

Anatomical effects of axillary nodes dissection on rat's lymphatic system model: ICG mapping and dissection

PASTOURET F.¹, CARDOZO L.¹, LAMOTE J.², LIEVENS P.¹

¹ Department of Rehabilitation Research, Vrije Universiteit Brussel, Belgium

² Department of Oncology and Thoracic Surgery, UZ Brussel, Belgium

Abstract

Introduction :

Axillary Nodes Dissection (AND) is an important risk factor for the appearance of Breast Cancer Related Lymphedema (BCRL). However, the specific anatomy and pathophysiology that leads to the development of BCRL after AND is not completely understood. Until now, various AND techniques were tested on rats to create an “in vivo” chronic lymphoedema model but none of them succeeded without additional chemical inflammatory drugs or physical technique applications (radiotherapy).

The aim of this study is to analyse the specific anatomical effects of AND on the rat's front leg lymphatic system before and after surgery.

Materials and Methods:

Superficial and deep AND were performed on seven Wistar rats with a new, less invasive, posterior surgical approach. Indocyanine Green (ICG) mapping was done before and after surgery to detect “normal and secondary superficial lymphatic pathways” of the operated rat's front legs. Volume changes were appreciated and compared to contralateral sides. After 12 months, dissections were done after subcutaneous hand blue dye injection to analyse superficial and deep lymphatic pathways.

Results:

After AND, a post-operation acute oedema of arm and shoulder appeared and persisted during 14-21 days. However, this did not result in a front leg chronic lymphoedema. In two cases, seromas appeared. In all cases, ICG mapping allowed detecting superficial lymphatic pathways and lymph leaks around the surgical sites. After euthanasia and dissections, substitution lymphatic pathways were visualised by blue dye mappings. Although no contralateral axillary lymphatic pathways were seen, functional superficial secondary lymphatic pathways were found in all cases and they connected to the deep lymph vessels by perforating lymph vessels.

Conclusion:

This type of lymphatic substitution pathways after AND on rat has never been described in the literature before. Anatomical description of the newly developed substitution lymphatic pathways after AND helps to understand why a chronic secondary lymphoedema could not be created in rats after AND without additional chemical or physical interventions. This finding permits researchers to remove specific substitutional lymphatic vessel parts that may prevent the development of a chronic secondary lymphoedema on the rat's front leg after surgery without using additional techniques.

Keywords :

Axillary nodes dissection, substitution pathways, rats, perforating vessels, ICG, Blue dye.

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