Impacts of arterial ischemia or venous occlusion on vascularized groin lymph nodes in a rat model

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Abstract

Background: Reported ischemia time of vascularized lymph nodes was 5 hours. This study investigated the effects of arterial ischemia and venous occlusion on vascularized lymph node function in rats.

Methods: Bilateral pedicled groin lymph node flaps were raised in 27 Lewis rats. Femoral artery and vein were separated and clamped for 1, 3, 4, or 5 hour(s). Lymph node flap perfusion and drainage were assessed by laser Doppler flowmetry and indocyanine green lymphography. Histologic changes were assessed using hematoxylin and eosin stain, terminal deoxynucleotidyl transferase-mediated dUTP nick end-labeling (TUNEL), and glutathione assays.

Results: Perfusion units of 2.84 ± 1.41, 2.46 ± 0.64, 2.42 ± 0.37, and 2.01 ± 0.90 were measured in arterial ischemia groups, and 1.71 ± 0.45, 2.20 ± 0.98, 1.49 ± 0.35, and 0.81 ± 0.20 in venous occlusion groups after 1, 3, 4, and 5 hours of clamping, respectively. Lymphatic drainage showed mean latency periods of 5.33 ± 0.88, 9.00 ± 3.21, 10.00 ± 2.08, and 24.50 ± 11.50 seconds in arterial clamping groups, and 25.00 ± 3.61, 26.00 ± 3.06, 23.33 ± 4.41, and 152.00 ± 0 seconds in venous clamping groups, respectively. Severe medullary and cortical congestion and hemorrhage on histology and cell damage by glutathione levels and TUNEL assay were found after 4 hours of venous clamping.

Conclusions: Arterial ischemia and venous occlusion impact the function and viability of vascularized lymph node flaps differently. The critical venous occlusion time was 4 hours.

KEYWORDS
arterial ischemia, laser Doppler flowmetry, lymphedema, vascularized lymph node transfer, venous occlusion

1 INTRODUCTION

Vascularized lymph node transfer (VLNT) is a promising physiological surgical procedure for treating Cheng’s Lymphedema grade II-IV patients.1 In this technique, a healthy lymph node flap is harvested from a distant area and transferred to a distal recipient site on the lymphedematous limb for maximal functional recovery.

It was only recently that experimental studies analyzed lymph nodes (LNs) for their functional recovery after transplantation to a new environment.2 LN transfers with microvascular anastomoses were found to have increased survival compared to nonvascularized transfers.3 Moreover, VLNT has demonstrated preservation of original histologic LN structures in rats.4 Therein, the crux of a successful VLNT requires that the transferred nodes re-establish...