Percutaneous Versus Open Approach to Metacarpal Nailing: Cadaveric and Clinical Outcomes

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INTRODUCTION: Metacarpal fractures have a high incidence, with treatment options ranging from nonoperative management to various surgical fixation techniques. While recent data has shown an increasing trend towards intramedullary screw fixation, no evidence exists on the optimal surgical approach for this technique. We hypothesized that percutaneous approaches may result in higher extensor tendon injury than an open approach but will show improved short term functional outcomes.

METHODS:

The study was divided into two phases: cadaveric validation and clinical outcome collection. Four cadaveric specimens (10 metacarpals) were selected to compare percutaneous and open approaches. For the percutaneous group, a 5mm stab incision was made through the skin only without deep dissection into the capsule or sagittal band. For the open approach, a 1.5 cm incision was made over the metacarpal head, the ulnar sagittal band was incised and then capsule was opened. A guidewire, drill and then 4.0 threaded screw (Zimmer Biomet) was then inserted into each metacarpal under fluoroscopy. Following screw insertion, the percutaneous specimens were then opened to assess for extensor tendon injury. For our clinical outcomes, a retrospective cohort of patients from 2022-2025 was collected, at a single institution, who sustained closed metacarpal shaft fractures. We compared patients who underwent surgical fixation with a fully threaded intramedullary screw with an open versus percutaneous approach. We included patients with a minimum three month follow up. Primary outcome measures included Quick Disabilities of the Arm, Shoulder, and Hand (QuickDash) scores, total active range of motion, extensor tendon lag and surgical time. Additional outcome measures collected included grip strength, radiographic shortening/angulation, visual analog scale (VAS) pain scores and complications.

RESULTS:

Cadaveric dissection demonstrated no occurrences of tendon injury in the percutaneous or open group. In the percutaneous group, 9 out of 10 specimens demonstrated screw hole passage just ulnar to the extensor tendon, and 1 specimen demonstrated passage between the EDM and EDC (Small Finger). Our clinical outcomes collection identified 54 patients, comprising 56 metacarpal shaft fractures, all of which were included in the study. 28 patients were treated with an open approach and 26 were treated with a percutaneous approach. Patients treated with a percutaneous approach demonstrated shorter surgical times than those with open approach (9 minutes versus 16 minutes, $p<0.05$). In the percutaneous group, there were superior short-term TAM, QuickDASH scores, VAS pain scores and grip strength (6 week, $p<0.05$). Final follow up demonstrated no difference in TAM, QuickDASH scores, VAS pain scores, grip strength or radiographic shortening/angulation. There were no complications or cases of extensor lag in either group.

DISCUSSION AND CONCLUSION:

Currently metacarpal fractures comprise 33-47% of all hand fractures and treatment ranges from nonoperative management, open reduction internal fixation, and closed reduction with IMHS. Treatment methods for fixation with an IMHS traditionally utilizes an open approach to take care as to not damage or disrupt the extensor mechanism. In our cadaveric arm, following percutaneous insertion there were no occurrences of extensor tendon injury. Furthermore, in our clinical arm patients treated with a percutaneous approach demonstrated no instances of extensor lag at short-term or long-term final follow up providing some evidence for the safety of a percutaneous approach. In terms of functional outcomes as measured by QuickDASH scores, total active motion, grip strength, and VAS pain scores the percutaneous approach favored superior outcomes during short term follow up. While no differences were seen at long term follow up, these findings highlight accelerated return to normalcy for those treated percutaneously. Allowing patients to return to baseline in an accelerated fashion can extrapolate to quicker return to work and quicker return to activities of daily living leading to improved overall satisfaction and quality of life in the operatively treated population. The percutaneous approach was also significantly faster than the open approach, by an average of 7 minutes. This decrease in operative time did not sacrifice reduction quality or safety of the procedure as final radiographic data measured by shortening and angulation did not differ between the two groups and again there were no cases of extensor lag. In conclusion, percutaneous treatment of metacarpal fractures can be performed safely, without violating the extensor tendon.