Early physical rehabilitation post-surgery in a complex type 5 Schatzker Tibial plateau fracture improves functional outcomes: A case report

Dushyant Bawiskar, Sapna Dhote, Pratik Phansopkar

Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India

Corresponding author
Assistant Professor, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra. INDIA.
Email: drpratik77@gmail.com

Article History
Received: 07 May 2020
Reviewed: 08/May/2020 to 29/June/2020
Accepted: 30 June 2020
E-publication: 06 July 2020
P-Publication: July - August 2020

Citation

Publication License
This work is licensed under a Creative Commons Attribution 4.0 International License.

General Note
Article is recommended to print as color digital version in recycled paper.

ABSTRACT
Background: Tibia is large, long bone of the lower extremity and the tibial plateau consists of the medial and lateral condyles and the inter-condylar eminence. Fracture of the tibia accounts for about 20 percent in middle aged and 8 percent in elderly populations. Tibial plateau fracture encompasses a wide range of severity, ranging from stable non-displaced fractures with minimal soft tissue injury to highly comminuted unstable fractures with massive soft tissue injury. Prompt physical therapy post-surgery leads to achieve functional goals. 43 years old male patient with a type 5 schatzker classification communicated bi-condylar tibial plateau fracture
was diagnosed on x-ray after a road accident, on which open reduction and internal fixation with buttress plates was done. Post-surgery patient’s concerns were reduced mobility of the right leg and unable to walk. Following the surgery patient underwent physiotherapy which comprised of exercises, electrotherapy, proprioception training and gait training for a period of 10 weeks which resulted in improvements in pain, range of motion, functional activities. Conclusion: The case report suggests that classic surgical approach and prompt structured physical rehabilitation led to improving the functional goals progressively and significantly which is a major aspect leading to a successful recovery.

Keyword: Physical therapy, Schatzker classification, Tibial Plateau Fracture, Rehabilitation, Buttress plates.

1. INTRODUCTION
Tibia is the second large and long bone of the lower extremity. Proximally tibia consists of tibial plateau which constitute the medial and lateral condyles and the intercondylar eminence. The medial condyle is larger than the lateral condyle and is the sturdy of the two tibial condyles. Smaller lateral condyle is more commonly fractured. Tibial plateau fracture encompasses a wide range of severity, ranging from stable non-displaced fractures with minimal soft tissue injury to highly comminuted unstable fractures with massive soft tissue injury that threaten the viability of the limbs. Tibia plateau fractures are well classified by schatzker classification which consists of 6 sub classification namely type 1 lateral plateau fracture without depression, type 2 lateral plateau fracture with depression, type 3 compression fracture of the lateral or central plateau, type 4 medial plateau fracture, type 5 bi-condylar plateau fracture and type 6 plateau fracture with diaphyseal discontinuity (Kfuri and Schatzker, 2018).

Fracture of the tibial plateau accounts for 1 percent of all fractures each year. Bi-condylar tibial plateau fracture is a particular form of low incidence tibial plateau fracture and so far few reports have been reported on this type of fracture (Zhao et al., 2019). Surgical treatment of tibial plateau fractures can provide excellent anatomical reduction, restore articular congruity, promote early movement, minimize post-traumatic osteoarthritis and achieve optimal knee function (Rozell et al., 2016). Post-surgery progressive physiotherapy rehabilitation has shown to be successful, including passive to active movements, manual joint mobilization, progressive resistance exercise, muscle energy technique, electrotherapy and proper patient education (Rozell et al., 2016). This case report describes a complextype 5 schatzker classification communicated bi-condylar tibial plateau fracture following road traffic accident in a 43-year-old male who underwent surgical treatment and subsequently treated under physiotherapy rehabilitation department at academic hospital in sawangi megha with proper rehabilitation protocol.

Patient Information
A 43-year old male with right hand dominance met with a road traffic accident on 14th January 2020. After consultation to an orthopedic surgeon, X-ray, CT-Scan was done, which revealed type 5 schatzker classification communicated bi-condylar tibial plateau fracture of right leg. Patient underwent surgical treatment, open reduction and internal fixation with buttress plates which was done on 16th January 2020. Physiotherapy sessions were started following the next day of surgery. Post-operatively patient had chief complaints of pain in right leg and knee which patient described as dull-aching pain with intensity 7/10 at rest and 9/10 slight movement and swelling over right lower limb and patient complained of limited mobility and unable to walk.

Clinical Findings
A proper informed consent was taken from the patient prior. Physical examination was done; he was examined in supine position. On inspection, patient’s right leg was slightly abducted, flexed, externally rotated and planter flexed. Presences of 4 scar mark on anterior aspect of knee (vertical scar on lateral aspect of knee extending to anterior aspect of lower limb, and horizontal scar on anterior aspect of knee) and lower limb (Anterior aspect of lower limb, and just distal to first scar) and abrasion present anteriorly on the thigh and marked edema were present on foot and visible muscle wasting at the right thigh. Local temperature was normal.

Length of scar mark
A) Anterior Knee: - a) Vertical scar- 17cm   b) Horizontalscar-7cm
B) Anterior Lower Limb: - a) Proximal scar- 5cm b) Distalscar-5cm
Tenderness was present with grade 3. On neurological examination: All sensations were present, Reflexes were intact. There was no limb length discrepancy. Pre-operative x-ray and clinical photographs are shown in figure 1, 2 and figure 3 depicts post-operative x-ray of fracture fixed with buttress plates (table 1 & 2).
**Figure 1** Pre-operative X-Ray of patient right lower limb showing communicated bi-condylar tibial plateau fracture.

**Figure 2** Clinical Presentation of right lower limb with scars

**Figure 3** Post-operative X-Ray of showing bi-condylar tibial plateau fracture fixed with buttress plates.
Timeline

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of injury(accident)</td>
<td>14-01-2020</td>
</tr>
<tr>
<td>Date of surgery</td>
<td>16-01-2020</td>
</tr>
<tr>
<td>Date of physiotherapy rehab</td>
<td>17-01-2020</td>
</tr>
<tr>
<td>Date of suture removal</td>
<td>02-02-2020</td>
</tr>
</tbody>
</table>

Initial Examination Findings

Table 1 Range of motion assessment on 1st day of physiotherapy treatment

<table>
<thead>
<tr>
<th>Joint</th>
<th>Right</th>
<th></th>
<th>Left</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Passive</td>
<td>Active</td>
<td>Passive</td>
</tr>
<tr>
<td>Hip Flexion</td>
<td>Unable to perform</td>
<td>0-30</td>
<td>0-110</td>
<td>0-117</td>
</tr>
<tr>
<td>Extension</td>
<td>Unable to perform</td>
<td>0-10</td>
<td>0-15</td>
<td>0-18</td>
</tr>
<tr>
<td>Abduction</td>
<td>0-10</td>
<td>0-30</td>
<td>0-40</td>
<td>0-48</td>
</tr>
<tr>
<td>Adduction</td>
<td>10-0</td>
<td>0-15</td>
<td>0-26</td>
<td>0-30</td>
</tr>
<tr>
<td>Knee Flexion</td>
<td>Unable to perform</td>
<td>0-25</td>
<td>0-135</td>
<td>0-135</td>
</tr>
<tr>
<td>Extension</td>
<td>Unable to perform</td>
<td>25-0</td>
<td>135-0</td>
<td>135-0</td>
</tr>
<tr>
<td>Flexion(BSS)</td>
<td>Unable to perform</td>
<td>Unable to perform</td>
<td>130</td>
<td>135</td>
</tr>
<tr>
<td>Extension(BSS)</td>
<td>Unable to perform</td>
<td>Unable to perform</td>
<td>130-0</td>
<td>135-0</td>
</tr>
<tr>
<td>Ankle Planter flexion</td>
<td>0-40</td>
<td>0-50</td>
<td>0-50</td>
<td>0-50</td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td>0-5</td>
<td>0-10</td>
<td>0-10</td>
<td>0-10</td>
</tr>
</tbody>
</table>

Table 2 Manual Muscle Testing (strength) assessment on 1st day of physiotherapy treatment

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>Abductors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Adductors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Flexors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Extensors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Internal Rotators</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>External Rotators</td>
<td>5/5</td>
</tr>
<tr>
<td>Knee</td>
<td>Extensors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Flexors</td>
<td>5/5</td>
</tr>
<tr>
<td>Ankle</td>
<td>Plantar Flexors</td>
<td>5/5</td>
</tr>
<tr>
<td></td>
<td>Dorsi flexors</td>
<td>5/5</td>
</tr>
</tbody>
</table>

Pain assessment: On NPRS pain was 7/10 on rest and 9/10 on slight movement.
Swelling: Mid patellar girth measurement: Left: 34cm& Right: 38cm.
Berg Balance score: 3/56
Dynamic Gait Index score: 0/24
Physiotherapy Intervention: Patient specific rehabilitation protocol was structured. Patient underwent physiotherapy rehabilitation for duration of 10 weeks, 6days per week.

Week 1: Maximum protection
Cryotherapy to reduce inflammation and swelling for 10 minutes. Knee Braces was applied throughout. Active assisted right hip, knee ROM exercises 10 repetitions 2 times a day. Full range of motion active resisted left lower limb and both upper limb exercises with weight cuffs. VMO activation was more focused uponand static contraction exercises with 10 repetitions and 10 second holds each forquadriceps, hamstrings and glutei muscles were performed. All the exercises were performed twice daily. Gait training was initiated with non-weight bearing with walker and long knee brace support to the right lower limb.
**Week 2-6: Progression in strengthening**
Knee was maintained in extension to avoid flexion contracture. Phase-1 program exercises were continued. Cryotherapy was continued to control inflammation. Core stability exercises were performed. Strengthening of uninvolved lower extremity and upper extremities was progressed with increase in intensity and repetitions. Strength training of right lower extremity was progressed to active pain free movement in available range. BSS dynamic quadriceps exercises were initiated within pain free range. NWB bearing was continued and progressed for independent functional tasks involved with supervision (figure 4). All the exercises were performed twice daily.

![Figure 4 Patient standing NWB](image)

**Week 6-8: Strengthening and proprioceptive phase.**
Same phase-2 exercises were continued. In supine right knee ROM was gradually initiated active assisted within pain free range. Modalities like CPM were used to enhance the knee range of motion. Electrotherapy surged faradic stimulation was given to quadriceps and hamstrings to enhance the muscle fibers recruitment for functional training. Dynamic quadriceps exercises were progressed with minimal to no assistance. Weight bearing was initiated in gait training with 25 percent weight bearing and progression in weight bearing every 2 weeks by 25 percent. Gait training in parallel bar systems was done to cope with the weight bearing status.

**Week 8-10: Advanced strengthening and balance regimen.**
All the above phase exercises were progressed and advanced strengthening weight transfers and weighing scale press were initiated to improve proprioception. Strength training to the right side lower limb muscles was progressed by using increasing repetitions and hold durations. Use of brace was withdrawn after the accomplishment of fair quadriceps, hamstrings and VMO muscle strength. Weight bearing in gait training was progressed with 50% which helped to improve patient’s confidence in ambulating independently. For 100% weight bearing patient was instructed to initiate only after the orthopedic surgeons instruction on radiological confirmation of fracture fragments fused and a physiotherapy follow-up to teach the necessary progressions.

**Follow-up and Outcome**
Post 10 weeks of rehabilitation patient showed remarkable improvements. Table 3 depicts pre and post rehabilitation range of motion evaluation and Table 4 depicts pre and post rehabilitation muscle strength evaluation.
### Table 3 Range of motion pre and post rehabilitation

<table>
<thead>
<tr>
<th>Joint</th>
<th>Pre-rehab</th>
<th>Post rehab</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active</td>
<td>Passive</td>
</tr>
<tr>
<td>Hip Flexion</td>
<td>Unable to perform</td>
<td>0-30</td>
</tr>
<tr>
<td>Extension</td>
<td>Unable to perform</td>
<td>0-10</td>
</tr>
<tr>
<td>Abduction</td>
<td>0-10</td>
<td>0-30</td>
</tr>
<tr>
<td>Adduction</td>
<td>10-0</td>
<td>0-15</td>
</tr>
<tr>
<td>Knee Flexion (supine)</td>
<td>Unable to Perform</td>
<td>0-25</td>
</tr>
<tr>
<td>Extension (supine)</td>
<td>Unable to Perform</td>
<td>25-0</td>
</tr>
<tr>
<td>Flexion (BSS)</td>
<td>Unable to perform</td>
<td>Unable to perform</td>
</tr>
<tr>
<td>Extension (BSS)</td>
<td>Unable to perform</td>
<td>Unable to perform</td>
</tr>
<tr>
<td>Ankle Plantar flexion</td>
<td>0-40</td>
<td>0-50</td>
</tr>
<tr>
<td>Dorsi flexion</td>
<td>0-5</td>
<td>0-10</td>
</tr>
</tbody>
</table>

### Table 4 Pre and post rehabilitation muscle strength

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Pre-rehab</th>
<th>Post rehab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Abductors</td>
<td>3/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Adductors</td>
<td>2/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Flexors</td>
<td>2/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Extensors</td>
<td>2/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Internal Rotators</td>
<td>3/5</td>
<td>5/5</td>
</tr>
<tr>
<td>External Rotators</td>
<td>3/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Knee Extensors</td>
<td>2/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Flexors</td>
<td>2/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Ankle Plantar Flexors</td>
<td>4/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Dorsi flexors</td>
<td>3/5</td>
<td>5/5</td>
</tr>
</tbody>
</table>

### Pain Assessment

Pre-rehabilitation: NPRS 7/10 at rest, 9/10 on slight movement.
Post-rehabilitation: NPRS1/10 at rest, 3/10 on activity.

Swelling: Mid patellar girth
Pre-rehabilitation: Left=34cm and Right=38cm
Post-rehabilitation: Left=34cm and Right=34cm.

### Berg Balance score
Pre-rehabilitation:3/56
Post-rehabilitation:50/56

### Dynamic Gait Index
Pre-rehabilitation:0/24
Post-rehabilitation:19/24

### 4. DISCUSSION

Bi-condylar tibial plateau fracture is a challenge as it is associated with soft tissue injuries, communication and complexity which usually results from high energy trauma in turn which further complicates the management of such complex fracture (Bhalotia et al.,...
Early passive mobilization has shown to be effective in greater improvement in knee flexion ROM during rehabilitation and lowered risk of deep venous thrombosis (Arslan et al., 2015). The different approaches such as cryotherapy, progressive range of motion exercises, soft tissue mobilization, isometric exercises, open and close chain muscle strengthening, stretching, gait training has been found to be effective in recovery of bi-condylar tibial plateau fracture (Linehan, 2018). The study conducted by Gabriel found that physiotherapy intervention has an positive impact to gain confidence, improve gait in post-operative physiotherapy (Bonifacio, 2019). It is always recommended for a structural rehabilitation program for the recovery of post-operative patient based on his physical status and functional needs to achieve positive prognosis outcomes. In the present report, the patient was provided a well-structured physiotherapy rehabilitation with various exercises, electrotherapy and by a skilled orthopedic physiotherapist. Cryotherapy, analgesics lead to gradual reduction in pain due to which the patient was able to put more effort in the rehabilitation which led to progressive improvements in the range of motion and muscle strength and functional outcomes. The physiotherapy sessions were designed to maintain the muscle integrity for the right lower extremity and enhance left lower extremity and both upper extremities to promote independent non weight bearing walking with walker and minimal assistance for daily activities. Electrotherapy modalities such as continuous passive motion were used to initiate and enhance the knee range of motion in the early phase to maintain and improve knee mobility. Girish et al. reported the beneficial use of CPM for early knee mobilization under supervision in all sub classification of schatzkar plateau fractures (Vasanad, 2013). Various proprioception and stabilization exercises in the later phase were initiated to improve proprioception and weight transfer. Involvement of proprioception exercises in the rehabilitation of patients under gone knee injuries and knee surgeries is vital aspect in rehabilitation (Arvanitakis et al., 2019). The patient was instructed to follow all the exercises as a part of home program and was provided with written protocol and advised for follow-up visits. This case report’s purpose was to focus on the significance of prompt surgical treatment and essential physiotherapy rehabilitation to attain the functional goals with to respect to patient and its prognosis.

5. CONCLUSION

Bi-condylar tibial plateau fractures are of a particular form of low incidence tibial plateau fractures. Complex type 5 schatzker classifications communicated tibial plateau fractures are well managed by surgical approach with buttress plates which provide excellent anatomical reduction, restore articular congruity, promote early movement, minimize post-traumatic osteoarthritis and achieve optimal knee function. The above case report concludes that classical surgical approach and prompt structured physiotherapy rehabilitation led to improving the functional goals progressively which is a major aspect in leading to a successful recovery in such post-operative patients.

Abbreviation

ROM- Range of Motion
NPRS- Numerical Pain Rating Scale
CT scan- Computerized Tomography scan
NWB- Non Weight Bearing
CPM- Continuous Passive Motion
BSS- Bed Side Sitting
VMO- Vastus Medialis Oblique

Conflict of interest
The authors declare that they have no conflict of interest.

Informed Consent
Written and Oral informed consent was obtained from the participant included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Author’s contribution
All author made best contribution for the concept, assessment and evaluation, data acquisition and analysis and interpretation of the data.

Funding
This study did not receive external funding.
REFERENCE


