Surgical Stability According to Lag Screw Position in Hip Nailing for Unstable Basicervical Intertrochanteric Fractures: A Finite Element Analysis

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Purpose: There are concerns regarding lag screw position and initial stability after cephalomedullary nailing (CMN) in unstable basicervical intertrochanteric fractures. This study aimed to investigate the surgical stability after CMN for unstable basicervical intertrochanteric fracture models according to lag screw position.

Methods: 12 finite element models (FEMs), comprising 4 different (superior 5 mm, center, inferior 5 mm, and inferior 10 mm) lag screw positions on AP view and 3 different (anterior, center, and posterior) positions on axial view, were constructed, and unstable basicervical intertrochanteric fractures fixed with short cephamedullary nails were reproduced in all FEMs. The rotation of the proximal fragment and stresses around the nail-bone constructs were measured.

Results: Rotation of the proximal fragment and stress concentration on the nail-bone constructs increased as the position of the lag screw within the femoral head moved downwards from superior to inferior in AP view and backward from anterior to posterior in axial view in all FEMs. The Peak von Mises stresses (PVMSs) on the nail were measured at the junction of the nail body and the lag screw in all FEMs. The PVMS on the nail and rotation of the proximal fragment was the lowest in the FEM, where the lag screw was positioned superior in the AP view and anterior in the axial view.

Conclusion: Considering the rotational instability of basicervical intertrochanteric fractures and our result, the superior position of the lag screw on AP view and anterior position on axial view may reduce the risk of fixation failure in unstable basicervical intertrochanteric fracture fixed with short cephamedullary nails.