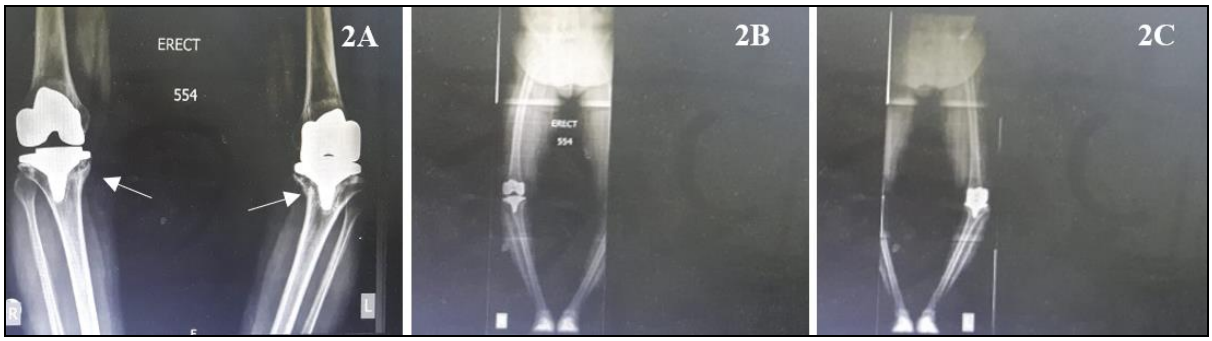

Fig 2 [A]: X-Ray knee, AP view in standing position showing bilateral periprosthetic fracture of medial condyle of tibia [type 1B], after primary TKA in morbidly obese patient. [B+C]: Standing long leg films/ orthoscanograms [R+L] showing bilateral periprosthetic fracture of medial condyle of tibia.

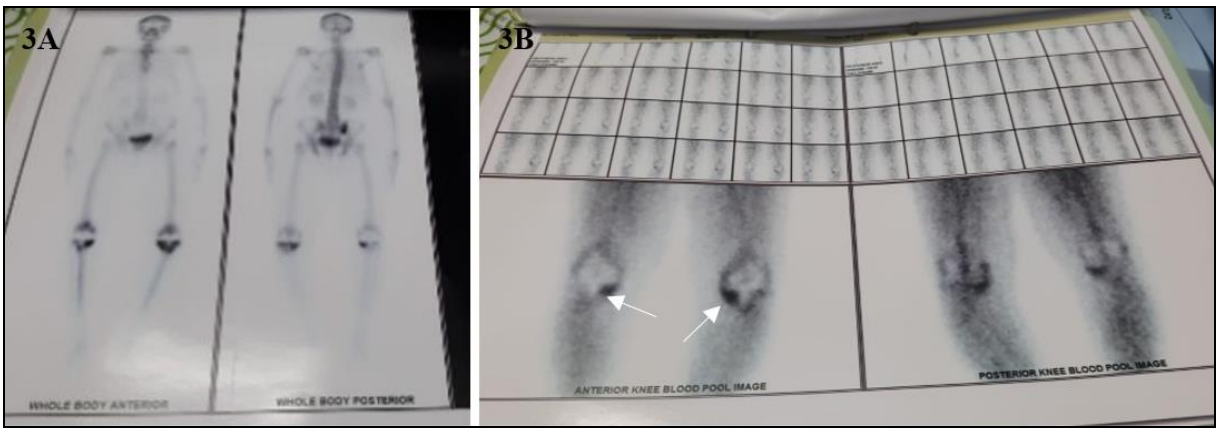

Fig 3[A+B]: SPECT CT findings in bilateral periprosthetic fracture medial condyle of tibia [type1B], showing increased blood supply around the prosthetic joint and radioactive tracer pooling with evidence of aseptic inflammation.

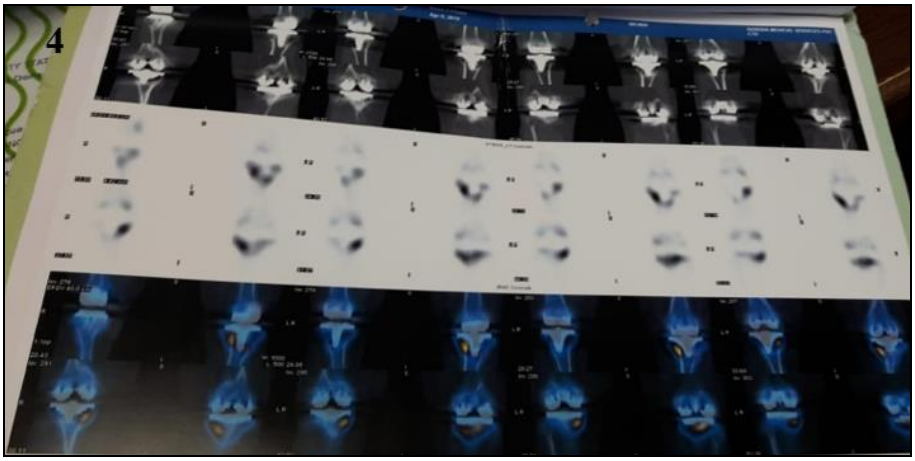

Fig 4: SPECT CT findings in bilateral periprosthetic fracture medial condyle of tibia showing component loosening after primary TKA, due to aseptic inflammation [radioactive tracer pooling, as seen on bone scintigraphy phase]; requiring revision TKA.

Fig 5: Revision arthroplasty done with TC3 mobile-bearing prosthesis with a 30mm Tantalum cone with adjuvant stems [cemented] and metallic bone augments for additional stability.

Fig 6 [A+B]: Patient on 10th postoperative day and followed up at 6 months, showing knee flexion of 0- 120 degrees.

Discussion

Periprosthetic fractures of the tibia are of rare incidence; as reported by the Mayo Clinic series, the incidence of intraoperative periprosthetic tibial fractures was 0.1% and that of postoperative fractures was 0.4% [1]. According to Felix *et al*, periprosthetic tibial fractures were classified into: Type1 fractures, adjacent to tibial plateau; Type 2 fractures, adjacent to the stem of the prosthesis; Type 3 fractures, distal to the prosthesis; Type 4 fractures, involving the tibial tubercle. Subcategories of these fractures were: Type A, where the prosthesis was well fixed; Type B, where the prosthesis was loose; Type C, which involved intraoperative fractures [1]. In this case, the patient reported bilateral Type 1B periprosthetic stress fracture of medial condyle of tibia at 3 months postoperatively after the primary TKA. As evident from available literature, Type1 fractures involving tibial plateau-implant interface were usually associated with component loosening, as seen here on SPECT CT Scans [bone scintigraphy phase]. The treatment for such a case was revision arthroplasty with a stemmed augmented tibial

component with cement fill and modular metal augmentation wedges, which is also supported by other authors [5]. Incidence of periprosthetic tibial fractures is rare and the treatment could be associated with high complication rates, which is predominantly observed in females and associated with low-energy trauma, as seen in this case [6]. Several studies have clearly indicated varus malalignment as a risk factor for periprosthetic fractures of tibia after TKA, as was observed in this patient [7]. The importance of correct tibial alignment and tibial cement fixation was of prime importance during revision TKA in our study, as also highlighted by other authors [8]. According to Ritter MA *et al*, [9], the effect of increased BMI and severe varus malalignment after primary TKA adversely affects functional outcomes in most patients, as it leads to damage of the polyethylene insert and component loosening with periprosthetic fractures; as was seen in this case. The use of long-stem augmented tibial implants for patients with morbid obesity as well as weight reduction in these patients has been considered mandatory by some authors [10], as also has been done in this case.

Conclusion: Bilateral periprosthetic fractures of tibia after primary TKA are of a rare occurrence in the available literature. However, if the patient [with morbid obesity] complains of persistent pain and swelling around the prosthetic knee with severe varus malalignment after TKA, the incidence of such fractures should be considered for early diagnosis and treatment. Patients with morbid obesity are a high-risk group for tibial periprosthetic fractures; hence weight reduction is mandatory before primary TKA, [by active exercise and dietary control], to improve the functional outcomes and reduce the incidence of revision arthroplasty.

Declarations

Ethics Approval: Ethics approval was obtained from hospitals from where the patient was included in the study; prior to beginning the study. The ethics approval document was obtained first from Fortis Hospital, Anandapur, Kolkata on 30.9 2015, followed by the same from IPGMER, Kolkata, on 28.10.15. The patient was recruited from Fortis Hospital, Kolkata,

Consent to Participate: Patient gave written consent to participate in the study through informed consent document forms as per ICMR [Indian Council of Medical Research] Guidelines.

Availability of data and materials: Available. Patient data has been recorded after obtaining proper consent. The data generated during and / or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: All contributing authors, declare that they have NO competing interests/ conflicts of interests.

Funding: The study received NO financial grant/ support from any sponsor. The hospital concerned provided free access to patient and imaging facilities for academic purposes.

Informed consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from the patient for being included in the study.

Authors contributions

Author 1, contributed to the concepts and study design, patient data acquisition, literature search, data analysis, manuscript preparation, final drafting and editing of the manuscript.
Author 2, contributed to the study design, data analysis.
All authors have contributed to the study and have finally reviewed the manuscript, and each author believes that the manuscript represents honest original research work.

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