

Role of Focused Ultrasound in Preservation of Lateral Group of Axillary Lymph Nodes in Patients with Breast Cancer

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Abstract

Background: Breast cancer-related lymphedema of the upper extremity is a fearful annoying complication for axillary clearance in breast cancer survivors. Preservation of upper extremity lymph nodes could help in reduction of incidence of the patients complaining of post axillary clearance lymphedema.

Aim of Study: To evaluate the role of focused ultrasound on lateral group of axillary lymph nodes in evaluation of clinically palpable axillary lymph nodes thus sparing the non-suspicious lateral group by ultrasound and prevention of upcoming lymphedema.

Patients and Methods: This prospective study was conducted on fifty patients with T1 and T2 breast cancer and pathological axillary lymph nodes by ultrasound. They were scheduled for either conservative breast surgery or modified radical mastectomy with axillary clearance. Lateral group of axillary lymph nodes were divided preoperatively by focused axillary ultrasound into 2 groups. Group A included non-suspicious lateral axillary lymph nodes while group B included suspicious lateral axillary lymph nodes. During axillary dissection, the lateral group of axillary nodes (lying lateral to the thoracodorsal pedicle) was sent separately for histopathological assessment (paraffin).

Results: In Group A, 40 patients had a free lateral group by focused axillary US. By postoperative histopathology examination, 37 of them were confirmed free and only 3 cases proved to have metastatic deposits. While in group B, 10 patients had suspicious lateral group by focused axillary US. By postoperative histopathological examination, 8 of them had metastatic deposits and only 2 cases were free of the lateral group.

So we concluded that the sensitivity of focused ultrasound of lateral group of axillary lymph nodes was 72.73%, the specificity was 94.87% and the accuracy was 90% in patients who had already suspicious lymph nodes by axillary US.

Conclusion: Focused ultrasound of lateral group of axillary lymph nodes has moderate sensitivity, high specificity and accuracy. Sparing of free lateral group in patients with breast cancer could be a helpful surgical procedure aiming to reduction of the rate of upper extremity lymphedema.

Key Words: Breast cancer – Lateral group of axillary lymph nodes – Arm lymphedema – Axillary ultrasound.

Introduction

BREAST cancer-related lymphedema of the upper extremity is a fearful complication of breast cancer survivors. Lymphedema affects the life style of the patient physically complaining of arm discomfort, pain; narrow the range of movement with upper extremity disability resulting in financial problems and psychological problems to the patients as well as reduction of self-confidence and anxiety. It also increases the post-operative hospitalization rate due to lymphedema related cellulitis

[1].

Incidence of lymphedema reaches about 20% in post-operative patients. Its risk factors may include obesity, post radiotherapy and extent of axillary dissection. Its rate in patients with axillary dissection is four times that of sentinel lymph node biopsy [1].

Till early 2000s, axillary dissection was the reference surgical procedure for breast cancer. The recent trials are in favor of reducing the rate of complete axillary dissection so preserving some of the lymphatics of the upper extremity and reducing lymphedema rate [2].

Several surgical procedures are gaining acceptance to prevent breast cancer-related lymphedema. In the recent years axillary reverse mapping is a technique using blue dye to identify and preserve the axillary lymph nodes draining the upper extremity. Other few surgeons performed lymphatic microsurgical technique by lympho-venous anastomosis of the lymphatic vessels of upper extremity

[2].

Preoperative axillary ultrasound is a standard imaging technique in axillary lymph node assess-

ment. It can help reduce the false positivity of clinical examination and help in avoiding unnecessary axillary dissection. Nodal mapping by ultrasound could help to delineate suspicious axillary lymph nodes, depending on the vascular structures in the axilla as landmarks for lymph node groups [3].

In our study we hypothesized that preoperative focused ultrasound on lateral group of axillary lymph nodes, draining the upper extremity as well as its isolation and preservation intraoperatively, could help in avoiding unnecessary extensive axillary clearance.

Our aim is to reduce the rate of lymphedema of the upper extremity thus improving the quality of life of breast cancer survivors.

Patients and Methods

Study population:

This prospective study was conducted from May 2019 to December 2020 on fifty female patients who were diagnosed with operable breast cancer.

Inclusion criteria: All female patients with operable breast cancer (T1, T2) treated primarily with surgery (conservative breast surgery or modified radical mastectomy) and ALND.

Exclusion criteria:

- 1- Male patients.
- 2- Patients undergoing surgery after neo adjuvant chemotherapy.
- 3- Any previous breast or axillary surgery.
- 4- Patients with non-suspicious axillary LN by axillary US.

All patients included in the study were subjected to the following:

Clinical assessment: Detailed medical, surgical, menstrual and family history. History of intake of oral contraceptive pills or hormonal replacement therapy with estrogen and progesterone. General examination. Full breast and axillary examination.

Investigations: Routine laboratory investigations. Bilateral sonomammography. Abdominal and pelvic ultrasound. Chest X-ray. Histopathological examination for the suspicious breast mass.

Axillary US: Level 1 axillary lymph nodes is subdivided into 3 groups the lateral group, the subscapular group and the medial group. Focused ultrasound examination of the lateral group of axillary lymph nodes was performed by a radiology consultant. The lateral group of LN can be seen

near the axillary vein which drains predominantly the upper limb (first landmark). The second important landmark is the subscapular artery which is the largest branch of the axillary artery with its characteristic hook shape. After identification of the subscapular artery, the main terminal branches, the circumflex scapular artery, and the thoracodorsal arteries can be visualized.

Multi-disciplinary team: Multi-disciplinary team at the breast unit at General Surgery Department of Ain Shams University reviewed every single case independently. The MDT Included: breast surgery consultant, pathology consultant and radiology consultant. Discussion was made up upon every case including her history, examination and investigations.

Patient counseling and consent: After admission and completion of history and examination, each patient received a detailed explanation of her condition regarding the disease itself, the type of surgery and expected postoperative adjuvant therapy. Operative details of both surgical techniques were explained for each patient using pictures of similar cases to help visualization of the outcome, risks and benefits of the procedures. Possible complications were also clearly stated and explained individually for each procedure. Also the need for post-operative radiation dose to the remaining tissue of the breast and the resultant effect of this dose on the skin and cosmetic outcome was explained. All patients were evaluated by our surgical team prior to surgery, full photography of the breast were taken from multiple views. A formal consent was written and explained to the patient.

Intraoperatively: During either conservative breast surgery or modified radical mastectomy, the axillary vein is first identified followed by the thoracodorsal bundle. After that, dissection of the axilla medial and lateral to the thoracodorsal bundle was done separately. During dissection any LN above the bundle was dissected medially (specimen 1). Then the lateral group of axillary nodes (lying lateral to the thoracodorsal pedicle) was sent separately for pathological assessment. (specimen 2).

Statistical analysis:

Baseline clinic-pathologic factors of the cohort were reported as numbers and percentage. Univariate analysis was performed using Pearson chi-square or Fisher's exact test to look for relation between presences of positivity in lateral LN group and focused lateral group of axillary ultrasound. A test was statistically significant if the two-sided p -value was ≤ 0.05 . Data were analyzed using SPSS version 22.0 (IBM) for Windows.

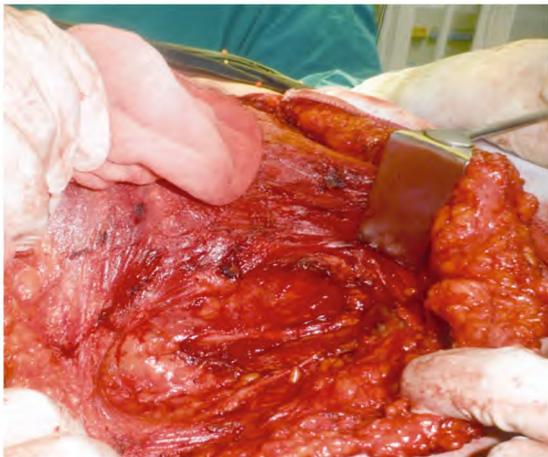


Fig. (1): Axillary fossa during modified radical mastectomy.

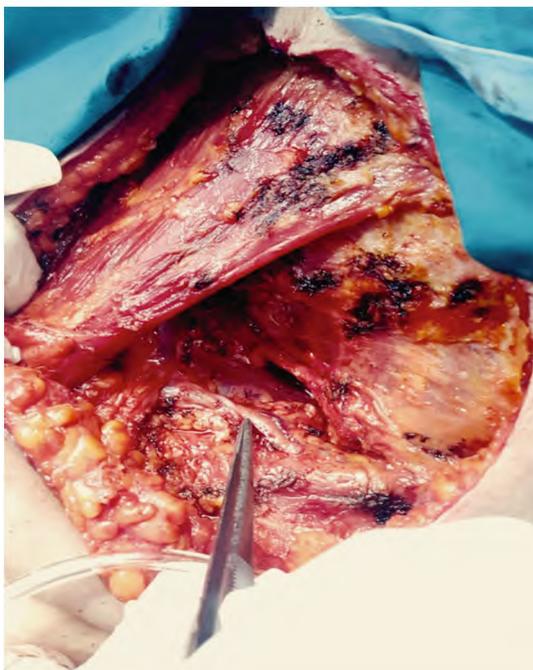


Fig. (2): Thoracodorsal bundle pointed by non toothed forceps during MRM.

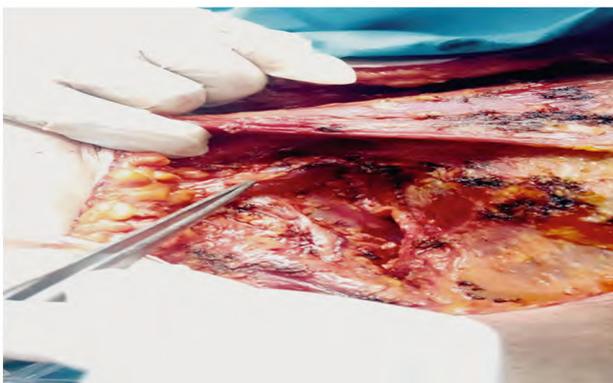


Fig. (3): Axillary vein pointed by non-toothed forceps during MRM.

Results

Patients' ages ranged from 37 to 70 years old with mean age 54 years with 7 years standard deviation, distribution of patients in different age groups is presented in, Fig. (2).

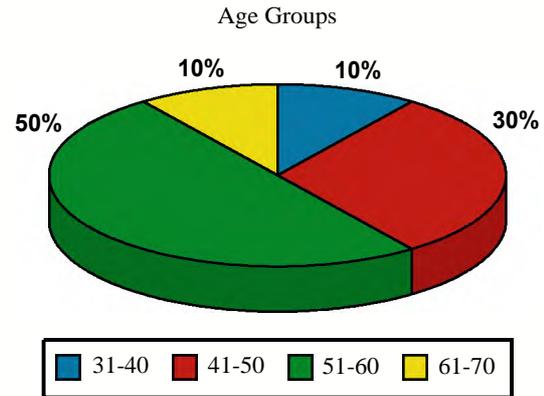


Fig. (4): Pie chart presenting the distribution of age groups in studied patients.

Clinical Presentation:

Table (1): Descriptive statistics of the mass by correlated clinical and radiological data.

Examination data	Study sample (n=50) (100%)
<i>Clinical examination:</i>	
Single mass (n, %)	40 (80%)
Multiple masses (n, %)	10 (20%)
<i>Breast examination (side of tumor):</i>	
Right breast (n, %)	33 (66%)
Left breast (n, %)	17 (34%)
<i>Clinical examination (size of tumor):</i>	
<2 cm (n, %)	10 (20%)
(2-5) cm (n, %)	40 (80%)
<i>Breast examination (site of tumor):</i>	
UOQ (n, %)	38 (76%)
LOQ (n, %)	5 (10 %)
UIQ (n, %)	5 (10%)
LIQ (n, %)	2 (4%)
Retro areolar (n, %)	–
Axillary tail (n, %)	–
<i>L.N examination (clinically):</i>	
N0 (n, %)	–
N 1 (n, %)	50 (100%)
<i>L.N examination (radiological):</i>	
Suspicious (n, %)	50 (100%)
Nonspecific (n, %)	–

The 50 female patients presented to us by uni-lateral breast tumor, 33 (66%) masses were located in the right breast, and 17 (34%) masses were located in the left breast. The commonest site of breast tumor in studied cases was UOQ in 38 patients representing 76% of the cases.

All tumors were of grade II except one that was grade III. The histopathology of 50 primary breast tumors was invasive ductal carcinoma confirmed pre-operatively by truecut and by Histopathological post-operative examination. The measurements of tumors established by means of radiological examination were between 1.5 and 5.0cm (stage T1 and T2).

Imaging evaluation: The preoperative standard axillary ultrasound assessment for all patients to assess the size, character and axillary LN status is summarized in Table (2). All 50 patients (100%) were diagnosed to have pathological lymph nodes by standard ultrasound examination.

Table (2): Descriptive statistics of radiological examination of axillary LNs.

Radiological data	Study sample (n=50) (100%)
<i>Shape:</i>	
Oval	33 (66%)
Rounded (n, %)	17 (34%)
<i>Cortical thickness* (mm)</i>	
<i>Mean ± SD (range):</i>	
5.33±3.22 (3-15)	*n=38
12 patients had lost hilum and cortical thickness was 0	
<i>Hilum:</i>	
Preserved (n, %)	5 (10%)
Eccentric (n, %)	33 (66%)
Lost (n, %)	12 (24%)
<i>Size of largest LN measured radiologically:</i>	
<2 cm (n, %)	25 (50%)
2-3 cm (n, %)	20 (40%)
>3 cm (n, %)	5 (10%)

Focused ultrasound of lateral group of axillary lymph nodes was performed for all fifty patients, showing 40 patients, 80% were non-suspicious (group A) while 10 patients, 20% were suspicious by ultrasound (group B).

Table (3): Descriptive statistics of radiological examination of lateral group axillary LNs.

Radiological data	Study sample (n=50) (100%)
<i>Shape:</i>	
Oval	40 (80%)
Rounded (n, %)	10 (20%)
<i>Cortical thickness* (mm)</i>	
<i>Mean ± SD (range):</i>	
3.33±2.22 (1.1-5.5)	*n=45
5 patients had lost hilum and cortical thickness was 0	
<i>Hilum:</i>	
Preserved (n, %)	40 (80%)
Eccentric (n, %)	5 (10%)
Lost (n, %)	5 (10%)
<i>Size of largest LN measured radiologically:</i>	
<1 cm (n, %)	40 (80%)
1-3 cm (n, %)	8 (16%)
>3 cm (n, %)	2 (4%)

Table (4): Preoperative focused US of the lateral group and its postoperative histopathological examination.

	Group A. free by US (40)	Group B. suspicious by US (10)
Total number of patients with suspicious axillary lymph nodes by ultrasound (50)		
Metastatic deposits in the lateral group (SPECIMEN 2) by histopathology	3	8
Free of the lateral group (SPECIMEN 2) from Metastatic deposits by histopathology	37	2

Table (5): Preoperative Axillary US and postoperative histopathology of the medial and lateral groups (according to thoracodorsal bundle).

	Patients with negative focused lateral group of axillary ultrasound (GROUP A) (40)	Patients with positive focused lateral group of axillary ultrasound (GROUP B) (10)
Total number of patients with suspicious axillary lymph nodes by ultrasound (50)		
Metastatic deposits in the medial groups (SPECIMEN 1) only	35	2
Metastatic deposits in both SPECIMEN	3	8
Free both SPECIMEN	2	0

Discussion

Lymph node metastasis status is a major point in the prognosis of breast cancer. Clinically evident LN affection (i.e. physical examination & radiological studies) are very essential in prediction of pathologically affected LNs [4].

Axillary lymph node dissection (ALND) has traditionally been a routine management for radical treatment. However, the lymphatic disruption caused by ALND may result in lymphedema which has a consequent bad effect on the quality of life [5].

In Milan, a mathematical model was constructed using 1,446 patients' data predicted that in order not to leave behind residual disease in 90% of patients, a minimum of 10 ALNs had to be dissected. Hence, in the TNM staging, a minimum of 10 ALNs were accepted to be crucial for precise staging of axilla. Physical examination of the axilla is notable inexact in staging, with a 30% false-positive rate and a 45% false-negative rate. Avoiding excessive axillary dissection is now accepted as the standard of care [6].

The axillary lymph nodes anatomical classification has undergone several alterations, specially related to their clinical consequences. Awareness has been paid to lymph node dissection and lymphedema, which constitutes the most incapacitating and often permanent complication after axillary clearance. Upper extremity lymphedema occurs in a very changeable percentage of patients undergoing axillary surgery (77%), and it is for this cause that some surgeons have tried new methods to avoid the excessive axillary lymph node dissection and therefore decrease the risk of lymphedema [7].

The advent of sentinel lymph nodes (SLN) biopsy technique has revolutionized the axilla surgical treatment in breast cancer patients, avoiding unnecessary ALND in selected patients. However, for those patients with involved axillary LN, ALND still be the standard of management. Although associated with several morbidities including extremities lymphedema, Potential shoulder dysfunction and numbness [8].

In 2007, Thomson et al., and Nos et al., reported for the first time, that preserving axillary reverse mapping (ARM) nodes during ALND could decrease the incidence of postoperative upper extremity lymphedema [9,10].

The conflict is between sparing of the axillary LN draining the upper extremity and the risk of compromising the oncological safety of the surgery.

Recently, clinicians try to avoid unnecessary axillary dissection by implication of only ultrasound with or without fine needle aspiration or core biopsy, to decide who can have a benefit from axillary dissection [11].

Noguchi M [12] has reported the metastatic rates to the ARM nodes in arrange from 14% to 43% indicating a possible connection between the lymphatic drainage pathways of the breast and upper limbs. Furthermore, special attention should be paid also to the possible existence of a crossover between breast SLNs and ARM lymph nodes, which may make impossible to preserve the arm draining lymph nodes [13]. This agrees with our study in which 11 of 50 breast cancer patients (22%) showed metastatic lateral group of lymph nodes draining the upper extremity.

Lee et al., [14] reported that axillary ultrasound has moderate sensitivity of 53.7%, high specificity 85.1% and accuracy 67.9%. In the current study focused axillary ultrasound of lateral group of lymph nodes showed 72.73% sensitivity, 94.87% specificity and 90% accuracy.

In our study, we found that there was considerable percentage of free lateral group of axillary lymph nodes of 39 out of 50 patients (78%). These patients underwent unnecessary extended axillary dissection and can have a benefit of limited axillary dissection.

Our study has few limitations. First, ultrasound has moderate sensitivity due to few missed pathological lymph nodes (false negative). 3 out of 40 patients (7.5%) were missed by focused ultrasound of lateral group. Second, ultrasound is operator dependent.

We recommend implication of ultrasound guided fine needle aspiration of the lateral group of lymph nodes to increase the efficacy of ultrasound examination in suspicious lymph nodes while in those non suspicious group, we recommend arm reverse mapping by blue dye. We also recommend an expertise radiology consultant for this technique.

Conclusion:

Focused ultrasound of lateral group of axillary lymph nodes has an aiding role in sparing of lateral group of lymph nodes in patients with breast cancer aiming to reduction of the rate of upper extremity lymphedema.

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دور الموجات فوق الصوتية المركزة في الحفاظ على المجموعة الجانبية من العقد الليمفاوية الأبطية في المرضى المصابين بسرطان الثدي

إن الوذمة الليمفاوية المرتبطة بسرطان الثدي في الطرف العلوي هو أحد المضاعفات للناجين من سرطان الثدي. ويؤثر الوذمة الليمفاوية على أسلوب حياة المريض حيث يشتكى جسدياً من عدم راحة الذراع، والألم، وتضييق نطاق الحركة مما يؤدي إلى مشا كل مالية ومشاكل نفسية للمرضى فضلاً عن ضعف الثقة بالنفس. كما أنه يزيد من معدل دخول المستشفى بعد العملية بسبب ازدياد معدل الإلتهاب الخلوي. تصل نسبة الإصابة بالوذمة الليمفاوية إلى حوالي ٢٠٪ في المرضى بعد العملية. وقد تشمل مسبباته على السمنة، والعلاج الإشعاعي اللاحق، ومدى استئصال الغدد الليمفاوية تحت الإبط. كما أن معدله في مرضى بعد استئصال الغدد الليمفاوية تحت الإبط هو أربعة أضعاف معدل خزعة العقدة الليمفاوية للحراسة. حتى أوائل العقد الأول من القرن الحادي والعشرين، كان استئصال الغدد الليمفاوية تحت الإبط هو العملية الجراحية المرجعية لسرطان الثدي. تتجه التجارب الأخيرة إلى خفض معدل التشريح الكا مل للغدد الليمفاوية تحت الإبط وذلك للحفاظ على بعض من الغدد الليمفاوية من الطرف العلوي وخفض معدل الوذمة الليمفاوية. وتكتسب عدة عمليات جراحية قبولاً للوقاية من الوذمة. الليمفاوية المتصل بسرطان الثدي

الموجات فوق الصوتية ما قبل الجراحة هي تقنية التصوير القياسية في تقييم العقدة الليمفاوية الأبطية. يمكن أن يساعد على تقليل الإيجابية الزائفة للفحص السريري ويساعد في تجنب التشريح الأبطي غير الضروري. التخطيط العقدي بالموجات فوق الصوتية يمكن أن يساعد على تحديد العقد الليمفاوية المثيرة للشك.

في دراستنا قمنا باستخدام الموجات فوق الصوتية قبل الجراحة على مجموعة جانبية من العقد الليمفاوية الأبطية المسؤولة عن تصريف الطرف العلوي لعزلتها والحفاظ، يمكن أن يساعد هذا في تجنب الإزالة الأبطية الموسعة غير الضرورية.

هدفنا هو خفض معدل الوذمة الليمفاوية من الطرف العلوي وبالتالي تحسين نوعية حياة الناجين من سرطان الثدي.