Intraoperative Near-infrared Fluorescence Imaging in Perforator Flap Reconstruction: Current Research and Early Clinical Experience

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ABSTRACT

Despite recent advances in perforator flap reconstruction, there can be significant variability in vessel size and location. Although preoperative evaluation may provide valuable information, real-time intraoperative methods have the potential to provide the greatest benefit. Our laboratory has developed the Fluorescence-Assisted Resection and Exploration (FLARE™) near-infrared (NIR) fluorescence imaging system for intraoperative visualization of details of the underlying vasculature. The FLARE™ system uses indocyanine green, a safe and reliable NIR fluorophore already FDA-approved for other indications. The system has been optimized in large-animal models for the identification of perforator size, location, and perfusion and has also been translated to the clinic for use during breast reconstruction after mastectomy. In this article, we review our preclinical and clinical data, as well as literature describing the use of similar NIR fluorescence imaging systems in plastic and reconstructive surgery.

KEYWORDS: Intraoperative imaging, near-infrared fluorescence angiography, microsurgery, perforator flap, indocyanine green

The use of perforator flaps in reconstructive surgery has increased over the past decade. The ability to isolate flaps without muscle has provided a significant advantage while simultaneously minimizing morbidity. Despite these advances, the key element in designing a perforator flap remains vessel identification and selection. As the perforating vessels demonstrate a high degree of variability, various imaging modalities have been used to identify vessels and increase reliability. The use of the handheld Doppler, duplex ultrasound, computed tomography, and magnetic resonance imaging all require a static preoperative evaluation correlated to observations made during surgery. Ideally, an intraoperative imaging system would provide the most information and utility in real-time flap design.

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