Clinical Outcome of Tibial Plateau Fractures Related to Meniscal Injuries

1,4Hoffmann, M F; +2,3Jones, C B; ... aware that clinical and functional outcome depends on anatomic reduction and accompanying injuries of the knee joint.

RESULTS:
Approximately 44 of the 130 fractures (34%) had intraoperative findings of meniscal injuries. Of the 44 meniscal injuries, 34 lateral (79%), 4 (9%) medial and 5 (11%) combined lesions were described in the operative reports (1 not recorded). Meniscal repair was performed in 32 patients (72.72%) while 16 patients (36.36%) underwent meniscectomy. Articular reconstruction with anatomic reconstruction or less than 2 mm step-off or gap was achieved in 54% of the fractures. ROM was correlated with intact menisci. Patients without meniscal injury had a mean flexion of 132°, patients with meniscal injury had a mean flexion of 123° (p=0.02).

When evaluating SMFA and SF36 scores, no significant differences were found for male versus female, polytrauma versus isolated injury, open versus closed, or AO/OTA Type B versus Type C. Patients with intact and repaired menisci had similar outcome measurements and better measurements than patients with torn and debrided meniscus at 6, 12 and 24 months.

DISCUSSION:
Multiple studies have evaluated long-term results of tibial plateau fractures. The role of the meniscus in preventing osteoarthrosis in uninjured or injured knees is important. Modern surgical techniques, for fractures of the tibial plateau, suggest indirect reduction techniques without direct inspection of the articular surface. Using this approach, tibial plateau fracture treatment ignores the meniscal condition during surgery especially in AO/OTA B and C type fracture-dislocations. Our study confirms findings of 25% meniscal injuries in tibial plateau fractures. Additionally B3 and C3 fractures had meniscal lesions in 34% and 47% respectively. These fractures are associated with severe articular surface damage and often result in irreparable articular incongruities and persistent step-offs. Favorable results have been demonstrated in tibial plateau fractures despite imperfect reduction and meniscal injuries, but articular step-offs seem to be better tolerated with intact menisci. An increase in contact pressure after meniscectomy was found compared to intact knees with the same articular step-off height. These results support that patients with residual articular step-offs benefit from meniscal repair.

Results of most studies show that meniscectomy leads to osteoarthritic changes even without articular step-off and partial meniscectomy is more beneficial than total meniscectomy. We demonstrated overall improved ROM, patient satisfaction, and radiological outcome for patients who underwent meniscal repair compared to meniscectomy. Additionally, most meniscal lesions have been reported to be peripheral, in the red-red zone and therefore qualify and benefit from direct repair. Based on the available data, meniscal repair surgery for traumatic-type meniscal tears portends a better result compared to degenerative meniscal tear repair. With reparable meniscal injuries, meniscal preservation should be accomplished especially in younger patients. Research into treatment options for irreparable meniscal injuries should be evaluated.

LImitations to our study are the varied injury patterns and treatment methods. Some of the operative reports did not distinguish between partial or total meniscectomy.

SIGNIFICANCE:
This study supports that orthopaedic trauma and sports surgeons should intraoperatively inspect the meniscus especially during minimally invasive procedures. Surgeons must also be aware that clinical and functional outcome depends on anatomic reduction and accompanying injuries of the knee joint.

INTRODUCTION:
The severity of a tibial plateau fracture and the complexity of its treatment depend not only on the fracture type and anatomical reduction but also on accompanying injuries of the knee joint. For high-energy tibial plateau fractures, anatomic reconstruction is the primary goal but may not always be possible. Articular step-off of 2 to 10 mm is widely accepted. Some of the “forgiveness” for step-offs has been attributed to intact meniscal coverage. Therefore, menisci play an important role in tibial plateau fracture outcomes. Meniscal injuries concomitantly occur with tibial plateau fractures 25% of the time. Some of the “forgiveness” for step-offs is lost.

Multiple studies evaluated the long-term results of tibial plateau fractures and showed an increase in radiographic osteoarthrosis after meniscectomy. But, no indication of the articular step-off, anatomic reduction, or fluoroscopic evaluation was recorded. Combined articular step-off and meniscal injury may cause increased osteoarthritic changes and limit patient satisfaction.

Many studies centered on the role of the meniscus in tibia plateau fractures, but to our knowledge no study has been performed which follows clinical outcome over time. The purpose of this study was to determine whether meniscectomy during tibial plateau fracture treatment was associated with increased incidence of osteoarthrosis and differences in clinical outcome measures over time.

METHODS:
Between 2002 and 2005, 196 consecutive patients with 197 operatively treated tibial plateau fractures were prospectively evaluated in a single large private orthopaedic practice affiliated with a Level I teaching trauma center. Excluded patients were related to age younger than 18 years and incomplete follow up. The IRB approved study consisted of 130 tibial plateau fractures in 129 patients.

Injuries were classified according to the AO/OTA and Schatzker classification. All surgeries were performed by three trauma fellowship trained orthopaedic surgeons. Surgeon discretion determined surgical indications, timing, and options. Thirty fractures underwent temporary external fixation and staged conversion to open reduction internal fixation. All surgeries utilized fluoroscopic assistance on a radiolucent table.

Postoperative protocol consisted of initiation of range of motion (ROM) while in the hospital. Formal physical therapy was initiated at two weeks postoperatively. At six weeks postoperatively, strengthening was begun. Weight bearing was begun at the 12 week interval. Further therapy was continued at the surgeon and patient discretion. Meniscal competency or repair did not change postoperative protocols.

Patients were evaluated clinically and radiographically at 2, 6, 12, 26, 52, and 104 weeks. Osteoarthrosis was classified according to Kellgren and Lawrence. SF36 and SMFA were performed at 6, 12, and 24 months.

RESULTS:
Gender was 62 (48%) males and 67 (52%) females with a mean age of 50 years (19-88). The average BMI was 30.0 kg/m² (17.4-49.9). Mean follow-up was 40 months (18-103). Injuries were related to motor vehicle accidents (25%) and low energy falls (24%). 48 patients (36.9%) were classified as polytrauma. 111 patients (85.4%) had closed fractures, 12 patients (9.2%) developed compartment syndrome. AO/OTA classifications included: 3 (2%) 41A, 68 (53%) 41B, 56 (44%) 41C, and 3 (2%) unrecorded. Schatzker classification are as follows:

<table>
<thead>
<tr>
<th>Schatzker Type</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2</td>
<td>40</td>
<td>2</td>
<td>17</td>
<td>46</td>
<td>21</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>1.56</td>
<td>31.25</td>
<td>1.56</td>
<td>13.28</td>
<td>35.94</td>
<td>16.41</td>
</tr>
</tbody>
</table>

44 of the 130 fractures (34%) had intraoperative findings of meniscal injuries. Of the 44 meniscal injuries, 34 lateral (79%), 4 (9%) medial and 5 (11%) combined lesions were described in the operative reports (1 not recorded). Meniscal repair was performed in 32 patients (72.72%) while 16 patients (36.36%) underwent meniscectomy. Articular reconstruction with anatomic reconstruction or less than 2 mm step-off or gap was achieved in 54% of the fractures. ROM was correlated with intact menisci. Patients without meniscal injury had a mean flexion of 132°, patients with meniscal injury had a mean flexion of 123° (p=0.02).

Patients with meniscal injuries had a significantly greater loss of extension (2.72° vs. 0.72°, respectively, p<0.01). Comparing patients without meniscal injury to patients with meniscus repair showed no difference in flexion (p=0.49) or extension (p=0.14). Patients with meniscectomy had 114° of flexion compared to 131° in patients with retained meniscus (p=0.01). Loss of extension was 3.50° in meniscectomy patients compared to 1.14° in patients with retained meniscus (p=0.01). Posttraumatic arthritis was correlated with status of the meniscus (p=0.01).

When evaluating SMFA and SF36 scores, no significant differences were found for male versus female, polytrauma versus isolated injury, open versus closed, or AO/OTA Type B versus Type C. Patients with intact and repaired menisci had similar outcome measurements and better measurements than patients with torn and debrided meniscus at 6, 12 and 24 months.

Limitations to our study are the varied injury patterns and treatment methods. Some of the operative reports did not distinguish between partial or total meniscectomy.

SIGNIFICANCE:
This study supports that orthopaedic trauma and sports surgeons should intraoperatively inspect the meniscus especially during minimally invasive procedures. Surgeons must also be aware that clinical and functional outcome depends on anatomic reduction and accompanying injuries of the knee joint.