



## Management of stress fractures of the proximal tibia in patients with advance knee osteoarthritis. A case series

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To evaluate the outcome of one stage long stem total knee arthroplasty (TKA) of patients with stress fracture of the proximal tibia of the knee joint.

Record of 15 patients, 14 females and one male who underwent one stage long stem TKA from the year January 2008 till December 2014 were reviewed retrospectively. Outcome variable was fracture healing which was seen clinically (pain free and postop ambulation) as well as radiologically (union of three out of four cortices).

Mean age of the patients were 65 years and the mean BMI was 31. Of the 15 knees 13 had varus malalignment and 2 had valgus malalignment. The mean duration of fracture healing was four and a half months and the mean duration of follow-up was 26 months. All the patients were ambulated full weight bearing with walker. One patient had non-union at fracture site which required bone grafting.

Long stem TKA is an effective method of treating tibial stress fractures associated with advance osteoarthritis as it not only restores the normal mechanical alignment but also facilitates fracture healing

Keywords : Knee arthroplasty ; stress fractures ; osteoarthritis ; rheumatoid arthritis.

### INTRODUCTION

Association of tibial stress fracture together with severe degenerative arthritis is not only rare but often a difficult entity for the orthopaedic surgeons (3).

Wheeldon (16) was the first surgeon who reported stress fracture complicating arthritis in three patients who were rheumatoid and suggested that abnormal

loading was the main reason for these fractures to occur. Later Papachristou (11) and various others further substantiated the causal relationship of long standing abnormal varus or valgus deformity with stress fractures of the proximal tibia (5,6).

Stress fracture of the tibia with severe degenerative arthritis is less commonly seen in the developed world but is still the bane of developing countries. Patients usually delay surgery secondarily to financial constraints, local taboos and sometimes even over exaggerated fear of surgery (3,7,12).

Managing these patients poses a unique challenge for the orthopaedic surgeon because most of these patients are elderly, obese, osteoporotic, sometimes steroid dependent and may have abnormalities of calcium metabolism. Furthermore the malalignment increases stresses at the fracture site predisposing to non-union or delayed union (9).

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There has been an attempt to classify these fractures according to location (intra-articular vs extra-articular), fracture mobility, amount of deformity and duration (7,9). But this has added further heterogeneity to an already rare entity.

Similarly, various treatment approaches have been advocated which are again diverse, ranging from conservative treatment to surgical options.

Non-operative management of stress fractures has been reported in literature but is associated with various complications like non-union and stiff knee and it fails to address the malalignment as the cause of this fracture (9,10,12). The goal of operative management is to restore limb alignment by replacing the joint and stabilizing the fracture. This may be achieved by separate internal fixation and TKA or a One stage TKA using long stem tibial or femoral component (1,3,7).

The purpose of this study is to evaluate the outcome of one stage long stem TKA for patients with arthritic knees and proximal tibial stress fractures.

## PATIENTS AND METHODS

This study included 15 patients with knee arthritis, including 14 females and 1 male, complicated by extra-articular stress fractures of the tibia who underwent a one stage cemented long stem TKA between January 2008 and June 2015.

Demographic variables like age, Gender, BMI and presence of co-morbidities were collected from patients' charts. Characteristics of the fracture and mechanical tibio-femoral angles were recorded from full length standing radiographs. All patients under went cemented posterior cruciate sacrificing TKA with tibial extension rod through a standard midline incision and medial para-patellar approach. Constrained implants and augments were not used in any of the cases.

All surgeries were performed under tourniquet and adequate precautions were undertaken to prevent cement extrusion into the fracture site.

For knees with mobility at the fracture site closed reduction was done prior to passing an intramedullary guide wire over which sequential reaming was done under fluoroscopic control.

But for knees with stiff nonunion or incomplete or impending fractures, no osteotomy was needed and the deformity was corrected at the joint line. Nonunion sites were not exposed to excise fibrous tissue instead reaming and dynamic loading were relied upon for union.

All patients underwent routine post TKA rehabilitation with full weight bearing ambulation with support, knee range of motion and quadriceps strengthening exercises. The patients were followed post-operatively in clinic at 2 weeks, 6 weeks, 12 weeks and at 6 months. Thereafter they were followed on a yearly basis.

## RESULTS

Mean age of the patients was  $65.3 \pm 6.2$  years and mean BMI was  $30.8 \pm 2.5$  kg/m<sup>2</sup>. Among the 15 knees included in this study, 12 had osteoarthritis whereas the remaining 3 had Rheumatoid arthritis. A varus deformity ( $20^\circ \pm 5^\circ$ ) was seen in 13 patients while 2 patients had a valgus deformity ( $10^\circ \pm 2.5^\circ$ ). An impending fracture was diagnosed in 3 patients, 4 had an acute fracture and 8 had a non-union out of which 4 each were mobile and stiff respectively. Two patients also had a concomitant fracture of the fibula.

The most common clinical presentation was insidious onset of localized pain not resolving with over the counter analgesics. However, four patients reported sudden increase in deformity and subsequent inability to walk.

The mean duration of surgery was  $162 \pm 16.8$  minutes. The mean time to fracture healing was  $4.5 \pm 0.6$  months and the mean post-operative follow up was  $26.3 \pm 23.9$  months.

Mean pre-operative Knee Society Knee Score was 31.5 (11-45) and functional score was 16.5 (0-30). These values increased to 87.6 (75-95) and 91.3 (80-100) respectively at 12 weeks follow up.

Two patients suffered from post-operative medical complications with one patient sustaining a stroke and the other having a pulmonary embolism. Both patients responded well to medical management and recovered completely with minimal residual morbidity. Details of all the patients is summarized in table I.

One female patient developed a non-union at the proximal fracture site and required further intervention. This subsequent procedure, nine months after the index surgery, included autogenous bone grafting, fibular osteotomy and open reduction internal fixation with a locking compression plate. Subsequently union was achieved after 4 months of second surgery Fig 1(a-d).

## DISCUSSION

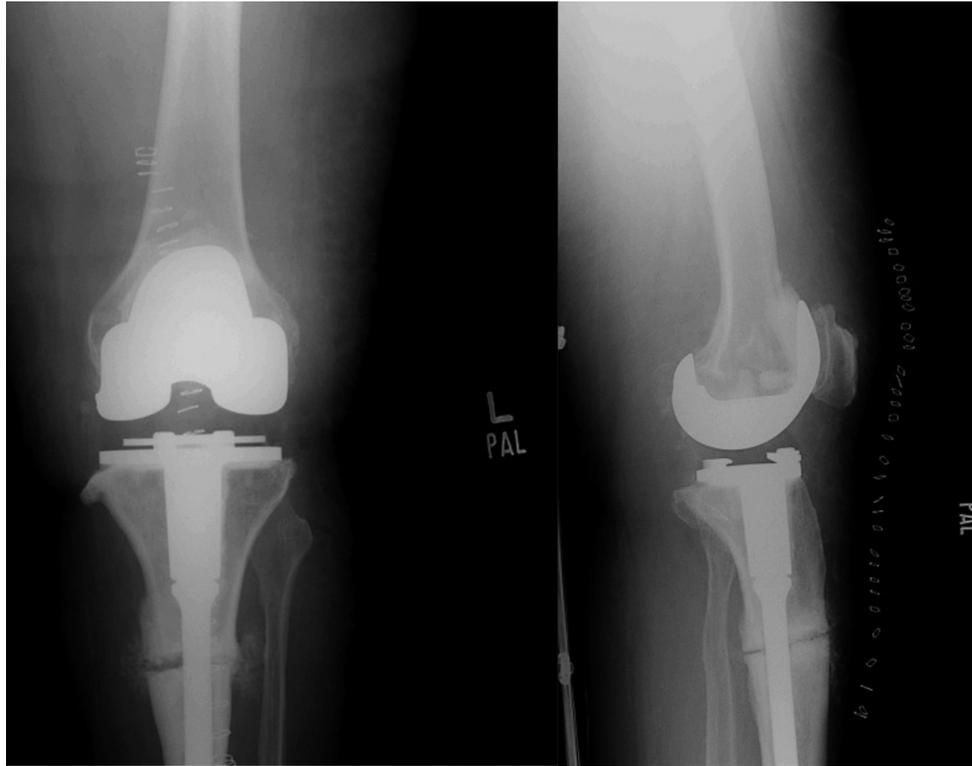
Arthritis of the knee complicated by stress fracture of the proximal tibia is not uncommon but under reported, mainly because this is commonly seen in developing countries where patients usually delay surgery either due to economic constraints or due to other local factors (3,7). There are only case

Table I. — Summary of Patients

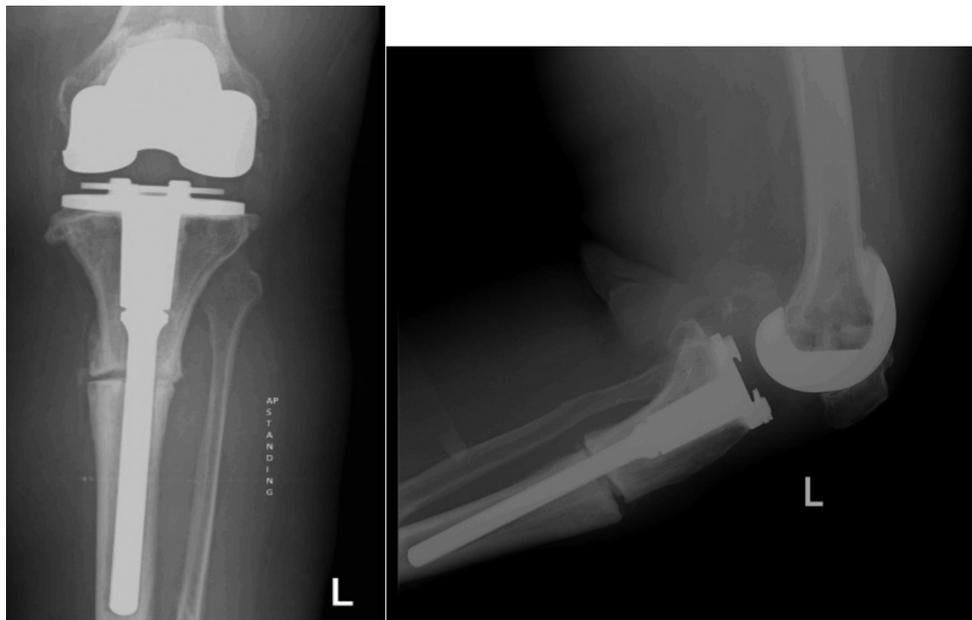
S.no	Age (years)	Sex	Side	Diagnosis	BMI	Fracture union (months)	Follow up (months)
1	66	F	Right	OA	29	4	12
2	74	F	Right	OA	30	5	28
3	60	F	Left	OA	36	5	12
4	69	F	Right	RA	25	4	24
5	60	F	Left	OA	31	4.5	12
6	56	F	Left	OA	32	Non Union	24
7	60	F	Right	RA	31	5	60
8	70	F	Left	OA	30	4	12
9	68	F	Right	OA	29	4.5	12
10	53	F	Right	OA	33	4	12
11	65	F	Right	RA	29	4	80
12	71	F	Left	OA	33	4	9
13	72	F	Left	OA	33	6	72
14	70	M	Right	OA	30	4	12
15	65	F	Left	OA	31	5	14



Fig. 1(a). — showing AP long film, AP and Lateral view of the knee joint



*Fig. 1(b).* — immediate post op x-rays AP and lateral views



*Fig. 1(c).* — post op 8 months after 1st surgery Ap and Lateral view



Fig. 1(d). — Post op 1 year after 2nd surgery AP and Lateral View

reports and few case series addressing this problem (1,2,10,14).

Moskal (8) and various others (3,4,10,14) have reported good outcomes with internal fixation of the stress fracture and total knee replacement with stem extender. But the procedure is usually extensive and hence theoretically more prone to complications. The plate may prevent dynamic loading at the fracture site leading to delayed union and the increased surgical exposure poses a greater risk of wound related complications.

With recent advances in technology one stage TKA with tibial extension rod has been proposed by many authors (13-15). This not only corrects deformity and abnormal alignment at the fracture

site but at the same time stabilizes the fracture. All this in a single stage with a standard surgical exposure resulting in early ambulation and better patient related outcomes.

Mithal et al (7) and Mullaji et al (9), both from India, published the two largest series of stress fractures and reported their successful outcomes with the use of tibial stem extenders. They classified fractures according to location (intra-articular or extra-articular) chronology of the fracture (impending, acute, malunion, nonunion) and degree of deformity. Their series included intra-articular fractures and malunion deformities alongside extra-articular fractures and mobile non-unions, with both groups having different management considerations

and implications. For example, malunions require corrective osteotomies and intra-articular fractures may require wedges & augments which is not the case in extra-articular fractures and mobile non-unions. Both these authors differ in their practice of managing non-unions with one advocating opening the fracture site to excise fibrous tissue whereas the other relies on reamed material and preserving biology. A summary of these series is presented in Table II.

Our series also had successful outcomes in terms of fracture healing and ambulation but included only extra-articular fractures and non-unions. We also did not violate the fracture or non-union site and found reaming and dynamic loading to be a sufficient stimulus for union.

One of our patients developed a nonunion at the stress fracture site which subsequently required internal fixation with a locking plate and bone grafting. Even though cortical perforation by the stem extender has been reported by Mullaji et al [9] as an intra-operative complication but a nonunion has not been reported in any of the previous cases

or series. We believe that the nonunion may have resulted due to distraction at the fracture site at the time of surgery and failure of subsequent compression with weight bearing due to an intact fibula. Hence, we recommend that if such a situation is encountered a fibular osteotomy should be considered to aid in compression at the fracture site with subsequent weight bearing.

As these stress fractures are a rare entity, our study is limited by a small sample size. Our limited follow-up allows us to only assess short term outcomes whereas long term outcomes and complications remain yet to be studied or reported.

## CONCLUSION

Single stage TKA with tibia extension rod for extra-articular fractures of the proximal tibia is associated with good short term outcomes with early fracture union and patient ambulation. Care must be taken to ensure good contact at the fracture site to prevent occurrence of non-union.

Table II. — Summary of Literature

Study	Patients	Mean Age (Years)	Extra-articular tibial stress fractures	Tibio-femoral angle	Management	Knee Society Score	
						Pre-op	Post-op
Mullaji et al <sup>9</sup> (J Arthroplasty 2010)	34	64.37	30 (13 united/malunited)	19.4° varus 23.4° valgus	Long stem TKA +/- Segmental Fibulectomy Osteotomy for malunions	Knee 36.7 Function 24	Knee 90.3 Function 86.2
Dhillon et al <sup>3</sup> (J Arthroplasty 2011)	8	70.25	8	-	2 TKA + plate 6 TKA with long stem	Knee 23.63 Function 18.75	Knee 80.88 Function 67.75
Mittal et al <sup>7</sup> (J Orthop Surg 2013)	29	66.5	24 (21 malunions)	25.4° varus 16° valgus	Long stem TKA with or without fibular osteotomy Tibial osteotomy for malunions >30°	Knee 38.5 Function 25.5	Knee 89.6 Function 86.5
This Study	15	65.3	15 (Malunions excluded)	20° varus 10° valgus	Long stem TKA	Knee 31.5 Function 16.5	Knee 87.6 Function 91.3

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