

Vasopressors and Reconstructive Flap Perfusion

A Review of the Literature Comparing the Effects of Various Pharmacologic Agents

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Introduction: Use of intraoperative vasopressors is of debate in microvascular surgery. Anesthesia is an important factor in maintaining the rate of success of flap transfer by affecting regional blood flow and global hemodynamics. We conducted a review of the literature comparing the use of different vasoactive agents on different flaps in various human and animal models.

Methods: A systematic review of the literature was performed. Bibliographies of key articles were also reviewed for additional resources. Analysis was done to determine the overall trend of how flap perfusion is affected by the use of intraoperative vasoactive medication.

Results: The literature search identified 16 relevant articles. Flaps were studied in pigs in 7 studies, rats in 5, and humans in 4. The most common flap was the rectus abdominis musculocutaneous flap. Phenylephrine and norepinephrine were the most common pressor agents used. No significant statistical changes were noted in 8 of the 16 studies; initial ischemia followed by delayed improved perfusion was observed in 4 studies, “true ischemia” and hypoperfusion of the skin flaps was noted in 3. There was no consistency in their effect on flap perfusion: initial ischemia followed by delayed improved perfusion was observed in 4 studies, whereas true ischemia and hypoperfusion of the skin flaps was noted in 3.

Conclusions: To date, there is no reliable prospective clinical evidence that supports the absolute contraindication of pressor agents during free flap surgery. This topic will continue to be a matter for debate until more definitive data can be obtained.

Key Words: vasopressor, microvascular, free tissue transfer, anesthesia

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A skin flap is composed of skin and subcutaneous tissue with an intact vascular supply that is transposed to a recipient site from a viable donor site.¹ Plastic surgeons are keenly aware that flap survival is dependent on blood flow. A reconstructive flap immediately becomes ischemic to a degree as soon as it is dissected; alternatively, a newly dissected flap is ischemic but viable.^{1,2} The nascent flap receives its nutrients from both the base of the primary defect and the vascular pedicle. Immediately after flap incision, local sympathetic fibers are activated, resulting in the release of catecholamines. This occurrence causes vasoconstriction for up to 48 hours (until the nerve's supply of norepinephrine is exhausted).^{3,4} As soon as sympathetic tone decreases, collateral blood flow is increased. Other factors such as the release of prostaglandins may play a role in autoregulation of vascular supply.

There are factors that potentially cause a decrease in flap perfusion including surgical trauma, tissue edema, closure of wounds under tension, and wound infection. During free tissue transfer, anesthesia is important in maintaining the success of flap transfer by affecting regional blood flow and global hemodynamics. The intra-anesthetic basic goal is to optimize blood flow to the vascularized flap.^{5,6} The use of intraoperative vasopressors has been a debated topic in microvascular surgery.⁷ It is widely suspected that the use of vasoconstrictive agents potentially leads to peripheral vasospasm, thrombosis, reduced flap perfusion, and, ultimately, flap failure.⁷ There is an ongoing debate between plastic and reconstructive surgeons and anesthesiologists; the former support the theory that administration of vasoactive agents causes vasoconstriction of the pedicle artery and other microvasculature, whereas the latter see the whole body as having blood flow dependent on systemic perfusion pressure.⁸ To date, there is no rigorous scientific evidence to suggest that during free flap surgery the use of pressor agents is an absolute contraindication.⁷ We present an analysis and report conclusions of the literature comparing the use of different vasoactive agents on different flaps from various human and animal models using a meta-analysis of the available data in the English literature.

METHODS

A systematic review of the literature was done on the effects of different intravenous vasopressor drugs on flap perfusion. A MEDLINE search was performed using the key words “vasopressor” and “flap,” which resulted in 120 articles. After a limit was set for only English language publications, this number was reduced to 114. Only articles in which actual testing of a vasoconstrictive agent on a flap from either an animal or human model was included, the number of articles then diminished to 12. Bibliographies of key articles were also reviewed for additional resources, this resulted in the addition of 5 more articles bringing the overall total to 16. All data were independently extracted by one of the coauthors. For each article identified, the following information was noted: author, title, year of publication, species of subject included (human vs animal), number of subjects included in the study, type of flap, pressor drug used, tests done, outcomes, and conclusions reached by the respective authors. A comparison was made among the different studies analyzed to determine the overall trend of how flap perfusion is affected by the use intraoperative vasoactive medication.

RESULTS

The literature search identified 16 articles on the effect of intravenous vasopressor medication on different flaps in both animals and humans.^{8–23} Flaps were obtained from pigs in 7 studies, from rats in 5 studies, and from humans in 4 studies (Tables 1 and 2). Twelve articles specified the number of species used (total of 585; 62 pigs, 147 rats, and 376 humans). The total number of flaps raised was specified in only 4 studies: 437 from humans, 102 from rats, and 7 from pigs.

The most common flap dissected was the rectus abdominis musculocutaneous flap (3 articles) followed closely by dorsal flaps,

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