Intramedullary Calcium Sulfate Injection During Transition from Frame to Nail: A Multicenter Study

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INTRODUCTION: Transitioning from ringed fixator to a nail can help prevent complications of prolonged external fixator use. Infection after transition to nailing (IMN) is reportedly as high as 43%, with concerns for colonized pin sites increasing risk of osteomyelitis. Techniques like pin holidays and off-axis pins can help prevent infection but are not always possible. The purpose of this study was to determine if patients in external fixators transitioned to an IMN with combination antibiotic-laden calcium sulfate injection would result in decreased infection rate.

METHODS: Retrospective review was conducted on patients treated at four academic hospitals 2020-2023. Patients with prolonged ringed external fixator placement (>1 month) for multiple diagnoses (limb salvage, segmental defect, deformity, nonunion) who transitioned to an IMN with calcium sulfate antibiotic-laden injection were included. Patients were treated with canal irrigation, and injection of calcium sulfate with vancomycin/tobramycin prior to IMN. Demographics, time in fixator, secondary procedures, complication, nonunion, and infection were recorded.

RESULTS: 49 patients were reviewed, with average age of 43 (range 18-76). Forty-five (92%) underwent limb salvage after fracture, the majority of which had pre-existing osteomyelitis, while four (8%) underwent correction for congenital deformity. Average follow-up time was 13.1 months (range two days-37 months). All patients had frame on for >1 month, pin tracts in line with future nail trajectory, and history of at least 1 pin tract infection. Nine patients (18%) had subsequent nonunions, five of which were at the docking site. All nine achieved union with 1 subsequent surgery. Six patients (12%) had infections, which is less than historical control ($p < 0.05$). All resolved with a single surgery except one who resolved with two subsequent procedures. No patients had adverse symptoms, renal injury, or medical complications related to the procedure.

DISCUSSION AND CONCLUSION: Placement of intramedullary antibiotic-impregnated calcium sulfate at the time of transition to an IMN in high-risk patients is associated with low rates of infection and complication. This represents a promising technique to minimize length of time in a frame, although further study is warranted to minimize risk and optimize antibiotic choice.