

RESEARCH ARTICLE

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