

Can Laser-Assisted Indocyanine Green Angiography Be Used to Quantify Perfusion Changes During Staged Fixation of Pilon Fractures? A Pilot Study

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Purpose: Our objective was to quantify soft-tissue perfusion changes in pilon fractures (OTA / AO 43-B and 43-C) during staged treatment using laser-assisted indocyanine green angiography (LA-ICGA).

Methods: Patients treated at our Level I trauma center with delayed definitive fixation for pilon fractures from 1 January 2017 to 1 January 2021 were considered for study inclusion. LA-ICGA was performed using the SPY fluorescence imaging platform. Perfusion measurements of the anterior, medial, and lateral leg and foot were performed at the time of initial external fixation (EF) application and then at the time of definitive fixation. Analysis via ImageJ was used to generate a fractional area of perfusion (FAP) based on fluorescence intensity to objectively quantify soft-tissue perfusion.

Results: 12 with 12 pilon fractures were included, 7 OTA / AO 43-C3, 3 43-C2, and 2 43-B2. FAP within the region of interest was on average 64% medially, 61% laterally, and 62% anteriorly immediately prior to EF placement. Immediately prior to definitive open reduction and internal fixation (ORIF), FAP within the region of interest was on average 86% medially, 87% laterally, and 86% anteriorly. FAP increased on average 24% medially ($P = 0.0004$), 26% laterally ($P = 0.001$), and 19% anteriorly ($P = 0.002$) from time of initial EF to time of definitive ORIF.

Conclusion: Quantitative improvement in soft tissue perfusion was identified through the course of staged surgical management in pilon fractures. LA-ICGA potentially may be used to determine appropriate timing for definitive surgical intervention based on the readiness of the soft-tissue envelope. Ultimately, these findings may influence clinical outcomes with respect to choice of surgical approach, soft-tissue management, surgical timing, and wound healing.

