Intraoperative Real-Time Bone Perfusion Imaging, Using ICG-Based Dynamic Contrast-Enhanced Fluorescence Imaging, Has the Potential to Predict Early Infection Recurrence

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Purpose: Infection following bony fracture is one of the most prevalent and challenging complications in trauma patients and recurrent infection rates are unacceptably high at approximately 30%. Since vascular perfusion plays a critical role in the health of bone, quantitatively assessing bone blood perfusion intraoperatively may provide an objective indicator for thorough debridement with the potential to reduce rate of recurrent infection. To address this, we have developed an indocyanine green (ICG)-based dynamic contrast-enhanced fluorescence imaging (DCE-FI) to provide surgeons with objective and quantitative data regarding bone perfusion. The aim of this study was to preliminarily evaluate whether bone perfusion, reflected by post-debridement DCE-FI, is related to the risk of recurrent infection within the 12 months after the initial surgery.

Methods: 28 patients who have completed 12-month follow-up visits were included in this preliminary assessment. 15 patients did not experience a recurrent infection, whereas 13 patients sustained a recurrent infection (7 within 3 months, 6 from 3 to 12 months). In each patient, 0.1 mg/kg of ICG was administered intravenously after debridement and DCE-FI was carried out by a fluorescence imaging system for 4.5 minutes. Bone perfusion-related parameters were calculated within the bone area exposed in the surgical view. Based on the clinical outcomes, patients have been divided into 3 groups of no infection, early recurrent infection (within the first 3 months), and late recurrent infection (between 3 and 12 months). Parametric maps were analyzed by histograms and intensity thresholding in each of the groups.

Results: There is a lower median bone perfusion among patients who went on to develop early recurrent infection (mean 53.4 RFUs, standard deviation [SD] 38.4 versus mean 63, SD 36.4 RFUs). Using a threshold of 18 RFUs, there were significantly higher ratios of low perfusion area in the group of patients who had an early infection recurrence compared to those who successfully healed their infection (mean 20.5%, SD 20.3% vs mean 8.7%, SD 11.2%).

Conclusion: The results from this study demonstrate that post-debridement bone perfusion, quantified using intraoperative ICG-based DCE-FI, has the potential to identify patients at high risk for early (<3 months) recurrent infection.

POSTER ABSTRACTS