Greater Acute Articular Inflammatory Response in Tibial Plafond Fractures as Compared to Rotational Ankle Fractures

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Purpose: Several factors are thought to contribute to posttraumatic osteoarthritis (PTOA) development including the post-injury inflammatory response. Previous work has demonstrated a significant intra-articular inflammatory response after tibial plafond fracture that is greater than the response after tibial plateau fracture. However, these injuries affect different joints and therefore may not be truly comparable. The purpose of this study was to compare two injuries in one joint (the ankle) that have a presumed different severity and different prognosis. This study compared the inflammatory response after rotational ankle fracture with tibial plafond fracture.

Methods: This prospective comparative study was conducted at a Level I trauma center between 2014 and 2019. Patients between 18 and 60 years of age with acute ankle (AO/OTA 44-A-C) or plafond (AO/OTA 43-B-C) fractures were prospectively enrolled. Patients with preexisting ankle OA, autoimmune disease, additional intra-articular injury, or open fractures were excluded. Synovial fluid aspirations were obtained within 24 hours of injury. The concentrations of interleukin (IL)-1β, IL-1RA, IL-6, IL-8, IL-10, and matrix metalloproteinase (MMP)-1, MMP-3, and MMP-13 were quantified using a multiplex assay. Wilcoxon rank sum test and Kruskal Wallis tests were used for statistical analysis.

Results: Aspirations were obtained from 29 plafond fractures and 38 ankle fractures. Average age was 43 years (range, 20-59 years). Of the plafond fractures 13 were partial articular and 16 were complete articular injuries. Ankle fractures were predominately trimalleolar (23 fractures) in nature and 15 ankle fractures had articular impaction. IL-10 ($P = 0.002$), IL-1b ($P = 0.005$), IL-6 ($P<0.005$), IL-8 ($P<0.005$), MMP-3 ($P<0.005$), and MMP-13 ($P = 0.006$) were significantly higher in acute plafond fractures as compared to acute ankle fractures. Complete articular plafond fractures had higher levels of several inflammatory markers (IL-10, $P<0.005$; IL-1b, $P = 0.002$; IL-6, $P = 0.05$; IL-8, $P<0.005$) than partial articular plafond fractures. In contrast, inflammatory marker levels for ankle fractures with articular impaction were not significantly different compared to those ankle fractures without impaction.

Conclusion: This is the first study to compare articular inflammatory marker profiles for injuries of different presumed severities occurring at the same joint. Several cytokines were significantly elevated in plafond fractures as compared to ankle fractures, suggesting the inflammatory response is greater in plafond fractures. Given the difference in prognosis and the higher rate of PTOA after plafond fractures compared to ankle fractures, these data strengthen the case that the post-injury inflammatory response plays a role in PTOA development.