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Invited Commentary

Commentary on JPRAS-D-18-00185: The use of Laser Speckle Contrast Imaging to predict flap necrosis: An experimental study in a porcine flap model article

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The authors need to be congratulated for their fine study on the use of Laser Speckle Contrast Imaging (LSCI) to predict flap necrosis in an experimental setting with a porcine pedicled flap model. LSCI has been repeatedly described for perfusion analysis in flap surgery. There has always been a demand to simplify or optimize intra- and postoperative flap monitoring, especially in free flap surgery. However, the individual techniques to postoperatively monitor free flaps vary considerably. In former studies from the early 1990s with questionnaires ninety percent of microsurgeons reported to routinely use monitoring devices, with external and laser doppler having achieved greatest popularity.[1] Although individual experience was always believed to be of utmost importance many surgeons believed that there is a value of an additional "safety net" utilizing more objective tools. The criteria for such devices postulated by Jones in 1984 which would define an ideal monitor of free flap viability still own validity. These include mainly that the method should be harmless to both flap and patient, accurate and reliable, rapid, simple and inexpensive, applicable to all types of flaps, repeatable, objective and recordable, rapidly responsive to circulatory change, and able to provide data that is easily interpreted by non-specialist staff.[2] The current spectrum of flap monitoring includes implantable Doppler probes, microdialysis, video-based applications, fluorescence angiography, spectroscopy, contrast-enhanced duplex, and activated clotting time and combined white-light / laser doppler spectrophotometry.[3] According to Cervenka et al. of these methods, implantable Doppler and spectroscopy have the most recent and largest series of data describing efficacy with implantable Doppler, demonstrating comparable flap survival rates to clinical monitoring.arterial implantable Doppler is described to have the additional benefit of less false-positives than venous Doppler. Spectroscopy demonstrates promise with commensurate flap survival rates and improved salvage rates over clinical monitoring. It also allows for an intraoperative tailoring of the flaps and thus reduces questions of viability through the removal of any not clearly perfused tissue parts. We have previously shown how this affects questions of flap perfusion in a series of DIEP flaps, where we combined laser-assisted Indocyanine Green (ICG) angiography together with measuring the post-capillary oxygen saturation and relative hemoglobin content (rHb) using combined laser Doppler spectrophotometry.[4] By doing so, ICG angiography provides an objective real-time analysis of flap perfusion, with high sensitivity for the detection of poorly perfused flap areas.[5] Because this is a physician based method with the injection of a contrast agent this method does not lend itself to a continuous postoperative flap monitoring.

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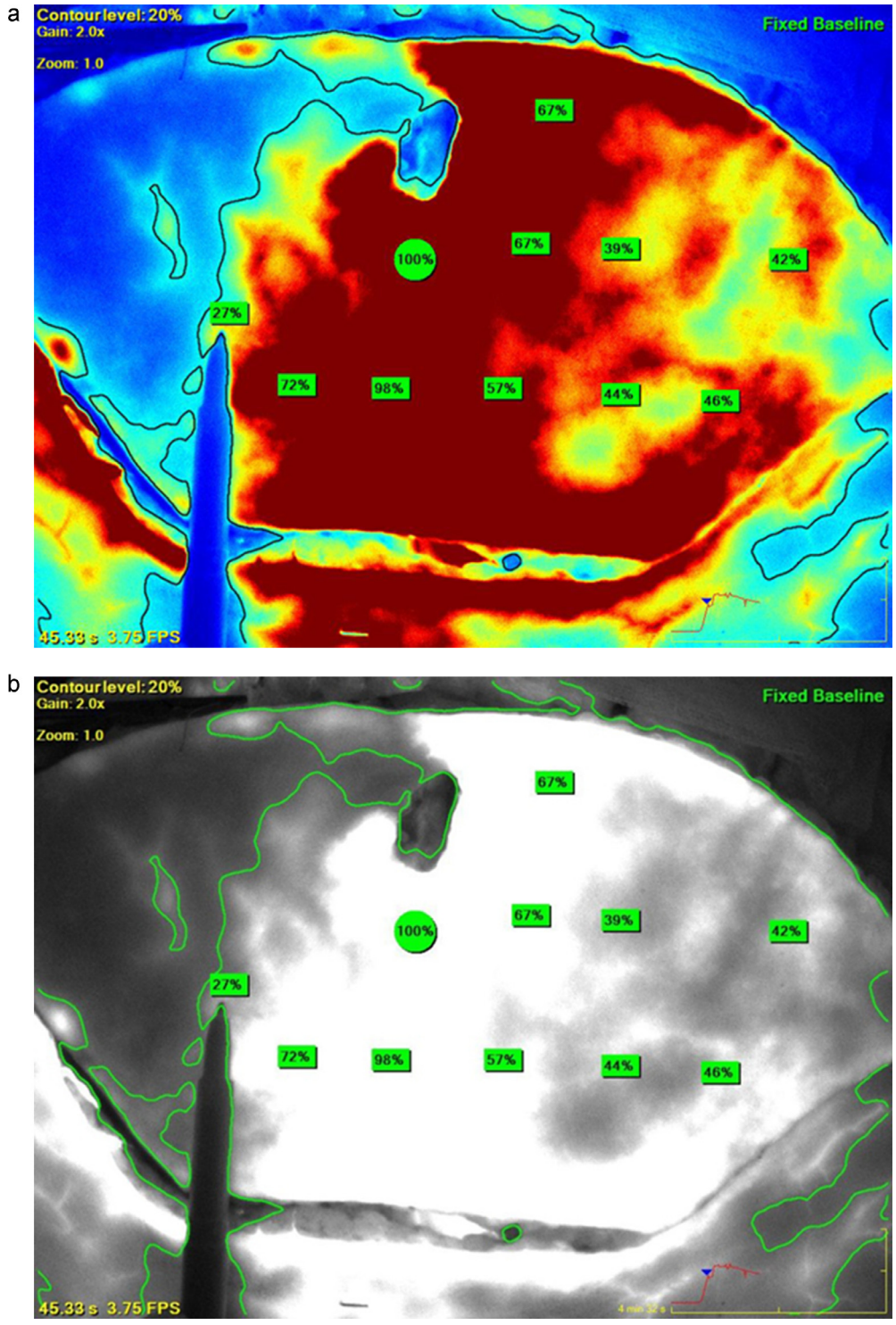

Figure 1 (a) Perfusion pattern of a muscle-sparing Transverse Rectus Abdominis Myocutaneous flap (ms1-TRAM flap) after complete dissection of one laterally located perforator using Laser assisted Indocyanine Green angiography (color mode). (b) Gray scale imaging of the same flap as in Figure 1b. 100% spot defines highest fluorescence in the flap.

With a non-contact, LSCI may provide a recording way not only for basic research, but also for clinical applications, because it can achieve real-time dynamic blood flow monitoring and video imaging. One advantage may be that the instrument does not need any contrast agent, the time resolution can be in milliseconds, the spatial resolution can be in microns according to the manufacturer. It also achieves the requirements of real-time observation of microvascular blood flow distribution and relative changes in values comparable to ICG angiography.

But here is a critical point that, to our opinion, should be discussed: if we have the tools to optimize flap design and

visualize which parts of the flap should better be discarded right away – no matter what the costs are – should we then go on like we have done for decades or should we try to optimize our intraoperative management? Once, whatever tools will be available in the future, we have the chance to optimize the flap design according to the individual perfusion pattern and discard any unsafe areas we might reduce at least one more critical aspect in the postoperative care after free flaps and hopefully achieve even better results for our patients. Until then, clinical evaluation by experienced surgeons and staff will remain a necessity to detect any flap perfusion related problems (Figure 1).

Conflict of interest

Both authors do not have a conflict of interest with regard to this paper, but have served in the past as invited speakers on the topic of ICG imaging on behalf of Novadaq Technologies Inc. Mississauga, ON L4W 4TW Canada and have received payment for travel expenses

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