

Collagen X Fracture Biomarker Suggests Surgical Intervention for Fracture Nonunion Drives Endochondral Bone Response

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Purpose: No validated method exists to monitor the effect of surgical intervention on nonunion healing. Growing evidence supports collagen X as a biomarker (CXM) for endochondral activity. We hypothesized CXM increases following nonunion surgical intervention.

Methods: Patients presenting with delayed or frank nonunion of tibia or femur fractures were consented and observed, receiving observation or surgical intervention following shared decision making. Blood was collected at all clinic visits and analyzed for CXM. Wilcoxon rank sum tested for differences in CXM between both treatment and nonunion types.

Results: 22 (13 nonunion, 6 delayed, 3 septic) patients originally sustaining femur/tibia fractures (mean age: 37 years [standard deviation, 12]; 82% male, 45% smoker) enrolled; 9 received surgical intervention (median days after index care: 321 [265-1442]). Mean CXM via observation: 649 pg/mL vs 778 pg/mL following nonunion operation ($P = 0.11$). Surgery yielded an average CXM increase from 536 pg/mL preoperatively to 700 pg/mL postoperatively ($P = 0.04$). CXM vs time demonstrates that nonunion intervention associates with increased endochondral response. Mean CXM in delayed unions was 1027 pg/mL, higher than that of nonunion (606 pg/mL, $P < 0.001$).

Conclusion: Patients receiving surgical intervention for fracture nonunion and delayed union demonstrated higher CXM levels after treatment than during pretreatment observation, implying that CXM may capture the effect of treatment on union progression.

