Computerized Tomography Measurement of Syndesmotic Reduction in Intra-Articular Tibial Plafond Fractures

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StatementofPurposeandLiteratureReview

Intra-articular fractures involving the ankle joint complex may be associated with significant patient morbidity, particularly if involving displacement and instability of the syndesmotic ligaments. Although this has been relatively well-established within the literature with respect to rotational ankle fractures [1,2], the association and impact of syndesmotic disruption and malreduction on intra-articular tibial plafond fractures (i.e. pilon fractures) is relatively unknown [3-5].

The diagnosis of syndesmotic instability has traditionally been performed through intra-operative stress examination [6], however, there has been a trend with the contemporary literature to identify syndesmotic malreduction with the use of computed tomography (CT) [7-10]. In a recent study, a pathologist has identified good reliability among several different assessment methods for post-operative syndesmotic reduction in ankle fractures with the use of CT scans [10]. The objective of this investigation was to measure syndesmotic alignment in intra-articular fractures of the tibial plafond.

Methodology

Following approval by our IRB, a retrospective CPT procedure code and ICD-9 diagnosis code search were performed within our institution to identify patients with a pilon fracture who had undergone a preoperative CT scan. Returned results were then reviewed for our specific inclusion (age 18-90 years, presence of skeletal maturity, presence of an intra-articular tibial plafond fracture [open or closed inclusive], and performance of a preoperative CT scan) and exclusion (other forms of ankle fracture [i.e. rotational ankle fractures], absence of syndesmotic disruption and malreduction) criteria. Measurements were performed on all CT scans meeting inclusion criteria based on three methods described and reviewed by Warner et al [10]. All measured axial images 1 cm proximal to the tibial plafond. The first method of measuring syndesmotic reduction (Fig 1a) was noted to be the anterior and posterior tibial incisions (Fig 1a). The second measured incidences indicated that the articular surface of the tibia relative to the fibula was translated anteroposteriorly in relation to the tibia (Fig 1b). The third measured incidences indicated that to the radius relative to the tibia (Fig 1c).

Results

Measurements of syndesmotic reduction were performed on all CT scans meeting inclusion criteria based on three methods described and reviewed by Warner et al [10]. All measured axial images 1 cm proximal to the tibial plafond. The first method of measuring syndesmotic reduction (Fig 1a) was noted to be the anterior and posterior tibial incisions (Fig 1a). The second measured incidences indicated that the articular surface of the tibia relative to the fibula was translated anteroposteriorly in relation to the tibia (Fig 1b). The third measured incidences indicated that to the radius relative to the tibia (Fig 1c).

Discussion

To our knowledge this is the first investigation of syndesmotic reduction in pilon fractures, and as such, it is likely to raise more questions than it is to answer. Although the statistically significant differences were observed, it is unclear what, if any, clinical significance might be attributed to these findings. A good example of this is with respect to the first method of measuring syndesmotic reduction, the anterior and posterior plafond incisions. Our observed measurement of both the anterior and posterior incisions demonstrated a statistically significant difference from the Warner et al study performed by Warner et al not statistically different than the measurements performed by Naish et al [10]. This was statistically less than the measurements performed by Lepojarvi et al [10]. This finding further supports the notion of possible observations! Further, it is difficult to assess these findings from a clinical perspective as the observed differences are measured on the order of millimeters. Although the measurement of anterior and posterior incision distance has been demonstrated to be reliable [10], we are not aware of the establishment of normal/abnormal thresholds for this measurement or any correlation of these measurements to functional outcome measures. We would presume to postulate that further prospective case reports or case series would be required to determine the limits in which this measurement should be used.

In conclusion, this investigation is the first to our knowledge to study syndesmotic reduction parameters of pilon fractures with computed tomography. Although we do not definitively conclude that these results indicate that these levels of syndesmotic malreduction in pilon fractures, they are the very least the door to this possibility and will hopefully lead to future investigations in this topic.