

Accuracy of Percutaneous Sacroiliac Screw Fixation for Pelvic Ring Injuries Using Standardized Image Intensifier Protocol with Lateral Shots as the Cornerstone for Screw Placement: A Prospective Cohort Study with Postoperative CT as the Reference Standard

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Purpose: The purpose of this prospective cohort study of patients treated with percutaneous sacroiliac (SI) screws for traumatic pelvic ring instability was to evaluate the accuracy of SI screw placement using a standardized image intensifier (II) protocol-using lateral II shots as the cornerstone for screw placement. Pre- and postoperative CT served as the reference standard to determine accuracy of SI screw positioning to calculate diagnostic performance characteristics, as well as for mapping of bony corridors and screw trajectories.

Methods: 52 screws were placed in 24 patients undergoing percutaneous SI screw fixation for pelvic ring instability and were prospectively enrolled from a Level-I trauma center in Australia, between September 2017 and May 2018. There were 14 type LC (lateral compression) ring injuries, 6 APC (anteroposterior compression), 2 VS (vertical shear) type, and 2 atypical injuries. 35 S1 screws were placed, with bilateral S1 screws in 7 patients, and 17 S2 screws. A uniform protocolized intraoperative fluoroscopy regimen was followed, using the lateral II shot as the cornerstone for screw entry and positioning, as follows: (1) obtain a perfect lateral II shot of the pelvis and sacrum, using specific landmarks and protocolized technique; (2) determine wire entry point and direction based on anatomical landmarks, and advance the wire 8 cm into the sacrum; and (3) subsequent alternating inlet and outlet views to verify positioning in extraforaminal bony corridors prior to definitive screw placement. Postoperative CT imaging was obtained in all cases to serve as the reference standard. For each individual case, the theoretical safe corridors as well as actual screw trajectories were mapped on CT and superimposed to evaluate accuracy of our protocol using a standard II. Diagnostic accuracy was calculated according to standard formulas.

Results: There were no foraminal protrusions in this series. Our protocol led to an accuracy of 94.3% for S1 screw placement and 94.1% for S2 screw placement, defined as the actual screw trajectory being within the cortical margin of the safe corridor when images were superimposed. Two S1-screws (5.7%) were found to be on the cortical border of the safe zone corridor, and 1 S2 screw (5.9%) was borderline; however, without protrusion of the S1 and S2 neuroforamina. No patients developed new neurological symptoms after surgery.

Conclusion: A uniform standardized protocol using lateral II shots as the cornerstone of screw placement to guide percutaneous SI screw fixation for pelvic ring instability, and subsequent alternating inlet and outlet views, is accurate and safe in terms of screw placement within cortical margins of safe zone corridors. The technique allowed full wire placement in all cases prior to changing the II from lateral to inlet/outlet views, and thus facilitates simplicity as well as reproducibility. Therefore, we conclude that standard intraoperative II techniques according to a stepwise protocol is safe and effective for percutaneous SI screw fixation.