Outcomes of Aseptic, Septic, and Occult Infected Index Nonunion Repair: A Retrospective Comparative Study

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Purpose: Our objective was to compare the effectiveness of index nonunion surgery for occult-infected nonunion (ON) with aseptic nonunion (AN) and septic nonunion (SN) in patients identified using fracture-related infection (FRI) criteria. This study also compared the success rate of achieving union with bone grafting versus no bone grafting in the treatment of ON.

Methods: Skeletally mature patients diagnosed with nonunion at a single Level I trauma center between 2013 and 2023 were retrospectively reviewed. Patients with incomplete culture data, missing inflammatory labs, or lack of 6-month follow up were excluded. Patients were categorized into AN, SN, or ON groups using FRI criteria. Successful union after nonunion surgery without need for additional surgical interventions was evaluated. ON patients were organized into bone graft (ONBG) and no bone graft (ONNBG) groups to compare successful nonunion surgery. Multivariate regression was used to compare outcomes while controlling for gender, ASA classification, and diabetes.

Results: In total, 208 patients with nonunion fractures were included in the analysis: 125 AN, 54 SN, and 29 ON. Most patients had either a femoral nonunion (34%) or a tibial nonunion (49%). ON patients were significantly more likely to be infected by a low virulence organism (82.8% vs 9.3%, $p<0.001$). The overall success rate of index nonunion surgery was 67.8%. Patients in the ON group had the highest success rate (79.3%), followed by those in the AN group (72.8%) and the SN group (50.0%) ($p = 0.004$). Recurrent infections were significantly lower in the AN (16.0%) and ON (10.3%) groups compared to the SN group (35.2%) ($p = 0.005$). Regression analysis demonstrated that surgery success was significantly lower in SN patients (OR = 0.38, $p = 0.009$); ON and AN patients had similar success (OR = 1.58, $p = 0.4$). Bone graft use did not significantly affect successful union in ON patients (ONBG [16 of 21] 76.2% vs ONNBG [7of 8] 87.5%; $p = 0.65$).

Conclusion: Index nonunion surgery in SN patients is associated with worse outcomes compared to AN and ON patients identified with the FRI criteria. Surgery success in ON patients is comparable to AN patients, suggesting that low-virulence infections do not significantly compromise effectiveness of nonunion surgery. Further, in this sample, bone grafting in occult infections did not impair nonunion surgery success.