Entry Point Position and Screw Length in Pelvic Anterior Column Screw Fixation

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Purpose: The anterior column of the pelvis can be stabilized with intramedullary screw fixation for acetabular fractures and pelvic ring injuries. Medullary anterior column screw fixation requires precise technique to avoid complications including intra-articular penetration, neurovascular injury, or bladder injury. The relationship between screw length and entry point position has not been described. We hypothesize that increasing the screw length results in cranial migration of the entry point.

Methods: A total of 20 pelvises were 3D-reconstructed in Slicer3d and exported in Rhinoceros 3D for analysis. A script was used to identify safe screw trajectories considering a 6.5-mm implant and minimal 20% clearance from the cortex. The algorithm identified safe screw trajectories using a previously published method through discretization of the smallest cross-section of the anterior column. The distance between the center of the acetabulum and each of the calculated entry points was expressed in percentage of the acetabulum radius and collected in relation to the correspondent intraosseous screw length. The results were analyzed by multivariate statistical analysis and identify the relationship between mean screw length and mean distance from the acetabulum center.

Results: The minimal distance of the entry point from the acetabular center was increased for longer intraosseous screw lengths. For screw lengths of 90 mm the minimal and maximal distances were measured 146% of the acetabular radius to 245% and were smaller than the percentages for the 140-mm screws (Table 1).

Conclusion: Our study has several limitations including the error induced by the smoothing performed on the 3D-reconstructed pelvises. A study by Puchwein et al. described the relationship between screw length and distance to the narrowest zone in anterior column. They discovered a mean screw length of 127.2 ± 7.1 mm, with a mean distance of the entry point to the narrowest zone to be 50.6 ± 6.3 mm. Peng et al. described the ranges of trajectory for screw placement along the anterior column describing angles between the superior and inferior limiting margins. In the current study we identified a relationship between screw length and migration of the entry point from the acetabular center. Proper selection of entry point has the potential to reduce complications, maximize intraosseous screw length, and potentially decrease intraoperative exposure to fluoroscopy.

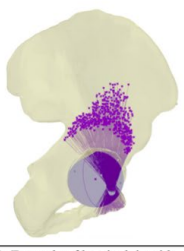

Figure 1: Example of hemipelvis with calculated safe trajectories and entry points

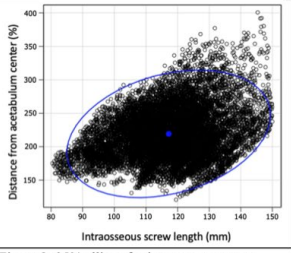

Figure 2: 95% ellipse for intraosseous screw length in relation to distance from acetabulum center expressed as percentage of acetabulum radius

Mean screw Intraosseous length [mm]	Mean minimal distance (%)	Mean maximal distance (%)
90	146	245
100	127	281
110	124	302
120	131	312
130	146	315
140	174	303

Table 1: Minimal and maximal distance (% of acetabular radius) of the entry point from the acetabulum center in relation to given average screw lengths