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When to assess the flap perfusion by intraoperative indocyanine green angiography(ICGA): On the donor site or the recipient site?

Dear Editor

It is with great interest to read the article by Paloma M and colleagues regarding a valuable clinical question about "When to assess the DIEP flap perfusion by intraoperative indocyanine green angiography (ICGA) in breast reconstruction?" [1]. They reported that the ischemic area was larger on the donor site and concluded that it is better to assess the perfusion here. Furthermore, they did not find benefit in performing the test again on the recipient site when there were enough perfused area at the donor site. Activated by this new idea, we would like to express some considerations on this study.

First, the purpose of the author was to determine the best timing to perform ICGA, on the donor site or on the recipient site? To find the answer, we believe it is supposed to compare the ischemic area of the two sites to the final necrosis area, that is, the gold standard of necrosis, rather than compare them to each other. Since ischemia is not the sufficient condition for necrosis, it is inappropriate to follow the criteria of "the larger the ischemia area is, the better the ICGA be performed". The delay phenomenon can acclimatize the flap to ischemia, permitting it to survive with less blood flow by causing adaptive metabolic changes at the cellular level. There was no gold standard about data on flap survival and necrosis during the follow-up on this study, which also cautioned us to pay attention to the false positive and false negative result of ICGA.

Second, there was no specific method for assessing perfusion by ICGA, what is the standard for "very low fluorescence signal"? Ethical considerations were well taken into account by the authors, who removed some of the well-perfused tissue in 83.3% of the cases. Nevertheless, if the flap is trimmed by the criteria of both symmetry as well as the quantitative ICGA result, for example the part with lower fluorescence percentage be trimmed first, the correlation between necrosis and ICGA can be better established. Therefore, the quantitative or semi-quantitative indicators should be used, and the trimming threshold and the symmetrically trimming criteria by ICGA should be described.

Third, the authors believe that there is no benefit in performing the test again on the recipient site in most circumstances. However, we believe that the flap status is different between the donor and the recipient sites, and the purpose of performing ICGA is not exactly the same. On the one hand, the flap survival is related not only to the theoretical perfused area tested on the donor site, but also to the vascular patency after anastomosis and ischemia-reperfusion injury [2]. On the other hand, when the perfusion assessed by ICGA on the recipient site is poor, we can anastomose an additional vessel according to the perfusion and perform ICGA again [3], especially in bilateral reconstruction or in cases that the contralateral breast is too large [4].

In general, the authors successfully converted a scientific phenomenon into a clinical question, which inspired us to figure out why the perfusion on the recipient site is better than that on the donor site. We believe it attributes to the delay phenomenon during flap elevation which permanently and irreversibly reorganizes the pattern of blood flow to more ischemic areas and improves vascularity. The main role is the choke vessel, some of them open, while some of them enlarge the caliber. The specific mechanism may related to VEGF, regulating the expression of *p*-Akt and HIF-1α, changing the ratio of Bax to BCL-2 and the activity of caspase-3 [5]. Besides, the vasodilatation may also result in part from a sympatholytic state that results from cutting the sympathetic innervation to the vasculature. Surgical delay has been proved to be the best way to improve flap survival at present. Many clinical studies have used delay to pretreat the flap in order to increase circulation, especially in breast reconstruction with TRAM flap [6].

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