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Review

Is axillary reverse mapping feasible in breast cancer patients?

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Abstract

In the surgical treatment of breast cancer, axillary lymph node dissection (ALND) can be avoided not only in sentinel lymph node (SLN)-negative patients but also in SLN-positive patients who undergo breast-conserving surgery with whole-breast irradiation and systemic therapy. However, it should be performed not only in clinically node-positive patients but also in other SLN-positive patients who do not meet the Z-0011 criteria. The axillary reverse mapping (ARM) technique has been developing for identifying and preserving lymphatic drainage from the arm during ALND, thereby expected to minimize arm lymphedema. Nevertheless, ARM nodes could be involved not only in clinically node-positive patients but also in clinically node-negative patients. Previously, it was considered that preservation of the ARM lymphatics or lymph nodes is not oncologically safe in patients with axillary lymph node metastases. However, recent studies have demonstrated that the ARM procedure is oncologically feasible in clinically node-negative, SLN-positive patients when ARM nodes do not coincide with SLNs. When ARM nodes do not coincide with SLNs, they are not involved even in SLN-positive patients. On the other hand, ARM lymphatics/nodes within the boundaries of a standard ALND should be resected in SLN-positive patients, when ARM nodes are SLN-ARM nodes. Therefore, surgical treatment of the axilla can be individualized on the basis of the axillary nodal status.

Keywords: Axillary reverse mapping; Fluorescence imaging system; Breast carcinoma

Abbreviations: ACOSOG, American College of Surgeons Oncology Group; ARM, axillary reverse mapping; ALND, axillary lymph node dissection; SLN, sentinel lymph node; H&E, hematoxylin-eosin; ICBN, intercostal brachial nerve; ICG, indocyanine green; NSM, nipple-sparing mastectomy; SSM, skin-sparing mastectomy; LTV, lateral thoracic vein.

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Core tip

Even in the era of Z-0011, ALND should be performed in clinically node-positive patients as well as SLN-positive patients who do not meet the Z-0011 criteria. The ARM procedure has been developed for identifying and preserving lymphatic drainage from the arm during ALND, thereby minimizing lymphedema.

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Introduction

Axillary lymph node dissection (ALND) was an integral part of the surgical procedure of breast cancer in the era of radical mastectomy. However, a randomized clinical trial demonstrated that it does not reduce systemic recurrence or improve survival.[1,2] Therefore, ALND was regarded as a surgical procedure for assessing axillary nodal status and preventing axillary recurrence.[3] Recently, sentinel lymph node (SLN) biopsy has become a standard method for assessing axillary nodal status in breast cancer. This procedure can avoid ALND in SLN-negative patients, thereby minimizing arm lymphedema. Nevertheless, it is difficult to prevent arm lymphedema perfectly even in SLN biopsy alone. It has been shown that arm lymphedema are in the range of approximately 7% with SLN biopsy alone, whereas the incidence of lymphedema ranged from 7% to 77% in patients who undergo ALND.[4]

The axillary reverse mapping (ARM) procedure aims to identify and preserve nodes and/or lymphatics draining from the arm during ALND, thereby minimizing arm lymphedema.[5,6] It has been hypothesized that the lymphatic pathway from the arm is uninvolved by breast cancer metastases.[7] However, the ARM nodes may be involved in patients with extensive axillary lymph node metastases. In addition, the SLN draining from the breast may coincide with the ARM node draining from the arm in some patients. Moreover, the success of ARM procedure has not yet been confirmed in preventing arm lymphedema. These issues are important drawbacks of the ARM procedure. On the other hand, the Z-0011 trial has demonstrated that the omission of ALND is safe in selected patients with positive SLN undergoing breast-conserving surgery (BCS) with whole-breast irradiation and systemic therapy.[8,9] However, it should not be indicated in patients who underwent total mastectomy. This article reviews the literature regarding the ARM procedure, and evaluates the feasibility of this technique in the modern era of breast cancer management.

Concept of ARM and variations of lymphatics from the upper extremity

The concept of ARM involves mapping the lymphatic drainage from the upper extremity to determine the anatomical lymphatic variation and thus have a roadmap to preserving them.[10] If arm lymphedema is caused by disruption of axillary lymphatics, then being able to identify and preserve them would prevent lymphedema. In fact, "ARM procedure is the reverse of SLN biopsy that serves to identify and then remove the lymph nodes draining from the breast".[10] However, it is not always possible to preserve the ARM nodes and/or lymphatics, because complete lymphatic preservation may be not compatible with oncological radicality.[7] Boneti et al.[11] have identified multiple variations of ARM lymphatics in the axilla as shown in Fig. 1. Usually, these lymphatics appear from the arm just lateral to the thoracodorsal vessels under the axillary vein.[11] Some of ARM lymphatics (Lymphatic routes 2, 3 and 4) could be near or within SLN biopsy field. These variations are complex and put the arm lymphatics in the risk of disruption during ALND and/or SLN biopsy.

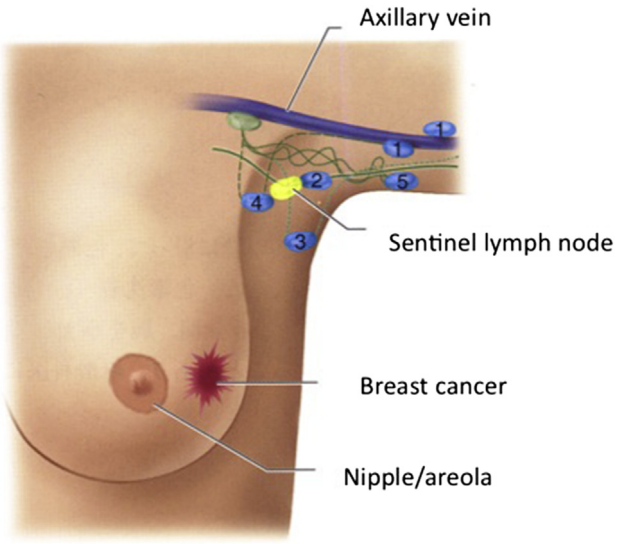

Figure 1. Variations of ARM lymphatics (from 45. Klimberg VS. Axillary reverse mapping. Chapter 14, In: Atlas of Breast Surgical Techniques (Klimberg VS, editor), Surgical Techniques Atlas Series (Townsend CM Jr, Evers BM, editor). Philadelphia: Saunders Eleseviers, 2010: 174–81). Lymphatic routes (1): above or below the axillary vein; (2): a sling pattern that may come as much as 4 cm below the axillary vein; (3): a lateral apron; (4): a medial apron; and (5): a twine or cord-like pattern of multiple small nodes.

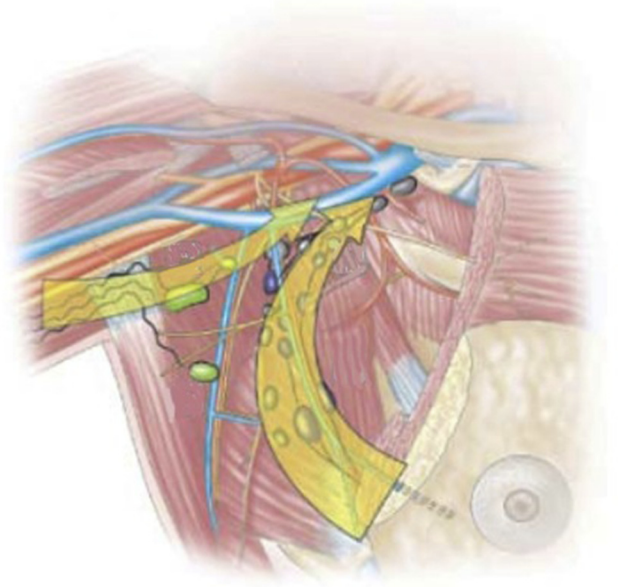

Figure 2. The hypothesis of two distinct lymphatic pathway in the axilla: a medial draining from the breast and a laterally draining from the arm (from Clough et al. Br J Surg 2010; 97:1659–65).