The Impact of Reduction Quality of Tibial Plafond Fractures during Temporizing External Fixation on Final Fracture Alignment and Overall Outcomes

Roberto C Hernandez-Irizarry[1], Anna P Meyer[2], Austin Montgomery, Thomas Joseph Moore[3], Jerad D Allen
[1]Emory University School of Medicine, [2]Emory University, [3]Emory Univ School of Medicine

INTRODUCTION: Fractures of the tibial plafond are often complex fractures that require an initial surgery with external fixation (ex-fix) to allow for soft tissue rest prior to definitive open reduction and internal fixation (ORIF). Current outcomes in literature regarding plafond fractures focus on the alignment and reduction quality after final fixation but do not account for the alignment of the fracture during the temporizing phase in the ex-fix. Our question was, does coronal and sagittal plane alignment of a tibial plafond fracture in the external fixator affect the final alignment of the fracture or lead to increased risk of complications?

METHODS: All patients with tibial plafond fractures at an urban level-1 trauma center between 2014 and 2021 were retrospectively reviewed. For this study, inclusion criteria was set as: closed AO/OTA 43C tibial plafond fractures treated initially with an ex-fix prior to definitive management with an ORIF. Patient charts were reviewed for injury characteristic, management, complication, and demographic data. Intraoperative fluoroscopy at the time of placement of the external fixation system was analyzed and measurements were taken from AP and Lateral views of anterior-posterior (AP) translation, lateral translation, the anatomic lateral distal tibia angle (aLDTA) to assess varus and valgus angulation, and the anatomic distal tibia angle (ADTA) to measure procurvatum and recurvatum. The same measurements were then repeated on the AP and lateral plain films from the final office visit to determine final fracture alignment. The complications that were considered included unplanned readmission, surgical site infection (SSI) both superficial and deep, radiographic nonunion as defined by clinical notes that returned to the operating room, and post traumatic osteoarthritis. The data was analyzed using descriptive statistics, paired sample t-tests, and logistic regression tests with significance set at $p < 0.05$. <br bcx0"="">

RESULTS: 153 patients with closed 43C tibial plafond fractures were reviewed for this study. In this cohort there were 105 males, 43 females with an average patient age of 42.5 years. 61 (39.9%) were injured in a motor vehicle collision, 50 (32.7%) were injured from a fall from height, and the rest fell into ground level fall, motor cycle collision, or pedestrian vs auto for mechanism of injury. 111 (72.5%) of patients also had a concomitant ipsilateral fibula fracture. For complications, 9(5.9%) had an unplanned readmission, 15(9.8%) had a superficial SSI, 7(4.6%) had a deep SSI requiring formal irrigation and debridement, 10(6.5%) had a nonunion, and 25(16.3%) developed post traumatic osteoarthritis. There was a significant difference between the measurements in the ex-fix and the final radiograph measurements for AP translation ($p < 0.001$), lateral translation ($p < 0.001$), and aLDTA measuring varus and valgus ($p = 0.001$). Notably, there was no significant difference between ex-fix and final measurements for the ADTA measuring procurvatum and recurvatum ($p = 0.339$). Patients with larger differences in AP translation were significantly more likely to be readmitted ($p=0.044$), and those with larger differences in aLDTA (coronal plane angulation) were significantly more likely to have a superficial SSI ($p=0.008$), a deep SSI ($p <0.001$), or a nonunion ($p=0.035$).

DISCUSSION AND CONCLUSION: Tibial plafond fractures can be complex injuries. The use of external fixation for temporization is important for soft tissue rest prior to open treatment of the fracture, however, this study shows that the quality of reduction of the fracture when the external fixation system is placed may be just as important of a component of this phase of treatment off these injuries, especially in terms of varus and valgus angulation in the coronal plane. The results of this study suggest that the greater the degree of correction that is required during ORIF, the higher risk the patient is for postoperative complications such as surgical site infections or poor fracture healing that can lead to further hospitalizations, further operations, and overall, a prolonged treatment course.