Δ Articular Inflammatory Cytokine Response is Greater in Acute Plafond Fractures than in Acute Tibial Plateau Fractures

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Purpose: The intra-articular inflammatory response has been proposed as playing a role in the development of posttraumatic osteoarthritis (PTOA). Prior studies have demonstrated an elevated inflammatory response following tibial plateau fracture. However, the reported rate of PTOA following tibial plateau fractures is not as high as other lower extremity articular fractures such as tibial plafond fractures. The purpose of this study is to evaluate the presence of inflammatory cytokines and matrix metalloproteinases (MMPs) following acute plafond fractures, and to compare this response to acute tibial plateau fractures.

Methods: After IRB approval, investigators prospectively aspirated synovial fluid from the injured and uninjured joints of 45 patients with tibial plateau fractures and from 19 patients with plafond fracture. Patients with open fracture, history of autoimmune disease, preexisting arthritis, or presentation greater than 24 hours from injury were excluded. The concentrations of interleukin (IL)-1ß, IL-1RA, IL-6, IL-8, IL-10, monocyte chemoattractant (MCP)-1, tumor necrosis factor (TNF)-α, MMP-1, -3, -9, -10, -12, and -13 were quantified using multiplex assays. Repeated measures analysis of variance (ANOVA) was used to test for differences on the log-transformed variables. A Bonferroni correction was used so that the adjusted alpha level for significance was $P < 0.004$.

Results: We enrolled 45 patients with tibial plateau fracture and 19 patients with tibial plafond fracture. Mean patient age was 42 years (range, 20-60) and there were 64% male patients. There were 24 Schatzker 1-3 (OTA 41B) plateau fractures and 21 Schatzker 4-6 (6 OTA 41B3 and 15 OTA 41C) plateau fractures. There were 8 OTA 43B plafond fractures and 11 OTA 43C plafond fractures. All inflammatory cytokines and MMPs except MMP-13 were significantly elevated in acute plafond fractures in the injured as compared to uninjured ankles. There was no difference in inflammatory cytokine or MMP concentration in OTA 43C plafond fractures as compared to OTA 43B plafond fractures. When comparing concentrations of acutely injured joints, IL-8 ($P < 0.001$), IL-1ß ($P = 0.002$), and MMP-12 ($P = 0.001$) were significantly higher in plafond fractures as compared to tibial plateau fractures. Concentrations of IL-1RA ($P = 0.008$) and MCP-1 ($P = 0.005$) were higher in acute plafond fractures compared to tibial plateau fractures, and MMP-10 ($P = 0.01$) was less in acute plafond fractures compared to plateau fractures (Fig. 1).

Conclusion: There is a significant inflammatory response in acute plafond fractures compared to the uninjured ankle. Most interesting, there were several inflammatory cytokines that were significantly elevated in acute plafond fractures as compared to acute tibial plateau fractures. Previous work in degenerative arthritis has suggested a correlation between inflammatory response and development of arthritis, and the role of inflammatory cytokines in PTOA is

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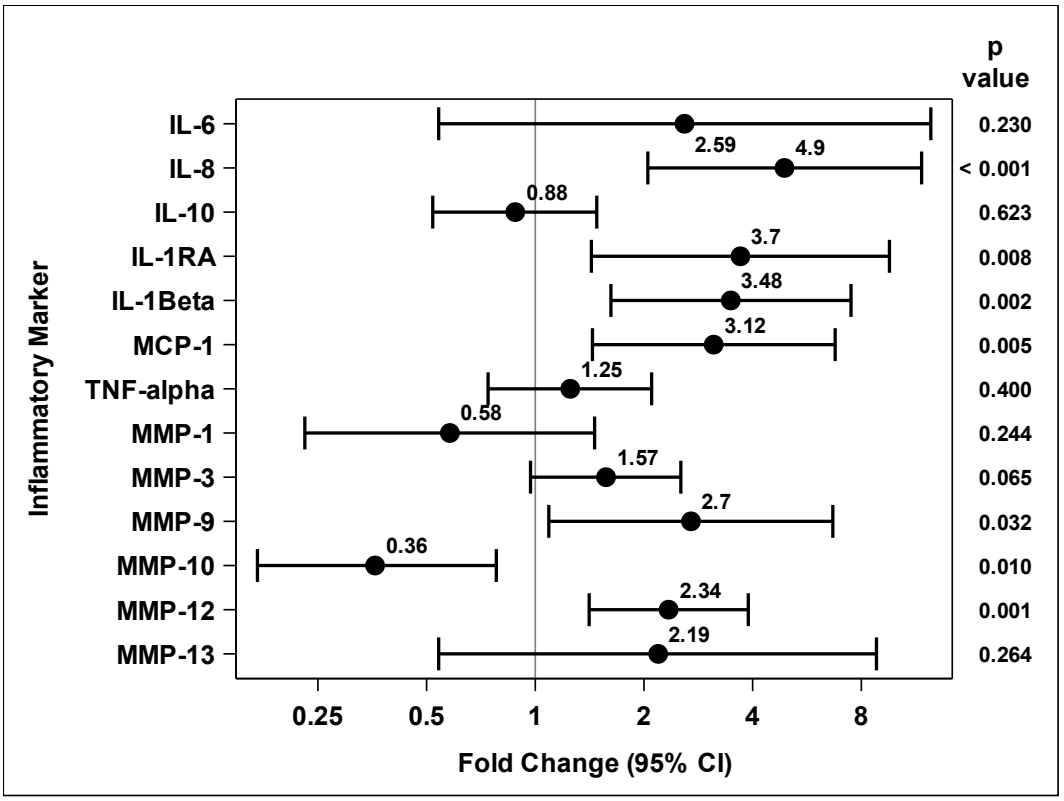
being explored currently. The higher inflammatory response in plafond fractures than plateau fractures is consistent with the clinical finding that plafond fractures have higher rates of PTOA than tibial plateau fractures. This may suggest an association of the inflammatory response with PTOA and indicates that these biomarkers merit further investigation for a possible role in the development of PTOA.

Figure 1. Fold Change in Inflammatory Responses Between Pilon vs. Plateau Fractures



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