

RESEARCH ARTICLE

Acute Primary Total Knee Arthroplasty for Proximal Tibial Fractures in Elderly

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Abstract

Background: Proximal tibial fractures in elderly patients with osteoporosis or knee osteoarthritis (OA) are challenging cases. In the current study, we present our experience with uncommon acute primary total knee arthroplasty (PTKA) in this patient population.

Methods: PTKAs were performed following proximal tibial fractures in 30 consecutive patients over 60 years of age with osteoporosis or knee OA between 2005 and 2009. Three constrained condylar knees (CCK) and no hinged knee prosthesis were used. Patients were followed up for 4.5 ± 1.1 years.

Results: Patients were discharged after 4.6 ± 1.2 days. The postoperative Tegner activity scale (3.5 ± 1.3) was improved significantly compared to the preoperative scale (2.5 ± 1.2) ($P < 0.001$). The knee flexion range was significantly greater in the operated side (106 ± 13 degrees) compared to the uninjured knee (120 ± 8 degrees) ($P < 0.001$). The two sections of knee society knee score (knee and function section) averaged 90.7 ± 6.5 and 69.6 ± 8.8 , respectively. All patients returned to their previous activities. Based on the visual analogue scale, the patients' satisfaction and pain at final visit were scored 8.1 ± 1 and 1.5 ± 1.2 , respectively. No infection, thromboembolic events and loosening were observed.

Conclusion: PTKA following a proximal tibial fracture in elderly patients with osteoporosis or knee degeneration can be considered as a safe alternative for open reduction and internal fixation. PTKA resulted in immediate weight-bearing, improved functional status and patients' satisfaction. However, functional outcomes were dependent on the general condition of 24 the patient. Also, constrained knee prostheses were not necessary for a vast majority of the patients.

Keywords: Knee osteoarthritis, Osteoporosis, Proximal tibial fracture, Total knee arthroplasty

Introduction

Tibial plateau fractures are common injuries and represent about 8% of all fractures in over 65 year old population (1). Due to the significant soft tissue damage, severe comminution, displacement, poor bone quality and cartilage injury, these intra articular fractures challenge the orthopedic surgeons, especially in elderly patients with osteoporosis or knee osteoarthritis (OA) (2-5).

Tibial plateau fractures can be treated nonoperatively. Several different methods for tibial plateau fracture treatment have been introduced such as close reduction and external fixation, percutaneous screw fixation, open reduction and internal fixation (ORIF), less invasive stabilization system, double osteosynthesis, and staged external and internal fixation, while each one has their own advantages and disadvantages; however the best

choice remains controversial (2, 4, 6-9).

In spite of these attempts, failure of obtaining anatomical reduction and restoration of proper alignment, cartilaginous injury, intra-articular step-off and other abnormal anatomical changes have made many patients to experience post-traumatic knee OA (10, 11). Posttraumatic knee OA seriously interferes with patients' daily living activities and disturbs their normal life indicating early future total knee arthroplasty (TKA) (10, 12).

Although TKA is the definite treatment for knee OA, however, authors have indicated that

TKA is complicated and technically demanding in patients with a history of intra-/extra-articular distal femoral or proximal tibial fracture (10-14).

Based on the poor outcomes following the treatment

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of tibial plateau fractures, high rate of complications in TKA for post-traumatic OA and the short time-interval between primary treatment of the fracture and required TKA, it has been advocated limitedly to perform acute primary TKA (PTKA) in older patients with osteoporosis or knee degenerative changes (15-19). Satisfactory outcomes in previous reports and limited data regarding this treatment method suggest the evaluation of acute PTKA outcomes in elderly patients with tibial plateau fractures.

Materials and Methods

A total of 30 consecutive patients with close tibial plateau fractures were enrolled in the current prospective study between 2010 and 2015. All patients aged above 60 years old and suffered from osteoporosis or knee OA. The study was approved by the research ethical committee of Shahid Beheshti University of medical sciences. All patients signed an informed consent before the operation. Arbeitsgemeinschaft für Osteosynthesefragen (AO) system was used to classify the fractures using preoperative x-rays and CT scans.

After preoperative planning, all patients underwent acute PTKA. All surgical procedures were performed by the same surgeon (M. M. S) through the same (medial prepatellar) approach. Three patients required constrained condylar knee (CCK) due to medial collateral ligament avulsion (two cases) and a very severe type C fracture (one case). Hinged type prosthesis was required for none of the patients. Routine physical therapy was performed after the operation and patients were allowed

to walk using assistive devices such as crutches (partial weight bearing) at the first postoperative month. Patients were also followed up for at least 3 years post operation. At the final visit, the knee society knee score (KSS) was completed for all of them to determine the functional results of the surgery. Scores between 80 to 100 were defined as excellent, 70 to 79 as good, 60 to 69 as fair, and scores <60 were considered as poor outcomes.

Tegner activity scale was also determined before and after the operation to compare the pre- and post-operative activity level. The knee range of flexion motion was measured by an orthopaedic surgeon using a goniometer. The knee ROM measurements were repeated consecutively three times for each patient, Patients were asked about returning to their previous job or sporting activity, the severity of pain, and their satisfaction with the outcomes of the surgery, using a visual analogue scale (VAS) on a zero (no pain/satisfaction) to 10 (severe pain/maximal satisfaction) scale, to investigate subjective outcomes. Any early or late complications such as deep vein thrombosis (DVT), infection and loosening of the prosthetics, and death (within the first postoperative month) were also recorded [Figure 1-3].

Statistical analysis

Statistical analysis was performed using SPSS version 16.0 (Chicago, Illinois). Wilcoxon test was used to compare the pre- and post-operative Tegner activity scale. Also, the range of knee flexion was compared between injured and uninjured limbs using independent samples t-test. *P-value* <0.05 was considered significant.



Figure 1. A 64 years old female with proximal tibial fracture AO type B associated with MCL avulsion. a) preoperative x-rays and b) X-rays 3.5 years after TKA.

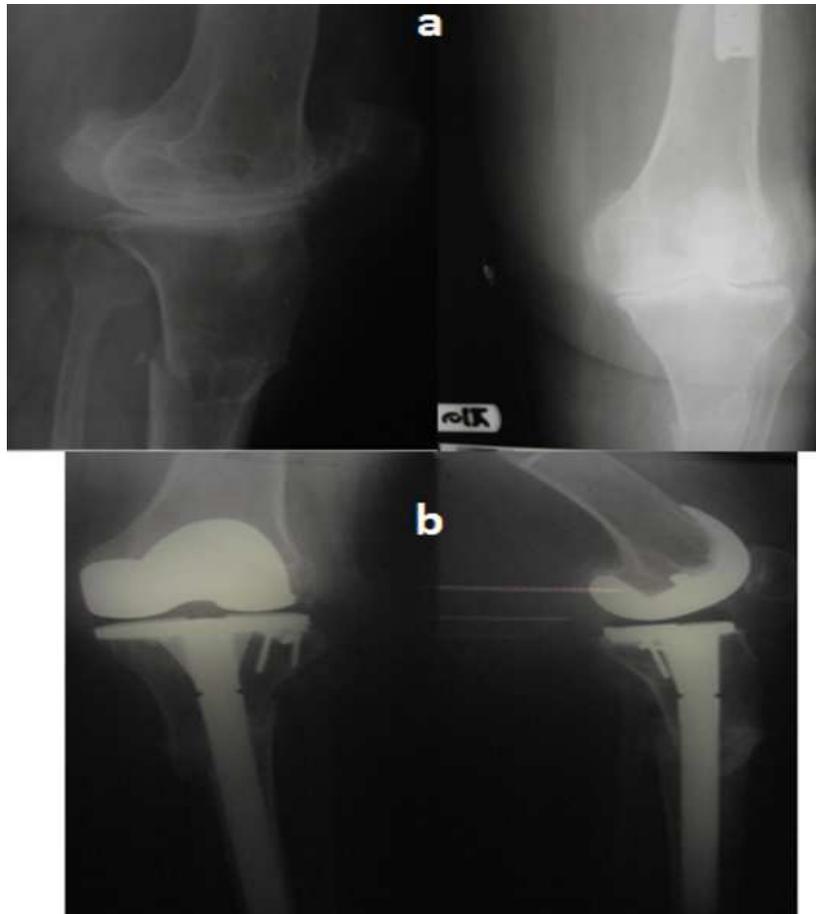


Figure 2. A 67 years old male suffered from proximal tibial fracture AO type A treated with TKA. a) Preoperative anteroposterior and lateral x-rays and b) Anteroposterior and lateral x-rays taken 4 years Postoperatively.

Results

The characteristics of the patients are presented in Table 1. The surgery and hospital stay times averaged 66.6 ± 6.7 min (ranged from 55 to 78) and 4.6 ± 1.2 days (ranged from 3 to 7 days), respectively. Table 2 shows the surgery outcome based on KSS which was not poor in any of the patients. The postoperative Tegner activity improved significantly ($P < 0.001$) [Table 2]. Also the range of knee flexion was significantly improved in operated knee (106 ± 13 degrees) compared to the contralateral side (120 ± 8 degrees) ($P < 0.001$).

All patients (100%) in the current study returned to their previous job or recreational activities within 2 months after the operation. The severity of pain at the final assessment averaged 1.5 ± 1.2 (range: 0-4) and only three patients needed some analgesics for pain relief. The patients were satisfied with the outcomes of the surgery and VAS for satisfaction averaged 8.1 ± 1 (range: 6-10). No infection, thromboembolic events or any other postoperative complications were seen. Also, the final x-rays showed no case of septic or aseptic loosening.

Table 1. The characteristics of the patients

Number		30
Age (year)		67.6 ± 4.2 (Range: 61-78)
Sex	Male	19
	Female	11
BMI (kg/m^2)		28.2 ± 2.7 (Range: 23.1-34.7)
Knee OA		23
Osteoporosis		7
High energy trauma		14
	41 A	5
	41 B	22
Type of fracture	41 C	3
Follow-up (year)		4.5 ± 1.1 (Range: 3-6)

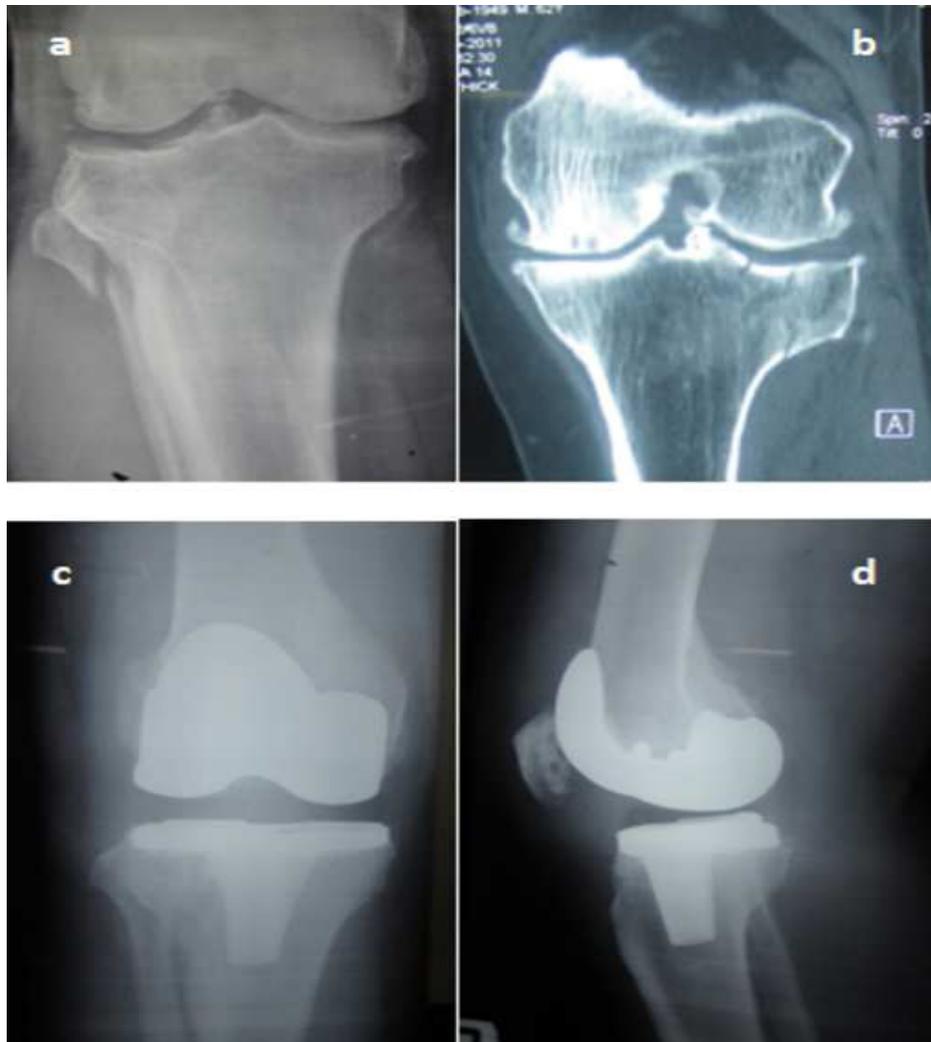


Figure 3. A 62 years male with proximal tibial fracture AO type B.

a) preoperative anteroposterior x-ray; b) preoperative posteroanterior CT scanning; c and d) postoperative anteroposterior and lateral x-rays after 4 years.

Table 2. The outcomes of treatment based on the scores				
Score		Mean±SD (range)	Grading (%)	P
KSS	Knee score	90.7±6.5 (67-97)	Excellent	28 (93.4)
			Good	1 (3.3)
			Fair	1 (3.3)
			Poor	0
KSS	Function score	69.6±8.8 (41-85)	Excellent	4 (13.3)
			Good	12 (40)
			Fair	13 (43.3)
			Poor	1 (3.3)
Tegner activity scale	Preoperative	2.5±1.2 (1-5)		< 0.001
	Postoperative	3.5±1.3 (2-6)		

Discussion

The hypothesis in the current study was that PTKA in elderly patients with proximal tibial fracture can be associated with satisfactory clinical, functional, and radiological outcomes. Our finding showed the midterm efficacy of PTKA as an optimal treatment for elderly patients with proximal tibial fractures with knee OA or osteoporosis.

To the best of our knowledge the current study has investigated the largest number of PTKA in elderly patients with proximal tibial fracture, however, like previous studies, it does have some limitations. The descriptive nature is the most important limitation of the current study. In other words, we did not compare the results of PTKA with those of ORIF for proximal tibial fracture which is vital for decision making and selection of the superior treatment method. Our study was also limited by its mid-term follow up. However, we wish to follow the patients to evaluate the long-term results.

Results of the present study confirmed that PTKA can be a realistic and reasonable treatment option in aged population with osteoporosis or arthritic knees with proximal tibial fractures. Early TKA led to excellent knee scores in nearly all patients. About half of our patients yielded fair and poor functional score which seems to be due to pre-existing poor general status and low functional capacity. Furthermore, the preoperative low Tegner activity scale (2.5) explains this fact clearly. The significant post operation increase in Tegner scale reflects the efficacy of PTKA in improvement of patients' functional status. No complications such as infection, DVT or component loosening were seen in our study and patients were highly satisfied with the outcomes of the surgery. Our results demonstrate that constrained knee prostheses are not necessary for a large number of these patients.

Based on these findings, TKA seems to be an appropriate treatment option in elder patients with knee OA or osteoporosis who suffer from a tibial plateau fracture. Furthermore, many of these patients require TKA early after the fracture to avoid subsequent severe degenerative changes. Acute PTKA can prevent complications with fracture healing and undergoing two major orthopedic surgeries (ORIF followed by TKA for post-traumatic knee OA) in elderly patients with high risk of perioperative morbidity and mortality.

Although surgical treatment of tibial plateau fractures in elder population had led to satisfactory outcomes; however, low bone quality, osteoporosis and unfavorable condition of the joint surfaces make it more difficult to

restore articular anatomy through stable fixation (1, 15, 20-22). It has been well documented that osteoporosis adversely affects the outcomes of tibial plateau fractures treatment (1, 15, 20, 21, 23, 24). Surgical treatment of tibial plateau fractures require long lasting postoperative immobilization, non-weight bearing ambulation (8-12 weeks), and long-term rehabilitation, while acute PTKA allows weight bearing ambulation at the first postoperative month or earlier based on the patient's condition (6, 8). In addition, many of elder patients suffer from knee OA and should undergo TKA for pain relief and functional improvement.

Recently, Vermire, Scheerlinck and Malviya et al presented the good results of PTKA in 11 and 26 patients with peri-articular knee fractures and demonstrated that this method of treatment can be used in elder patients with osteoporosis or arthritic knees (5, 17).

Studies have shown that the results of TKA in patients with previous history of periarticular fractures are less satisfactory and these procedures are associated with higher risk of postoperative complications. Suzuki et al showed that previous history of fracture and remnants of internal fixation are major risk factors of post-TKA infection (13). Civinini et al demonstrated that TKA in patients with previous history of tibial plateau fracture requires particular technical solutions and is associated with higher rates of complications (32%) (10).

Considering the optimal knee score, patients' satisfaction, and possible immediate weight-bearing acute PTKA can be suggested as an appropriate and safe alternative for ORIF in aged patients with poor bone quality and/or severe degenerative changes of the knee who sustained a proximal tibial fracture. The final functional status was dependent on the general condition of the patient and improved postoperatively. CCK prosthesis may be necessary in some certain patients with injuries increasing the risk of postoperative instability. However, future comparative studies with larger sample sizes are required.

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References

1. Hsu CJ, Chang WN, Wong CY. Surgical treatment of tibial plateau fracture in elderly patients. *Arch Orthop Trauma Surg.* 2001; 121(1-2):67-70.
2. Chin TY, Bardana D, Bailey M, Williamson OD, Miller R, Edwards ER, et al. Functional outcome of tibial plateau fractures treated with the fine-wire fixator.

- Injury. 2005; 36(12):1467-75.
3. Rosen AL, Strauss E. Primary total knee arthroplasty for complex distal femur fractures in elderly patients. *Clin Orthop Relat Res.* 2004; (425):101-5.
 4. Subasi M, Kapukaya A, Arslan H, Ozkul E, Cebesoy O. Outcome of open comminuted tibial plateau fractures treated using an external fixator. *J Orthop Sci.* 2007; 12(4):347-53.
 5. Vermeire J, Scheerlinck T. Early primary total knee replacement for complex proximal tibia fractures in elderly and osteoarthritic patients. *Acta Orthop Belg.* 2010; 76(6):785-93.
 6. Faldini C, Manca M, Pagkrati S, Leonetti D, Nanni M, Grandi G, et al. Surgical treatment of complex tibial plateau fractures by closed reduction and external fixation. A review of 32 consecutive cases operated. *J Orthopaed Traumatol.* 2005; 6(4):188-193.
 7. Ma CH, Wu CH, Yu SW, Yen CY, Tu YK. Staged external and internal less280 invasive stabilisation system plating for open proximal tibial fractures. *Injury.* 2010; 41(2):190-6.
 8. Singh S, Patel PR, Joshi AK, Naik RN, Nagaraj C, Kumar S. Biological approach to treatment of intra-articular proximal tibial fractures with double osteosynthesis. *Int Orthop.* 2009; 33(1):271-4.
 9. Zura RD, Browne JA, Black MD, Olson SA. Current management of high-energy tibial plateau fractures. *Curr Orthopaed.* 2007; 21(3):229-35.
 10. Civinini R, Carulli C, Matassi F, Villano M, Innocenti M. Total 264 knee arthroplasty after complex tibial plateau fractures. *Chir Organi Mov.* 2009; 93(3):143-7.
 11. Honkonen SE. Degenerative arthritis after tibial plateau fractures. *J Orthop Trauma.* 1995; 9(4):273-7.
 12. Wasserstein D, Henry P, Paterson JM, Kreder HJ, Jenkinson R. Risk of total knee arthroplasty after operatively treated tibial plateau fracture: a matched-population-based cohort study. *J Bone Joint Surg Am.* 2014; 96(2):144-50.
 13. Suzuki G, Saito S, Ishii T, Motojima S, Tokuhashi Y, Ryu J. Previous fracture surgery is a major risk factor of infection after total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc.* 2011; 19(12):2040-4.
 14. Weiss NG, Parvizi J, Trousdale RT, Bryce RD, Lewallen DG. Total knee arthroplasty in patients with a prior fracture of the tibial plateau. *J Bone Joint Surg Am.* 2003; 85-A(2):218-21.
 15. Bansal MR, Bhagat SB, Shukla DD. Bovine cancellous xenograft in the treatment of tibial plateau fractures in elderly patients. *Int Orthop.* 2009; 33(3):779-84.
 16. Gerich T, Bosch U, Schmidt E, Lobenhoffer P, Krettek C. Knee joint prosthesis implantation after fractures of the head of the tibia. Intermediate term results of a cohort analysis. *Unfallchirurg.* 2001; 104(5):414-9.
 17. Malviya A, Reed MR, Partington PF. Acute primary total knee arthroplasty for peri-articular knee fractures in patients over 65 years of age. *Injury.* 2011; 42(11):1368-71.
 18. Nau T, Pfliegerl E, Erhart J, Vecsei V. Primary total knee 285 arthroplasty for periarticular fractures. *J Arthroplasty.* 2003; 18(8):968-71.
 19. Nourissat G, Hoffman E, Hémon C, Rillardon L, Guigui P, Sautet A. Total knee arthroplasty for recent severe fracture of the proximal tibial epiphysis in the elderly subject. *Rev Chir Orthop Reparatrice Appar Mot.* 2006; 92(3):242-7.
 20. Roerdink WH, Oskam J, Vierhout PA. Arthroscopically assisted osteosynthesis of tibial plateau fractures in patients older than 55 years. *Arthroscopy.* 2001; 17(8):826-31.
 21. Su EP, Westrich GH, Rana AJ, Kapoor K, Helfet DL. Operative 305 treatment of tibial plateau fractures in patients older than 55 years. *Clin Orthop Relat Res.* 2004; (421):240-8.
 22. Frattini M, Vaienti E, Soncini G, Pogliacomi F. Tibial plateau fractures in elderly patients. *Chir Organi Mov.* 2009; 93(3):109-14.
 23. Schandelmaier P, Partenheimer A, Koenemann B, Grün OA, Krettek C. Distal femoral fractures and LISS stabilization. *Injury.* 2001; 32(Suppl 3):SC55-63.
 24. Shah A, Asirvatham R, Sudlow RA. Primary resection total knee arthroplasty for complicated fracture of the distal femur with an arthritic knee joint. *Contemp Orthop.* 1993; 26(5):463-7.