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Authors' Affiliation:
[1]Resident, Department of Neuro-Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Research (Deemed to be University), Sawangi (Meghe), Wardha-442001, Maharashtra, India
Email: ruchikazade20@gmail.com
ORCID: 0000-0003-0533-6235
[2]Professor, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Research (Deemed to be University), Sawangi (Meghe), Wardha-442001, Maharashtra, India
Email: drpratik77@gmail.com
ORCID: 0000-0003-3635-8840

*Corresponding Author
Resident, Department of Neuro-Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Research (Deemed to be University), Sawangi (Meghe), Wardha-442001, Maharashtra,
India
Email: ruchikazade20@gmail.com
ORCID: 0000-0003-0533-6235

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An 82-year-old patient with a tibial plateau fracture and the impacts of comprehensive rehabilitation: A case report

Ruchika Zade[1*], **Pratik Phansopkar**[2]

ABSTRACT

Tibial plateau fractures, which are a rare injury to the proximal tibia, range in severity from minimal displaced stable fractures to high energy complicated fractures with severe articular and metaphyseal comminution and injury to soft tissues. The consequences concerning tibial plateau fractures include stability and function with regard to knee, a crucial weight-bearing joint. In addition to management-related issues including High-energy, discus articularis, injuries of tibial plateau may lead to later sequelae that is different collapse, implant failure, and arthritis of the knee joint. Wound Destruction and critical comminution lead to malalignment. An 82-year-old man who had previously suffered injuries from an automobile accident to his right leg was brought to the hospital's emergency room. After admission, an X-ray was taken, and it showed a compound grade 3A fracture on the right side of the distal 1/3 of the tibia and fibula. After that, he underwent surgery (debridement and extra-cutaneous plate fixation), and directed toward physiotherapy. There are difficulties for the operating physician because each fracture necessitates a unique surgical strategy. Anatomical reduction and restoration of the joint line are required for firm fixation and prompt joint mobilization following a tibial plateau fracture. This drastic complex injury and successfully treated tibial shaft fracture, the knee joint function recovered satisfactorily. The exercises and training improved the patient's standard of living in bed mobility. The client improved his postural stability, lower limb strength, and muscle strength due to functional re-education, which also improved the muscle's strength and endurance.

Keywords: Debridement, tibial plateau fractures, soft tissue, external fixation, extra cutaneous, reduction

1. INTRODUCTION

The key management strategies for severe open tibial fractures include secure fracture fixation, prompt wound closure, and excellent infection prevention and treatment (Shen et al., 2021). When a wound is covered early, it means that the necrotic tissue has been removed and the wound is covered as

quickly as possible (Shen et al., 2021). Estimating the vitality of the affected tissue is challenging, particularly for wounds from firearms sustained in combat, which makes therapy more challenging (Shen et al., 2021).

There is widespread agreement regarding the significance of early, repeated, and comprehensive debridement (Raman and Mangal, 2021). Debridement can sometimes result in greater tibial and soft tissue deficiencies, which makes it much more difficult to heal and reconstruct later (Raman and Mangal, 2021). There is discomfort throughout the entire bone transport procedure, which significantly decreases the quality of life (Raman and Mangal, 2021). Making the most of the benefits of the Ilizarov procedure, cutting the amount of time patients need to use an external fixator, and enhancing patient quality are all essential (Raman and Mangal, 2021).

During each stage of treatment, several approaches should be used, and customized care should be used, like early debridement, drainage sealed with a vacuum and antibiotic carrier technology. In addition to bone transport, the shortening-lengthening procedure, flap surgery, and bone transport can be chosen during repair and reconstruction depending on the patient's specific situation (Li et al., 2020).

The tibia frequently sustains compound fractures. The tibia is more prone to open fractures because it has a smaller muscular surround. Irrigation, complete debridement, antibiotic coverage, and fracture repair have typically been used as treatments. Firm internal fixation has replaced other procedures as the industry standard in recent years, based on patient's age, any additional wounds, location of the fracture, and degree of soft tissue injury, surgeon's training, and other criteria, telecom technologies. The fracture has been treated with flexible intramedullary nailing and external fixation (EF) (Li et al., 2020).

Since the 1800s, fractures involving the proximal part of the tibial articular surface, with or without extension into the metaphysis, have been documented. Since the introduction of American Orthopedics (AO), the preferred treatment option among surgeons has been surgery rather than conservative measures (Bhattacharyya et al., 2005). Following treatment for tibial plateau fractures, surgical site infection is frequent. The occurrence rate was formerly estimated to range from 2.6% to 45% is a significant percentage compared with different fractures treated with ORIF. Orthopaedic implant-associated infections have been linked to the development of biofilms by bacteria that adhere to surfaces. Antibiotics and host immunity cannot effectively treat biofilm that has become well-established on an implant. Evidence suggests that even after biofilms have been thought to have been cleared; it's possible that the entire tissue bed will keep infecting brand-new implants (Barei et al., 2008).

After ORIF, TPF surgical site infection is associated with significant morbidity. In addition to careful infection treatment and fixing a bone deficiency, it requires extensive knee therapy to reclaim function. Local stabilization and via means of locally tailored antibiotics for certain microorganisms are crucial in addition to radical debridement. For local stabilization, external fixators were the initial option. Restoration of knee function is a crucial objective in addition to infection management and defect reconstruction. Knee discomfort that lasts longer than three to four weeks may become permanent (Papagelopoulos et al., 2006).

Patient information

A male patient, 82 years old, was brought to the emergency room with a history of trauma from a car accident over his right leg. Pain started out suddenly and built up steadily. Moving the limb causes more pain, which is accompanied by leg swelling in the lower portion. Despite a history of head injuries, there are no abnormalities on the MRI. Since 15 years, the patient has been diagnosed with asthma.

2. CLINICAL FINDING

On observation it was noted that he had a slouching posture on physical examination, it was determined that he was afebrile. Supine examination of the patient was performed with both ASIS at the same level. Around 10 cm of the distal third leg's anterior and lateral surfaces are covered by a sutured wound on the right leg. Seen is a diffuse swelling. Bony tenderness was present over 3rd tibia & fibula. Abnormal mobility at the site was present. Loss of transmitted movements, active ankle and toe movements was present. Knee could not be elicited due to pain. According the resisted isometric contraction grading on affected site it’s weak and painful for knee flexion and extension. DPA and PTA were palpable. No loss of sensation found.

Investigation

X-ray was done, in pre-operative x-ray show the distal tibia compound fracture as in (Figure 1) and Post-operative after plating and k-wires fixation as in (Figure 2).

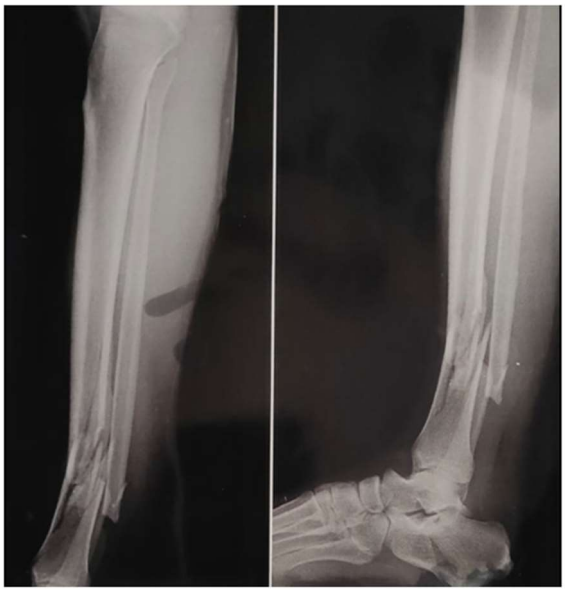


Figure 1 Pre-surgical X-ray

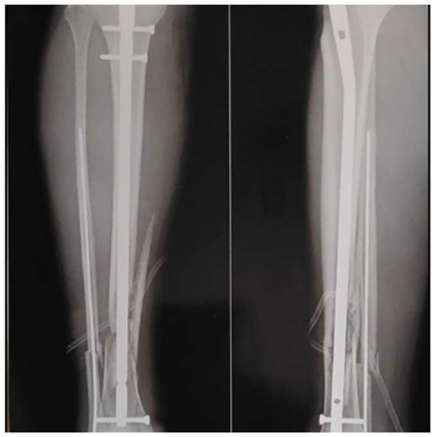


Figure 2 Post-surgical X-ray (after removal of extra-cutaneous plate fixation)

Table 1 Timeline

Date	Event
20/02/23	Met with an accident (7:00pm)
20/02/23	Brought to local hospital (8:00pm)
21/02/23	Patient brought to AVBRH hospital (11:00am)
22/02/23	X-ray were done and manage conservatively
24/02/23	Surgery were done
27/02/23	Refer for physiotherapy
17/03/23	Patient was discharge
24/03/23	Patient came for follow-up

Therapeutic Intervention

Operative Notes

Patient has undergone Debridement and extra-cutaneous plate fixation. After cleaning, painting and draping stay sutures were removed as well as dead and necrotic tissue was also removed. With traction and manipulation reduction was achieved. Reduction was held temporarily by the help of 11 hole right femoral plate and k-wires extra cutaneously. Reduction was confirmed under the guidance of C-arm and fixed with screws proximally and distally extra cutaneously. Stay suturing was done (Figure 3).

Figure 3 Shows operated site with extra-cutaneous plate fixation

Medical Management

The patient received injections after operation Inj. TT 0.5ml Inj. Ceftriaxone + sulbactum 105 gm IV twice daily. Tablets were given, Tab. Pantaprazole 40 mg twice daily. Tab. Trypsin chymotrypsin thrice daily. Tab. Paracetamol 650 mg thrice daily.

Physiotherapeutic Intervention

Our immediate objectives are to develop muscle strength, decrease pedal oedema, improve sitting posture, reduce secondary issues such an increase in ability to relax, improve functional abilities, promote independence, and prevent impairment. The patient's quality of life was to be improved, and the long-term objective was to get him back to doing functional tasks and preventing symptoms from returning to re-establish muscle function and strength.

Phase 1 (1-8 days)

Physical therapy will focus on easing post-operative symptoms, getting the patient ready for a quick recovery, and shortening the hospital stay during the first week. Our primary goal is to minimize the pain of patient. Cryotherapy was given to reduce swelling which was appeared postoperatively. Postural advice was given to strengthen lungs and minimize the risk of respiratory complications. Breathing exercises were given to improve the vital capacity of the patient. Proper wound care was given to prevent infection and other complications. Wound care will make the healing process easier. Positioning was given to avoid the development of pressure sores. As the patient is properly positioned it plays a huge role in the part of recovery.

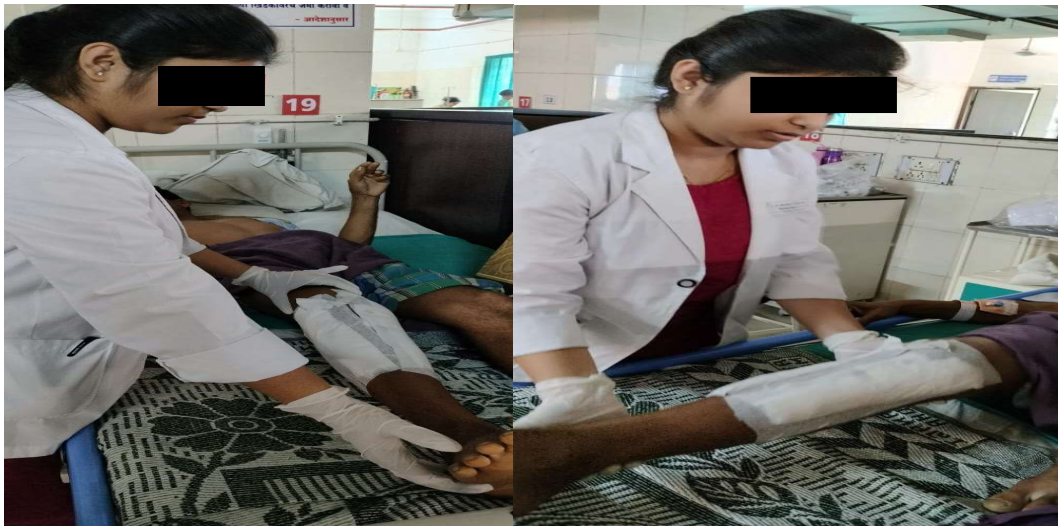
Phase 2 (8-16 days)

The second week physiotherapy session aims on early mobilization of the patient so that he can be able to do transfer activities. Initially bed mobility exercises were started. Straight leg raising to improve the strength, 10 repetitions were given for each leg (Figure 4). Pelvic strengthening exercises were done in which pelvic bridging was started as it is an effective measure to strengthen the pelvic and abdominal muscles. Advice was given on the safest way to stand properly and improving the mobility indoors and outdoors. The patient was instructed on moving and lifting techniques to minimize the risk of low back pain and lower limb pain. Additional treatments protocols are patient-centred and take into account the patient's aim and ambition. These protocols include exercises for balancing and strengthening the ankles and for partial weight bearing and ankle mobility.

Exercises for bed mobility were introduced gradually. Encourage the patient to engage in active movement. Depending upon the severity promotion of flexion and extension of knee; increase weight bearing exercises. Gaining strength and proprioception is also necessary. Additionally, the patient received functional re-education, with a focus on rolling, supine to side lying, and side lying to prone lying. It was then gradually transitioned from prone to side lying, side lying to supine. As a result, postural stability may have improved by increasing pelvic stability.

Phase 3 (12-18 days)

The physiotherapy program will now be modified for more practical tasks in the third week and to focus towards returning to full fitness levels. Our aim is to progress the entire previous exercise plan and increase its duration. After the removal of suture ambulation was started. Ambulation protocols have become an essential component in postoperative cases. We instructed the patient to sit up out of bed for 6 to 8 hours and walk at least 6m up to five times in a day with the help of walker. Walking is the best strategy to prevent blood clots; therefore, as the days went by, the patient started walking more frequently.



A B

Figure 4 Images taken during the physiotherapeutic intervention; 4A: While performing knee ROM exercise; 4B: While performing active assisted SLR

We advise the patient on how to maintain a good posture to reduce additional stress on the operated area. Breathing exercises were continued which helped the patient to prevent respiratory complications. Essential instruction was given to the patient regarding weight lifting as that he cannot lift weights. Static back exercises to increase his back strength. As his strength grows, he will eventually be able to carry out all the fundamental daily tasks, gradually enhancing his quality of life and health.

Home Program

The patient was advised to keep up their exercise regimen and follow the ergonomic suggestions to maintain good posture at rest and work. Avoid postures that will cause too much tension. Additionally, he was instructed to progressively transition to instrumental daily activities.

3. RESULT

The patient's quality of life was improved by the exercises and training in bed mobility. Functional re-education increased strength and endurance of the muscle as well as it increased pelvic stability which improved his postural stability also. Lower limb strength was achieved by the patient. After about a month of physiotherapy treatment, the patient underwent another evaluation, and the prognosis was determined as in (Table 2). He can now carry out all everyday tasks and has some degree of independence to complete his own work.

Table 2 Outcome measure

Outcome Measure	Pre-intervention	Post-intervention
NPRS	9/10	5/10
LEFS	0/80	49/80
FIM	50/126	104/126

[a]NPRS- Numerical Pain Rating Scale; LEFS- Lower extremity functional scale; FIM- Functional Independence Measure.

4. DISCUSSION

Patients who are elderly and have tibial plateau fractures need to receive special care. After high impact trauma, the tibial plateau frequently suffers from severe intra-articular fractures. That can affect not just young patients but even elderly patients who already have osteoporosis (Wasserstein et al., 2014). The fractures have a variety of characteristics, from straightforward split fractures to complex, multi-fragmentary fracture morphologies (Barei et al., 2008).

All patients were older than 60 (mean age 66.3; range 61–80). 22 patients with displaced in order to treat tibial plateau fractures, open reduction and AO/ASIF buttress plates were used for internal fixation. Some of them, as depicted, included extra small

fragment plates or inter-fragmental screws. The range of follow-up times was 36 to 68 months, with a 49.8-month average. At the outpatient clinic, 20 patients were questioned, and radiographs were taken of both standing knees. On radiographs, compared to the damaged side, all patients' range of motion was recovered, unless as noted of the patient who has a superficial wound infection, flexion of more than 120 degrees and no extension lag. No complications required further surgical treatment (Hsu et al., 2001).

Operative therapy emphasizes repairing the articular surface, preserving the leg's mechanical alignment, and avoiding problems due to infection, fixation loss, or incomplete range of motion recovery. Maintaining the fragile tissue envelope in this patient population is equally crucial for enhancing healing potential. Physical treatment should start with isometric quadriceps exercises and then go on to an active range of motion and passive, active assist. For individuals who refuse to wear the brace, a lengthy leg cast with minimal knee flexion may be used instead, although frequent skin checks are necessary. If repeat radiographs demonstrate healing, 8 to 12 weeks after the injury, full weight bearing can be gradually introduced. Fracture displacement is a sign that surgery should be performed (Koval and Helfet, 1995).

The 60 patients in this third 3-arm randomized controlled trial had tibial plateau fractures. Proprioceptive neuromuscular facilitation (PNF) training, standard treatment plus PNF training, or standard training plus PNF training plus TENS intervention were the interventions given to the participants. Six weeks was the length of each therapy. At three weeks, PNF training may reduce discomfort while enhancing dynamic postural stability, but at six weeks following the intervention, TENS with PNF was more effective at lessening discomfort, enhancing strength in the muscles, and improving dynamic postural stability (Wu et al., 2022).

The knee joint's early range of motion exercises is where the most agreement exists. Continuous passive motion devices have not been associated with improved results. Immobilization using a brace does not appear to provide any benefits. The area of these patients' postoperative weight-bearing status that has generated the greatest debate recently is where more aggressive methods have gained ground. Although there is relatively little research on on-going therapy, it is recommended that continued quadriceps strengthening be given more attention.

Limitation

Due to hospital stay his treatment protocol was not increased as during hospital stay there are some limitations while rehabilitation. As he was an elderly patient, we could not initiate more activities.

5. CONCLUSION

As he was an elderly person so it will take an increased amount of time to make the healing process. Surgery will help for better rehabilitative process and he will be able to achieve all the activities gradually. Healing process is slow but it will achieve a higher recovery rate.

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Authors' contribution

The concept, evaluation, assessment, interpretation of the data analysis, and data collecting were executed most effectively by Ruchika Zade and Pratik Phansophkar.

Informed consent

The study's subjects gave their verbal, informed consent.

List of Abbreviation

EF- External fixation
ORIF- Open reduction internal fixation
TPF- Tibial plateau fracture
ASIS- Anterior superior iliac spine
DPA- Dorsalis pedis artery
PTA- Posterior tibial artery

EN- Enders nail

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Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

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