Establishing A Lymphedema Rat Model for Vascularized Lymph Nodes Transfer

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Abstract

Objective:
This study was aimed to establish a lower limb lymphedema animal model for vascularized lymph nodes (VLN) flap transfer.

Materials and Methods:
Lymphedema in the lower extremity was created by removing the unilateral groin lymph nodes followed by treatment with 20, 30, and 40 Gy (group IA, IB, and IC, respectively) radiations or removing both inguinal groin lymph nodes and popliteal lymph nodes followed by treatment with 20 Gy (group IIA) radiation in the Sprague-Dawleys rat (10-12 weeks old, weighted 350 g to 400 g). The vascularized LN flap from periaortic lymph nodes was transferred to the groin site of the lymphedematous limb. The volume differentiation was assessed by micro-CT and defined as the volume of lesion limb minus health limb and divided by the health limb. The lymph flow was assessed by Tc\textsuperscript{99} nano-collid lymphoscintigraphy for 30 minutes, 5 hours and 24 hours at 3 months after LN transfer.

Results:
At 4 weeks after lymph nodes removal followed by radiation, 0 % in group IA (n=3), 37.5 % in group IB (n=16), and 50 % in group IC (n=26) developed lymphedema in the lower limb. But 40 Gy and 30 Gy radiation treatment would cause higher mortality and mobility. However, the success rate of group IIA was 80 % (n=27). The volume differentiation of the lymphedematous limb compared to the health limb was 7.14 ± 0.46 % in the group IIA. Tc\textsuperscript{99} nano-collid was accumulated in the lymphedematous limb in the sham group, but was not accumulated in the VLN group on lymphoscintigraphy image. In addition, the more lymph nodes transferred, Tc\textsuperscript{99} clearance time was quicker.

Conclusions:
Removal of both inguinal groin lymph nodes and popliteal lymph nodes and followed by radiation of 20 Gy may develop the lymphedema in the lower limb in 4
weeks. Vascularized lymph node transfer can effectively drain the lymph in Tc$^{99}$ nano-collid lymphoscintigraphy.

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