The Anatomy of the Axilla in Breast Cancer

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REVIEW Open Access

New classifications of axillary lymph nodes and their anatomical-clinical correlations in breast surgery

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Introduction

Breast cancer is the most common cancer in women

There are various anatomical classifications with regard to the axillary lymph nodes and their clinical implications in breast cancer

This is important as lymphoedema is one of the most disabling complications post axillary clearance

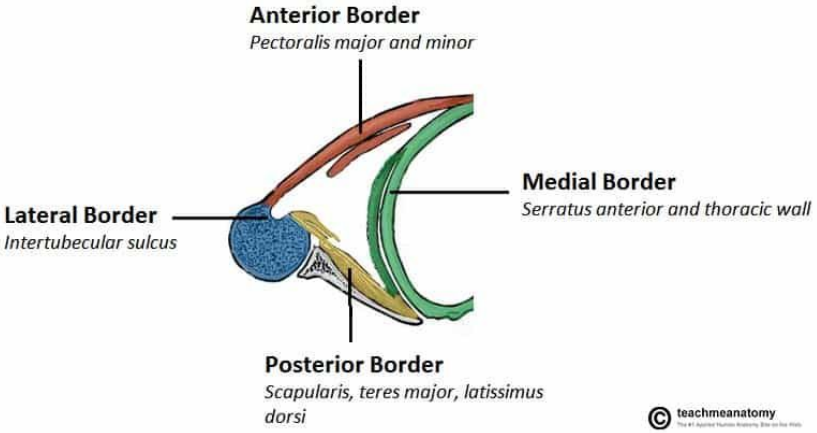
Lymphoedema has varied incidences reported (7-77%)

The mainstay of treatment for breast cancer was Modified Radical Mastectomy (MRM) with Axillary Lymph Node Dissection (ALND) until recently

The use of Sentinel Lymph Node biopsy (SLN) has reduced the use of ALND, however a significant number of patients still undergo primary or completion ALND

If the lymph drainage to the upper arm can be preserved, without compromising oncological outcomes, this can improve the complications associated with ALND

Anatomy


Anterior Border
Pectoralis major and minor
Medial Border
Serratus anterior and thoracic wall
Lateral Border
Intertubecular sulcus
Posterior Border
Scapularis, teres major, latissimus dorsi
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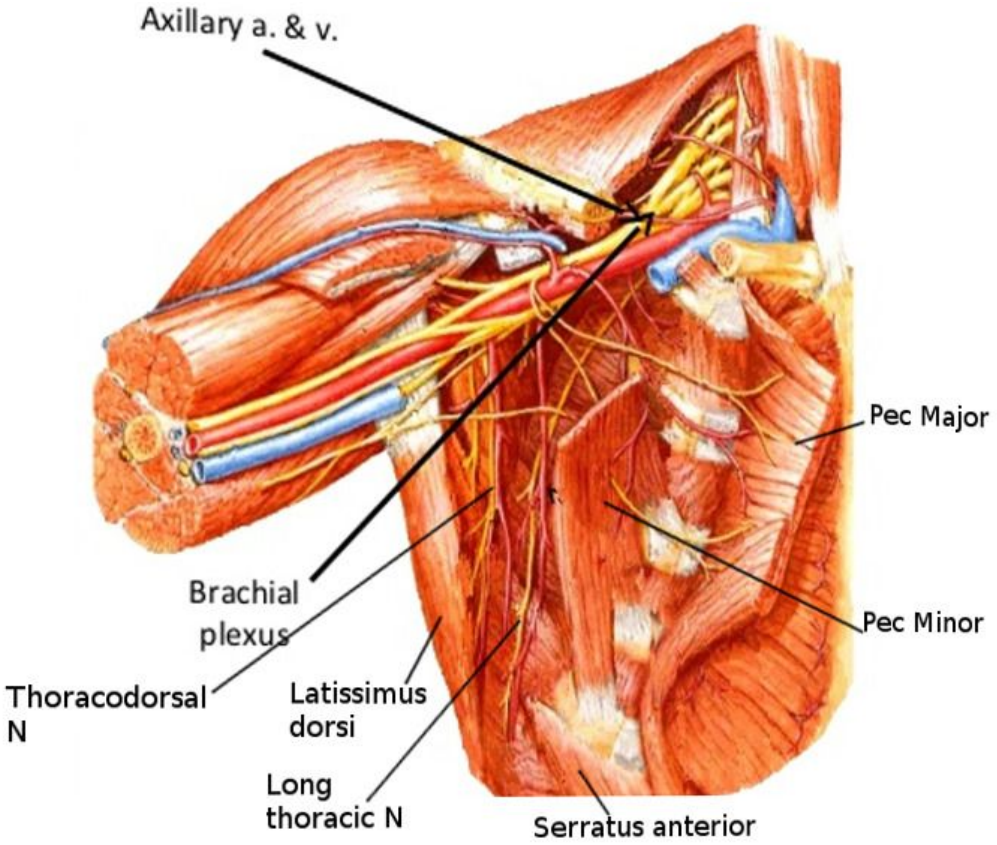
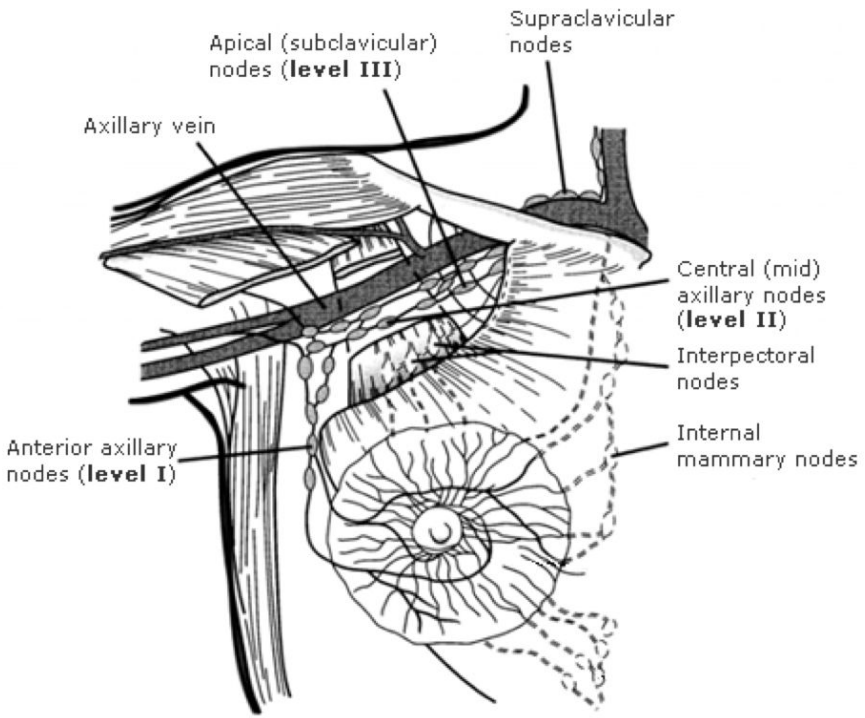
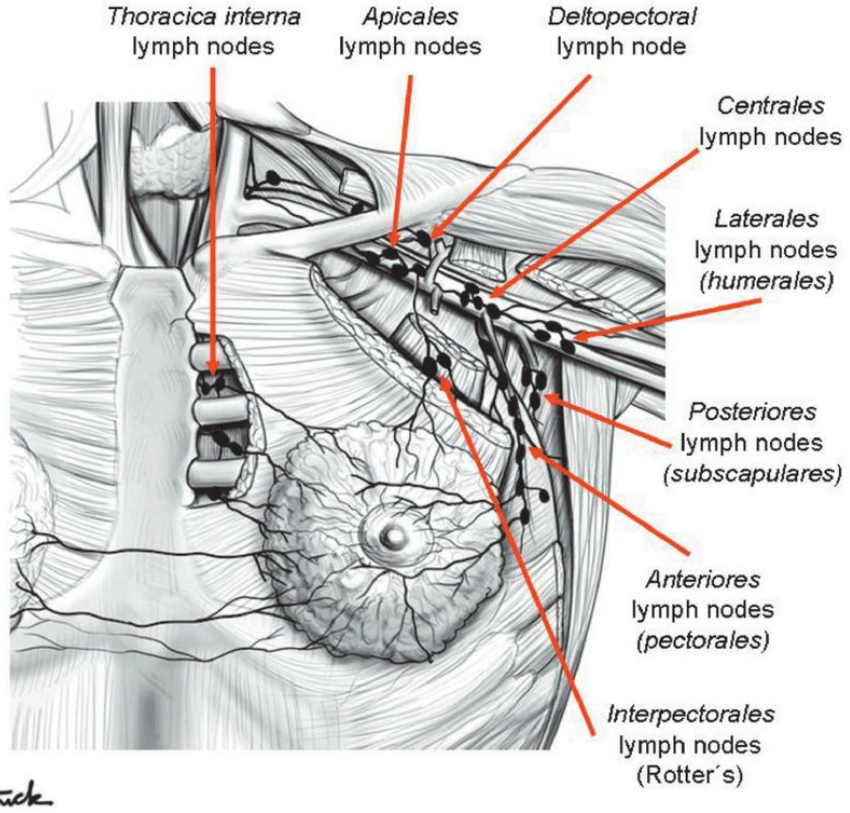

Axillary a. & v.
Pec Major
Brachial plexus
Pec Minor
Thoracodorsal N
Latissimus dorsi
Long thoracic N
Serratus anterior

Lymph Drainage of the Breast





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SURGICAL TECHNIQUE

COMPLETE AXILLARY DISSECTION: A TECHNIQUE THAT STILL HAS RELEVANCE IN CONTEMPORARY MANAGEMENT OF BREAST CANCER

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Complete Axillary Dissection

ALND is an integral part in the management of breast cancer

All node positive patients and in some cases SLN positive patients will need an ALND

At the New South Wales Breast Cancer Institute 14% of women with a tumour >20mm and vessel invasion had level 3 LN metastases

At this center, a level 3 LN clearance was associated with no increase in morbidity and minimal increase in operating time, when compared to a level 2 dissection

Procedure

Patient positioned with the lateral chest wall at the edge of the bed

Arm abducted to 90 degrees, the bed can be angled away to improve visualization of the axilla

A curved incision, convex upwards, is made below the hairline, this facilitates healing

Anterior and posterior skin flaps are raised for approximately 3 cm

Dissection continues anteromedially until the lateral border of pec major is identified, at this point the axillary tail of the breast is separated from the axillary fat pad

Serratus Anterior (SA) is identified and followed down to Latissimus Dorsi (LD), at the level of T4 is the caudal extent of the dissection, allowing the axillary fat pad to be lifted out of the axilla

The lateral edge of LD marks the lateral border of the dissection, and it can be followed cranially, the Intercostal Brachial Nerve (ICBN) will be in the dissection field and may be preserved or divided

The axillary fascia is incised 1 cm anterior to the lateral border of LD and the Thoracodorsal nerve (TD) is 2 cm medially to the border of LD

The lateral intercostal vessels can be followed towards the chest wall to identify the Long Thoracic (LC) nerve

The fascia on the muscle of SA should be preserved, keeping the nerve bound to it, and the axillary fat pad should be dissected medially and cranially off of it, continuing up to the Axillary Vein

The ICBN will be crossed, with the AV approximately 1 cm cranially

The gutter between the TD and LC can be dissected out to free up the level 1 axillary nodes

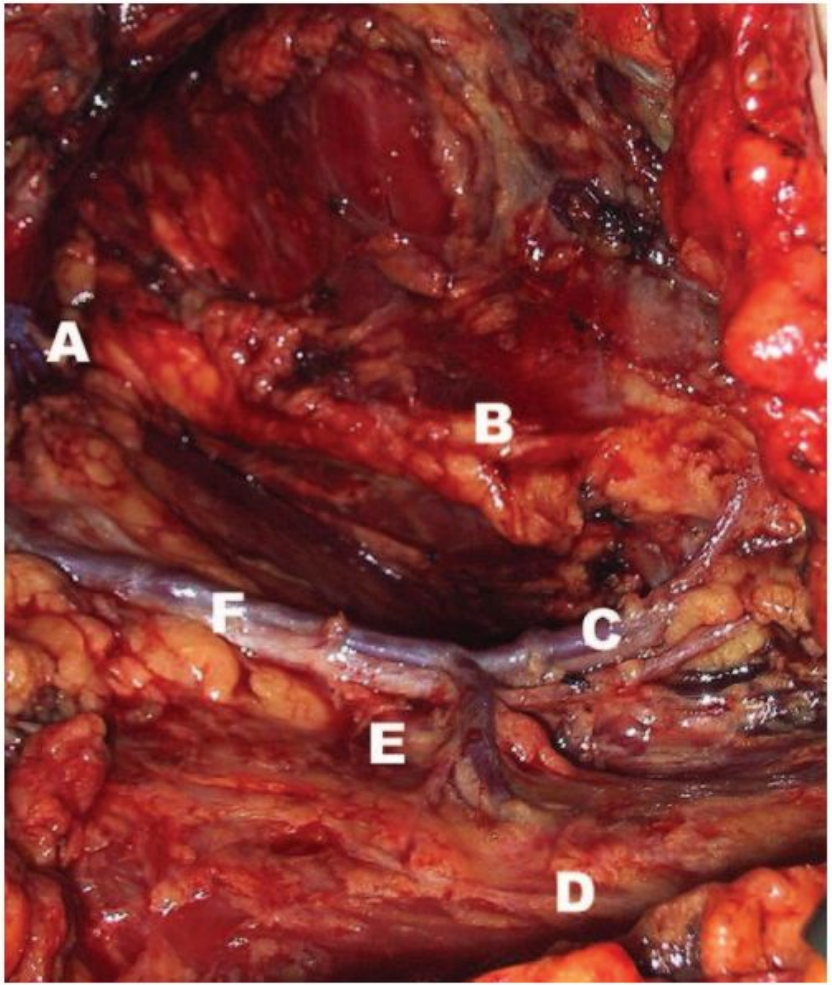


Fig. 1. A, axillary vein, exposed along its inferior length; B, long thoracic nerve, subfascial tissue remains undisturbed protecting the neuro-vascular bundle and leaving the nerve applied to the serratus anterior muscle that it supplies; C, angular vein, following this venous vascular arch towards the chest wall leads to identification of the long thoracic nerve; D, latissimus dorsi muscle, the muscular edge defines the lateral and inferior limit of the axillary dissection; E, thoracodorsal nerve, the nerve has crossed from a medial position to lie just lateral to the subscapular vessels where it enters the muscle; F, subscapular vein, along with the subscapular artery accompanies the thoracodorsal nerve (nerve to latissimus dorsi).

The axillary fat pad is retracted inferiorly, to expose the clavipectoral fascia, which is incised to identify the AV

The fat pad is dissected off the inferior surface of the AV, with care to preserve the medial pectoral nerve, lateral intercostal vessels can be divided

Dissection stops at the tendon of subclavius as the superior border

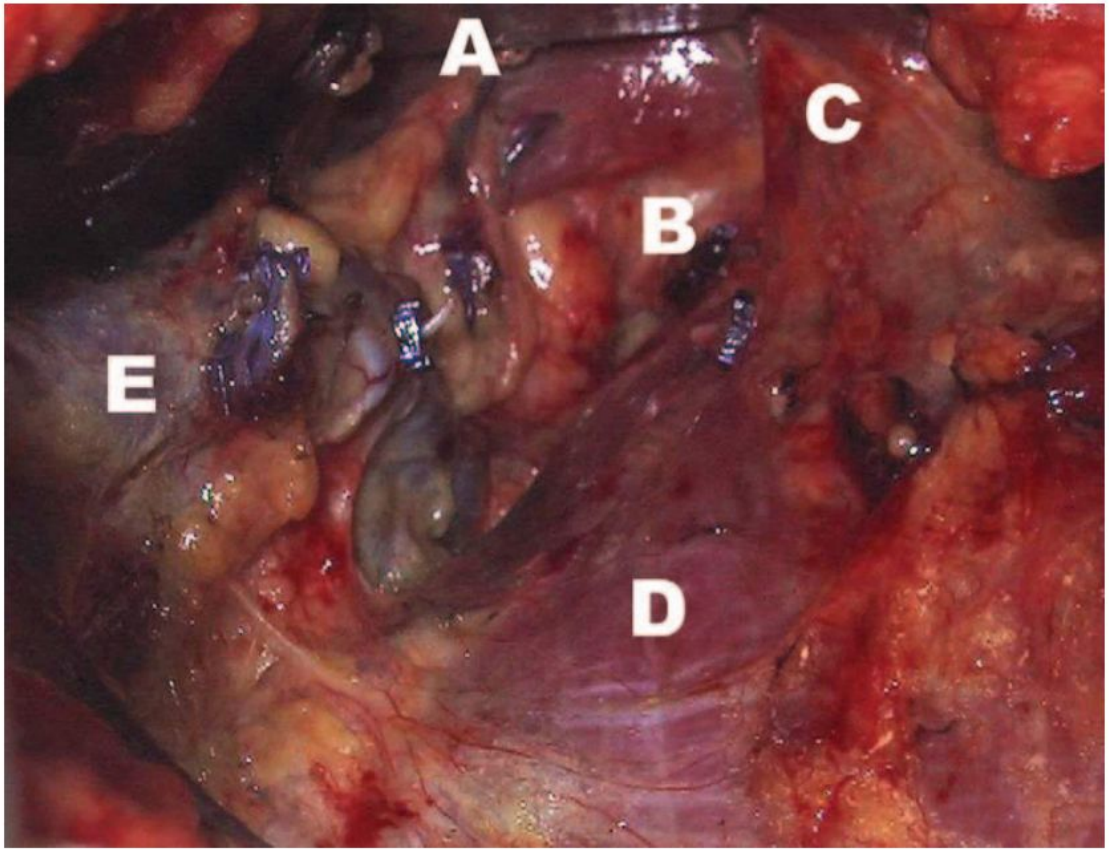


Fig. 2. A, retractor, lifts pectoralis minor and clavipectoral fascia anteriorly; B tendon of subclavius, level III proximal limit of dissection; C, pectoralis minor, anterior wall of the axilla, all nodes immediately deep to this muscle constitute the level II axillary nodes; D, chest wall, serratus anterior defines the medial wall of the axilla; E, axillary vein, defines the superior border of the axilla.

This technique was described stating that there is no published evidence showing level 3 dissection has greater morbidity than level 2 dissection

If the boundaries of the dissection are followed, there shouldn't be an increase in the rate of lyphoedema

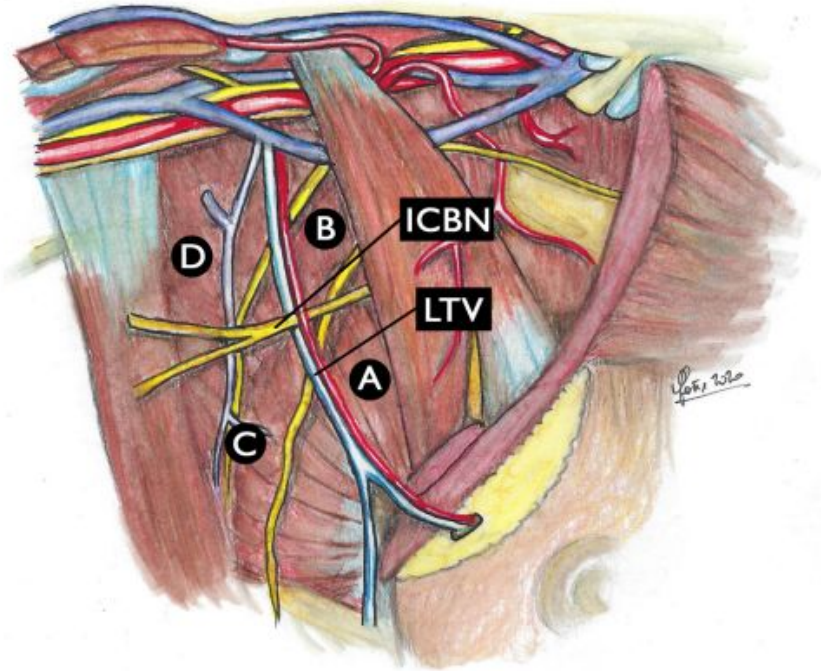
They quote one cohort had an incidence of lymphoedema in 29% undergoing both surgery and radiotherapy, as opposed to surgery (8%) or radiotherapy (6%) alone

Level 3 ALND avoids the need for radiotherapy in the axilla

Clough's Classification

In 2010, a French group classified the axillary lymph nodes in relation to the intersection of the 2nd ICBN and the Lateral Thoracic Vein (LTV)

This divided the axilla into 4 quadrants, A to D

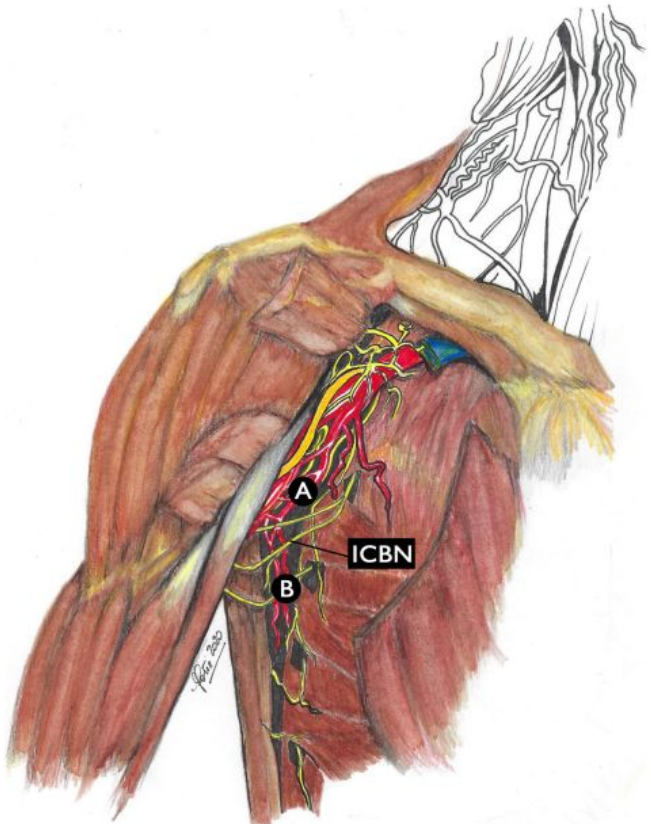


In their study of over 200 patients who underwent SLN biopsy, 98% were localized in Zone A or B

This could be used to avoid unnecessary lateral axillary dissection when performing SLN biopsy

Li’s Classification

In 2013, a Chinese group used the ICBN to divide the axillary lymph nodes into an upper part (A) and a lower part (B)



In their study of 72 patients, all SLN were found in zone B and more than 10 lymph nodes were found in that space

When micro or macrometastases were found in Zone A, there were also metastases positive nodes in Zone B

When there were no micro or macrometastases in Zone B, there were no metastases positive nodes found in Zone A

Clinical Applications

Though both of these papers were published in 2010 and 2013, there has been no other research groups who have adopted these methods

The Axillary Reverse Mapping (ARM) procedure was developed to preserve nodes draining the upper arm to decrease lymphoedema, however some studies show a 14 - 43% chance of metastases to ARM nodes

This suggests some crossover between ARM and breast SLN, and some studies have confirmed this. So even post SLN biopsy some patients experience lymphoedema

Following the ACOSOG Z0011 trial, showing the lack of benefit in ALND, even in the presence of metastases in SLN, SLN biopsy remains the gold standard for axillary management for early stage breast cancer

Upper limb lymphoedema is caused by resection of lymph nodes and lymphatic vessels during ALND and also in up to 7% of SLN biopsies

The greater the number of lymph nodes removed during SLN biopsy, especially non-SLN to reduce false negatives, the higher the rate of lymphoedema

Therefore it's important to correctly map and identify SLNs in order to minimize this risk

These studies show that lymphoedema may be minimized by keeping dissection for SLNs to below the ICBN and anterior to the LTV

There is still no clear consensus in the management of macrometastases in SLN, with regards to further axillary surgery vs no surgery and axillary surgery vs radiation

The oncological safety in the preservation of arm lymph nodes and the real effectiveness in preventing lymphoedema has not been determined yet