The Influence of Sagittal Proximal Tibial Anatomy in Tibial Intramedullary Nailing

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Purpose: Tibial intramedullary nailing (IMN) is an effective treatment for tibial fractures but is associated with a significant postoperative complication rate. The ideal surgical approach for nail insertion remains controversial. Previous studies have compared the influence of suprapatellar (SP) and infrapatellar (IP) approaches on tibial IMN, but no study has evaluated the effect of proximal tibial anatomy on tibial IMN.

Methods: This was a randomized controlled trial randomizing patients to the IP or SP approach at a Level-I trauma center by 6 surgeons experienced in the procedure. Novel measurements were developed to quantify proximal tibial anatomy including proximal tibial angle (PTA) (Fig 1A) and start point centrality (SPC) (Fig. 1B, SPO = x/y). Guidewire and nail position were evaluated on intraoperative and postoperative films. Patients were stratified into 4 groups based on nail insertion method and PTA (high PTA + SP, high PTA + IP, low PTA + SP, low PTA + IP). Pearson's correlation coefficient and unpaired 2-tail Student t-test was performed using SPSS.

Results: 46 tibias in 45 patients were randomized (22 IP, 24 SP). Correlation coefficient for PTA and SPC was 0.79. Insertion method did not influence wire start point, nail position, or fracture alignment. SP nailing had significantly shorter surgical times compared to IP nailing (45.5 vs 55.6 min, P = 0.03). Patients with low PTA + IP nailing had significantly longer operative times (60.4 min) when compared to the other 3 groups (45.3 min). When stratified by PTA, patients with high PTA >22° (Fig. 1A) had more central start points, more vertical guidewire position, more central nail position, and less eccentric reaming compared to patients with low PTA <22° (Fig. 1B).

Conclusion: Tibial anatomy influences nail insertion and nail position. Patients with low PTA who underwent IP nailing had significantly longer operative times, which can be considered an indicator of difficulty of the operation and suggests that patients with this anatomy should be considered for SP nailing. This is the first study examining the influence of anatomy on tibial nail start point.