

Definition of a Safe Zone for Screw Fixation of Posterior Talar Process Fracture by Three-dimensional Technology

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Category: Hindfoot

Keywords: Percutaneous fixation; Safe zone; Screw; posterior talar process

Introduction/Purpose: Percutaneous screw fixation can provide stable fixation with a minimally invasive surgical technique for posterior talar process fracture. This surgical technique is limited procedure due to the complex anatomy of the posterior talar process and the varying narrow safe bony zone. The purpose of this study was to investigate the optimal posterior screw placement and the geometry of safe zones for screw insertion in the posterior talar process by analyzing with three-dimensional technology.

Methods: One hundred adult who had feet CT scans were evaluated. CT data were imported into Mimics 18.01 software for three-dimensional reconstruction; Two 3.0mm-diameter screws were simulated from the posterior to anterior position for posterior talar process. The morphology parameters of posterior talar process was also quantitatively measured. The incidences of safe at different angles were investigated in order to determine optimal angle for screw direction. The safe zone and the length and entry point of screw were defined.

Results: The safe zone was mainly between the 30% location and the 60% location; the width of each safe zone was 13.6 ± 1.4 ; the maximum height of each safe zone was 7.8 ± 1.2 . The height of the safe zone was lowest at the 30% location (4.5) and highest at the 50% location (7.3). The mixed safe zone of all talar was between the 50% location and the 60% location. And inserting a 48.7 mm screw, 5.6 cm laterally and 7.4 cm superiorly from the lateral tubercle of the posterior process of the talus towards the talar head is safest. The second screw best position is the medial posterior process the talus.

Conclusion: The zones for safe screw positioning are very narrow, making percutaneous screw fixation of the posterior talar process a challenging procedure. The predefined angles with computer-assisted three-dimensional techniques for the most frequently positioned percutaneous screws may aid in preoperative planning, shorten the operation time and reduce the incidence of surgical complications.

