Improved Random Component Viability of Axial Skin Flap through the Use of Human Adipose Derived Stem Cells

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Abstract

Purpose: Flap necrosis caused by inadequate blood supply and inflammation is a common postoperative complication in reconstructive surgery.[1] Lu et al. claimed adipose-derived stem cells increase the viability of random pattern skin flaps via subcutaneous injection.[2] The purpose of this study is to examine if administration of human adipose-derived stem cells via local intra-arterial injection could improve survival of the random component of axial skin flap by animal study.

Materials and Methods: Human adipose-derived stem cells were isolated from a healthy 48 year-old woman by liposuction with patient consent and expanded ex vivo as standard protocol. After the elevation of axial epigastric flap in nude mice, human adipose-derived stem cells were then injected via right femoral artery (Figure 1) in different concentration (group A=$1x10^3$, group B=$1x10^4$, group C=$1x10^5$). The control group received 0.2 ml phosphate-buffered saline solution. After local injection, right superficial epigastric vessels were ligated to create unipedicle skin flap with random extension. The percentage of necrotic area was measured at postoperative day 7 for evaluation of flap viability. Specimens were also harvested for histologic analysis and ELISA assay.

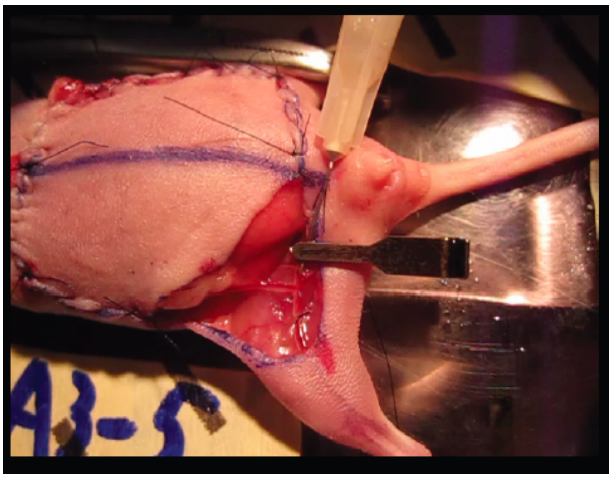

Figure 1. Human adipose-derived stem cells were then injected via right femoral artery.

Results: Human adipose-derived stem cells led to a statistically significant increase in random component viability in both group A and group B compared with the control (Figure 2), especially group B ($1x10^4$). Histologic examination also showed some of the endothelial cells were stained positively for anti-human CD31. Moreover, ELISA assay revealed the amount of TNF- α decreased in group A, B and C compared with the control.

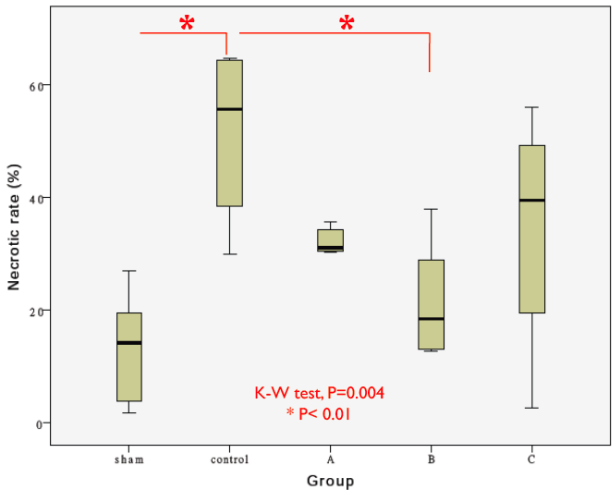

Figure 2. Human adipose-derived stem cells led to a statistically significant increase in random component viability in both group A and group B compared with the control.

Conclusion: Human adipose-derived stem cells increase the viability of random component of axial skin flap via local intra-arterial injection. The mechanism of improved viability of skin flap might be the direct differentiation of human adipose-derived stem cells into endothelial cells or inhibited inflammation process via TNF-α.

References

1. Khouri, R.K., et al., *A prospective study of microvascular free-flap surgery and outcome.* Plast Reconstr Surg, 1998. **102**(3): p. 711-21.
2. Lu, F., et al., *Improved viability of random pattern skin flaps through the use of adipose-derived stem cells.* Plast Reconstr Surg, 2008. **121**(1): p. 50-8.

Disclosure/Financial Support
The authors declare that they have no conflicts of interest to disclose.