

# Role of Axillary Reverse Mapping in Breast Cancer to Decrease Complications

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## Abstract

**Introduction:** The concept of axillary reverse mapping (ARM) is to map this part of upper limb drainage. If lymphedema of the upper extremity is caused by removing lymphatics and nodes situated in the axilla, theoretically the ability to map these lymphatics would enable surgeons to preserve them.

**Aim:** The aim of the study was to study the effect of ARM technique on the incidence of seroma and lymphedema after modified radical mastectomy (MRM).

**Materials and Methods:** A prospective, randomized, and controlled study over 40 female patients who underwent MRM. Patients were divided and randomized into study and control groups, 20 patients for each. In the study group, the ARM procedure was done by injecting 2.5 ml of methylene blue dye intradermally and subcutaneously in the upper inner ipsilateral arm along the medial intramuscular groove before axillary lymph node dissection. Operative and post-operative results were recorded.

**Results:** ARM procedure and successful visualization of arm lymphatics were achieved in 17 patients (85%). Statistically, there was no significant difference between the two groups regarding patient and tumor characteristics, operative time and a number of excised lymph nodes. There was significant difference favoring the ARM group in decreasing the incidence of seroma, lymphedema and time passed till remove drains.

**Conclusion:** ARM procedure facilitated arm lymphatics visualization. It is an easy non-time-consuming procedure. It resulted in a significant reduction in the incidence of seroma and lymphedema, with a considerable reduction in the overall complications rate.

**Key words:** Arm lymphedema, Axillary lymph node dissection, Axillary reverse mapping, Seroma

## INTRODUCTION

Breast cancer is the most common malignancy in women worldwide, with an increased incidence almost every year.<sup>[1]</sup> Nowadays, the general survival after breast cancer treatment is good with a 5-year survival of 85% or more.<sup>[2]</sup> Due to the increasing survival, the quality of life becomes more and more important for breast cancer patients. Quality of life is impacted by the morbidities provoked by breast cancer treatment. Patients treated with axillary lymph

node dissection (ALND) as well as sentinel lymph node biopsy (SLNB) experience a wide variety of morbidities such as axillary web syndrome, numbness, loss of range of motion, pain, scapular winging, fatigue, and lymphedema<sup>[3-5]</sup> Lymphedema is one of the most dreaded morbidities due to the chronicity related to this morbidity. Although serious efforts have been made to reduce the invasiveness of the surgery, lymphedema is still morbidity encountered by breast cancer patients.<sup>[6,7]</sup> The incidence of lymphedema depends not only on whether ALND has been combined with subsequent radiotherapy but also on the definition of lymphedema used. Most of the lymphatic drainage of the upper extremity is situated cranial to the axillary vein. However, some lymphatics may also be situated below the axillary vein and therefore communicate with lymph nodes which mainly drain the (female) breast. The concept of axillary reverse mapping (ARM) is to map this part of upper limb drainage. If lymphedema of the upper extremity is

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caused by removing lymphatics and nodes situated in the axilla, theoretically the ability to map these lymphatics would enable surgeons to preserve them. The use of this technique has been described for both SLNB and ALND.<sup>[8]</sup> In most of these reports, ARM was used for separate removal of the lymph nodes of the upper extremity.

### Aim

The aim of the study was to study the effect of ARM technique on the incidence of seroma and lymphedema after modified radical mastectomy (MRM).

## MATERIALS AND METHODS

In this prospective study; patients with clinically node-positive invasive breast cancer, confirmed by fine-needle aspiration cytology and planned for ALND were included. Patients were divided into two groups; Group A MRM was done with ARM and Group B (control group): MRM was done without ARM. All patients were submitted to complete history taking, physical examination and pre-operative work up to diagnose cancer and detect its metastasis. We excluded patients arranged for conservative breast surgery or SLN, patients arranged for immediate breast reconstruction and patients with advanced breast cancer. After completion of simple mastectomy and 5–10 min before ALND, 2.5 ml of methylene blue dye was injected intra-dermally and subcutaneously in the upper inner arm along the medial intramuscular groove of the ipsilateral side. The upper inner area was chosen simply because it has the most rapid drainage and it hides the tattoo that could last from 1 week to 6 months. After injection, the site was massaged and the arm was elevated for 5 min to enhance arm lymphatic drainage. Axillary dissection in the study group was done from the lateral side first to detect and preserve the mapped lymphatic channels. The entrance of the axilla in the control group was done as usual from medial to lateral. After dissection through the axillary fascia, we could identify and preserve the apparent blue lymphatics draining the arm and ligation of the injured ones. Coagulate mood of diathermy was used to control bleeding from small vessels. Two limbs of 16 F suction drains were placed in all patients. One limb was placed in the axilla and the other one under the upper flap. Tape measurement of the arm circumference 10 cm above and below olecranon process was used to detect lymphedema. This was done preoperatively and 2 weeks, 1, 3, and 6 months postoperatively up to 24 months.

## RESULTS

A total of 40 patients were randomly included into two groups; Group A underwent MRM with ARM and Group B

underwent MRM without ARM. The average age of the patients was 51.28 years and with the rate from 36 to 64 years. There was no statistical difference between age groups. There was no statistical difference noted between menopausal of the patients. The average tumor size of Group A was  $2.69 \pm 0.38$  cm and in Group A was  $2.72 \pm 0.41$  cm, no statistical difference noted. The upper outer quadrant was common in both groups [Table 1]

The average operative time for Group A was  $110.28 \pm 9.25$  min and Group B was  $92.51 \pm 8.91$  min, there was no statistical difference noted. Successful mapping to the axillary lymphatics of the upper limb occurred in 17 patients (85%), three failed. There was no significant difference between the numbers of lymph nodes harvested between groups. There was statistical difference noted in between drain removal days, reduction duration was noted in Group A [Table 2]. Notable complications reduction noted in Group A [Table 3].

## DISCUSSION

Breast cancer has remained the second leading cause of cancer death among women worldwide over the past

**Table 1: Basic characteristics of the study group**

Variables	Group A	Group B
Age (Years) Mean±SD	49.54±6.12	54.28±5.12
Tumor size (cm) Mean±SD	2.69±0.38	2.72±0.41
Tumor Side		
Right	11	12
Left	9	8
Tumor site		
UOQ	11	10
LOQ	5	6
UIQ	1	0
LIQ	1	1
Central	2	3

SD: Standard deviation, UIQ: Upper inner quadrant, LIQ: Lower inner quadrant, UOQ: Upper outer quadrant, LOQ: Lower outer quadrant

**Table 2: Distribution of operative characteristics**

Variables	Group A	Group B	P value
Operative time	110.28±9.25	92.51±8.91	0.102
Number of lymph nodes	16.91±1.89	16.42±2.9	0.612
Drain removal (days)	10.89±0.61	13.28±1.82	<0.0001

**Table 3: Distribution of complications**

Complications	Group A	Group B	P value
Seroma	2	5	<0.0001
Lymphedema	1	4	
Infection	1	4	
Dehiscence	1	2	

three decades with estimated 28% of all females' newly diagnosed cancer and 15% of estimated annual causes for deaths in the USA in 2010 and contributing significantly to cancer surgical load. In breast cancer, ALND remains an essential part of surgical treatment. Seroma and chronic lymphedema are the most usual complications.<sup>[9-11]</sup>

Lymphedema which is defined as an increase in arm volume >20% from baseline and due to its chronicity it is considered one of the most dreaded morbidities. The hypothesis of the ARM procedure is to map the lymphatics draining the arm into the axilla. It is postulated that the lymphatics draining the arm are not the same lymphatics that drain from the breast. When visible, the surgeon can spare these lymphatics during lymph node (s) surgery; limiting the possibility of breast cancer-related lymphedema (BCRL)

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. 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."<sup>[12]</sup> 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.<sup>[13]</sup>

The strongest evidence (level 2) concerning the effect of ARM on lymphedema was provided by a randomized control trials from Yue *et al.* The authors demonstrated that the incidence of lymphedema was significantly ( $P < 0.001$ ) lower in a sample that received ARM (=5.9%) in comparison to the control group (=33%) without ARM.<sup>[14]</sup> Unfortunately, all patients received an ALND; which makes it impossible to generalize these findings for SLN-patients. It is unlikely that ARM will completely eliminate the risk of BCRL since cross-over nodes are present in some patients. These patients do stay at risk of developing BCRL.<sup>[15]</sup> However, theoretically, there is still a clear advantage to perform an ARM procedure.<sup>[16]</sup>

## CONCLUSION

ARM facilitates much visualization and preservation of arm lymphatics during ALND. It is an easy procedure

and does not have a significant effect on operative time. ARM decreased significantly not only the incidence of post-operative lymphedema and seroma but also the time elapsed to remove the drains.

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