Updates in Management of Axilla in Breast Cancer

Essay

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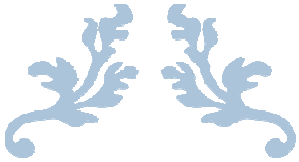

INTRODUCTION

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Breast cancer is the most common malignancy and the second most common cause of cancer-related deaths in women worldwide. Since the status of axillary lymph node is the most important prognostic factor for recurrence and survival, accurate staging of the axilla has been a key area of debate for many years. Over the last 150 years, there have been significant changes in the surgical management of breast cancer, but axillary lymph node dissection has remained an integral part of breast surgery for more than a century. Axillary dissection has stayed for years as the standard technique for the majority of cases, and it is still useful in a significant number of patients affected by this disease. ***(Luini et al., 2005).***

The routine performance of axillary dissection in patients with breast cancer has been questioned due to the relatively high postoperative morbidity, e.g. arm complications, that has a negative effect on quality of life for breast cancer patients. Arm complications include lymphedema, pain, numbness, and restricted arm mobility. These complications are influenced by the extent of surgery in the axilla, the number of removed lymph nodes, the tumor burden to the lymph nodes and whether postoperative radiotherapy is given.***(Jung et al., 2012).***

The morbidity associated with axillary lymph node dissection has led to a search for new methods that can stage the axilla accurately; however, most of these methods are still associated with minor postoperative sequelae. ***(Mansel et al., 2006).***An alternative method is axillary sampling that entails the removal of a sufficient number of suspicious lymph nodes with the aim of detecting the presence of lymph nodal metastasis, however there is a risk of under-staging the axilla and node-positive patients may go unrecognized and untreated. ***(Bassi et al., 2012)***

Introduction

Preliminary studies have shown that lymphatic mapping and sentinel lymph node biopsy using of combination of mapping techniques may stage the axilla accurately and decrease morbidity compared to axillary dissection. This minimally invasive technique allowed node negative patients to avoid the morbidity inherent in a wider dissection while providing staging information important in deciding on the need for adjuvant chemotherapy, as well as the extent of radiotherapy needed. ***(Mansel et al., 2006).***

In doing so, many patients have been spared the morbidity associated with axillary lymph node dissection. Currently, the approach to the axilla has become even more selective, as the choice of axillary lymph node dissection may be based not only on the Sentinel lymph node biopsy result but also on tumor and patient characteristics.***(Daniele et al., 2013).***

The objective of this article is to review different and recent methods in the management of axilla in breast cancer.

ANATOMY & PHYSIOLGY OF AXILLARY LYMPHATIC SYSTEM

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Since the status of axillary lymph nodes is very important in staging and determination of prognosis and different techniques of management of breast cancer,knowledge of the anatomy of the lymphatics is therefore of fundamental importance, not only knowledge of the topographic structure, but especially a concept of the functional and physiologic system as a whole, which will be reviewed at this chapter.

General Description of the Breast:

The adult female breast is located within the superficial fascia of the anterior chest wall. The base of the breast extends from the 2nd rib above to the 6th rib below, and from the sternal border medially to the midaxillary line laterally. Two third of the base of the breast lies anterior to the pectoralis major muscle; the reminder lies anterior to the serratus anterior muscle. A small part may lie over the aponeurosis of the external oblique muscle.***(Skandalakis et al., 2000).***

The average breast measures 10 to 12 cm in diameter, and its average thickness centrally is 5 to 7 cm. Breast tissue also projects into the axilla as the axillary tail of Spence. ***(Harris et al., 2000).***

The tubuloalveolar glands derived from modified sweat glands of the epidermis lie in the subcutaneous tissues. Each of the 15 to 20 irregular lobes of branched tubuloalveolar glands in the adults terminates in a lactiferous duct (2 to 4 nm in diameter) which opens into a constricted orifice (0.4 to 0.7 mm in diameter) with entry into the ampulla of the nipple ***(Fig.1)*** Immediately under the areola, each duct has a dilated portion, the lactiferous sinus. ***(Schwartz et al., 1999).***

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The skin of the breast is thin and contains hair follicles, sebaceous glands and eccrine sweat glands. The nipple, which is located over the fourth intercostal space in the nonpendulous breast, contains abundant sensory nerve endings, including Ruffini like bodies and end bulbs of the Krause. Moreover, sebaceous and apocrine sweat glands are present, but not hair follicles. The areola is circular and pigmented, measuring 15 to 60 mm in diameter. The Morgagni tubercles located near the periphery of the areola are elevations formed by opening of the ducts of the Montgomery glands.***(Harris et al., 2000).***Beneath the breast is a condensation of superficial fascia, the continuation upwards of the membranous layer of superficial abdominal fascia and forming a posterior capsule for the breast. Between this fascia and the deep fascia over pectoralis major is a submammary space in which the lymphatics run. ***(Fig.1) (McMinn, 1990).***

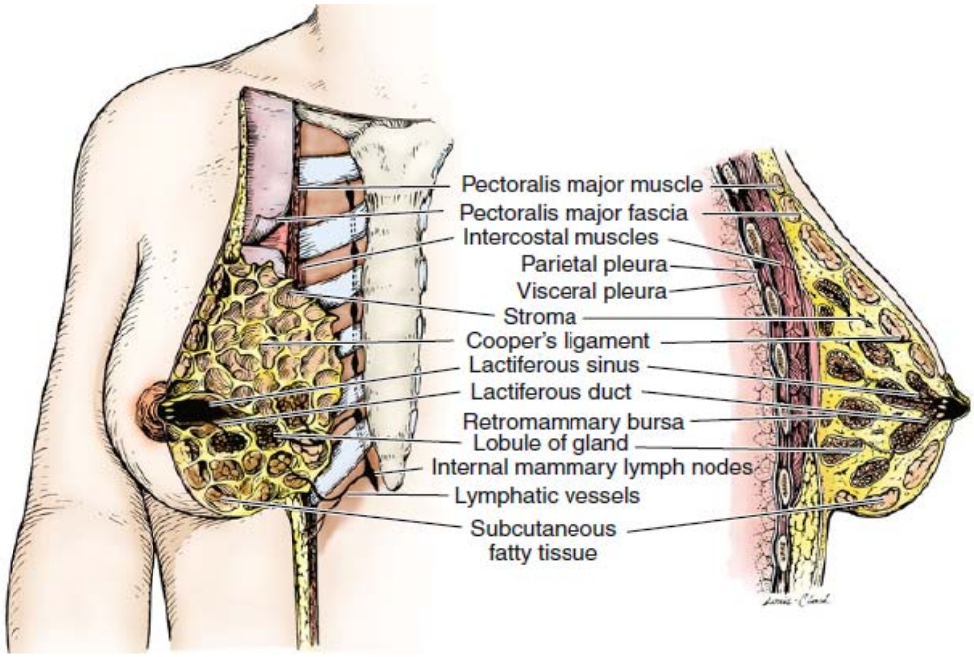

Figure1: A tangential view of the breast on the chest wall and a sectional (sagittal) view of the breast and associated chest wall.(***Bland Kirby I. and Copeland Edward M. (2009***): The Breast: Comprehensive Management of Benign and Malignant Diseases.*Elsevier*; 4th edition, chapter 54, page 21)

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AXILLA:

➢ *Boundaries of the Axilla*

The axilla is a pyramidal compartment between the upper extremity and the thoracic walls ***(Fig.2)***. It is described as having four walls, an apex, and a base. The curved base is made of axillary fascia and skin. Externally, this region, the armpit, appears dome-shaped (and covered with hair after puberty). The apex is not a roof but an aperture that extends into the posterior triangle of the neck through the cervicoaxillary canal. The cervicoaxillary canal is bounded anteriorly by the clavicle, posteriorly by the scapula, and medially by the first rib. Most structures pass through the cervical axillary canal as they course between the neck and upper extremity. The anterior wall is made up of the pectoralis major and minor muscles and their associated fasciae. The posterior wall is composed primarily of the subscapularis muscle, located on the anterior surface of the scapula, and to a lesser extent by the teres major and latissimus dorsi muscles and their associated tendons. The lateral wall is a thin strip of the humerus, the bicipital groove, between the insertions of the muscles of the anterior and posterior walls. The medial wall is made up of serratus anterior muscle that covers the thoracic wall in this region (over the upper four or five ribs and their associated intercostal muscles).

(Bland and Copeland, 2009).

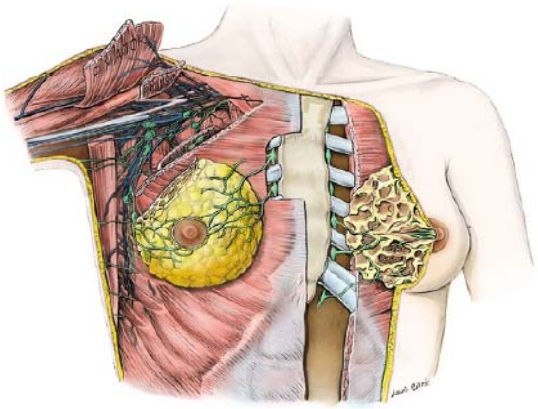

Figure 2: The anterior chest illustrating the structure of the chest wall, breast, and axilla..(Bland Kirby I. and Copeland Edward M. (2009): The Breast: Comprehensive Management of Benign and Malignant Diseases. Elsevier; 4th edition, chapter 54, page 27)

- ***Contents of the Axilla***

The axilla contains the great vessels and nerves of the upper extremity. These, along with the other contents, are surrounded by loose connective tissue.

(Fig.2) illustrates many of the key relationships of structures within the axilla. The vessels and nerves are closely associated with each other and are enclosed within a layer of fascia, the axillary sheath. This layer of dense connective tissue extends from the neck and gradually disappears as the nerves and vessels branch. The axillary artery may be divided into three parts within the axilla.

1. The first part, located medial to the pectoralis minor muscle, gives one branch the supreme thoracic artery that supplies the thoracic wall over the first and second intercostal spaces.
2. The second part, located posterior to the pectoralisminor muscle, gives two branches the thoracoacromialartery and the lateral thoracic artery. Thethoracoacromial artery divides into the acromial,clavicular, deltoid, and pectoral branches. The lateralthoracic artery passes along the lateral borderof the pectoralis minor on the superficial surface ofthe serratus anterior muscle. Pectoral branches ofthe thoracoacromial and lateral thoracic arteriessupply both the pectoralis major and minor musclesand must be identified during surgical dissectionof the axilla. The lateral thoracic artery isof particular importance in surgery of the breastbecause it supplies the lateral mammary branches.
3. The third part, located lateral to the pectoralis minor, gives off three branches the anterior and posterior circumflex humeral arteries and the subscapular artery. Although the latter artery does not supply the breast, it is of particular importance in the surgical dissection of the axilla. It is the largest branch within the axilla, giving rise after a short distance to its terminal branches, the subscapular circumflex and the thoracodorsal arteries, and it is closely associated with the central and subscapular lymph node groups. In the axilla, the thoracodorsal artery

crosses the subscapularis and gives branches to it and to the serratus anterior and the latissimus dorsi muscles. A surgeon must use care in approaching this vessel and its branches to avoid undue bleeding that obscures the surgical field.

The axillary vein has tributaries that follow the course of the arteries just described. They are usually in theform of venae comitantes, paired veins that follow anartery. The cephalic vein passes in the groove betweenthe deltoid and pectoralis major muscles and then joinsthe axillary vein after piercing the clavipectoral fascia.***(Bland and Copeland, 2009).***

Throughout its course in the axilla, the axillary artery is associated with various parts of the brachial plexus **(Fig.3)**. The cords of the brachial plexus—medial, lateral, and posterior—are named according to their relationship with the axillary artery. A majority of the branches of the brachial plexus arise in the axilla. The lateral cord gives three branches, namely, the lateral pectoral nerve, which supplies the pectoralis major; a branch that communicates with the medial pectoral nerve, which is called the ansa pectoralis; and two terminal branches, the musculocutaneous nerve and the lateral root of the median nerve. Injury to the medial or lateral pectoral nerves, or the ansa pectoralis, which joins them, maylead to loss of muscle mass and fatty necrosis of the pectoralis major or minor muscles, depending of the levelof nerve injury. The ansa pectoralis lies anterior to theaxillary artery, making it vulnerable to injury duringlymph node dissection in the axilla.***(Grife et al., 2002)***.

The medial cord usually gives five branches, the medial pectoral nerve, the median brachial cutaneous nerve, the medial antebrachial cutaneous nerve, and two terminal branches the ulnar nerve and the medial root of the median nerve. The posterior cord usually has five branches. Three of these nerves arise from the posterior cord in the superior aspect of the axilla—the upper subscapular, the thoracodorsal, and the lower subscapular; the cord then divides into its two terminal branches the axillary and radial nerves.***(Bland and Copeland, 2009).***

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Two additional nerves are of particular interest tosurgeons because they are vulnerable to injury duringaxillary dissection: the long thoracic nerve, which is abranch of the brachial plexus, and the intercostobrachialnerve. The long thoracic nerve is located on the medialwall of the axilla. It arises in the neck from the fifth,sixth, and seventh roots of the brachial plexus and then entersthe axilla through the cervicoaxillary canal. It lies onthe surface of the serratus anterior muscle, which itsupplies. The long thoracic nerve is covered by the serratusfascia and is sometimes accidentally removed withthe fascia during surgery. This results in paralysis of partor all of the serratus anterior muscle. The functionaldeficit is an inability to raise the arm above the level ofthe shoulder (or extreme weakness when one attemptsthis movement). A second nerve, the intercostobrachial, is formed by the joining of a lateral cutaneous branch of the second intercostal nerve with the medial cutaneous nerve of the arm. This nerve supplies the skin of the floor of the axilla and the upper medial aspect of the arm. Sometimes, a second intercostobrachial nerve may form an anterior branch of the third lateral cutaneous nerve. This nerve is commonly injured in axillary dissection, resulting in numbness of the skin of the floor of the axilla and the medial aspect of the arm. Lymph nodes are also present in the axilla. They are found in close association with the blood vessels. ***(Bland and Copeland, 2009).***

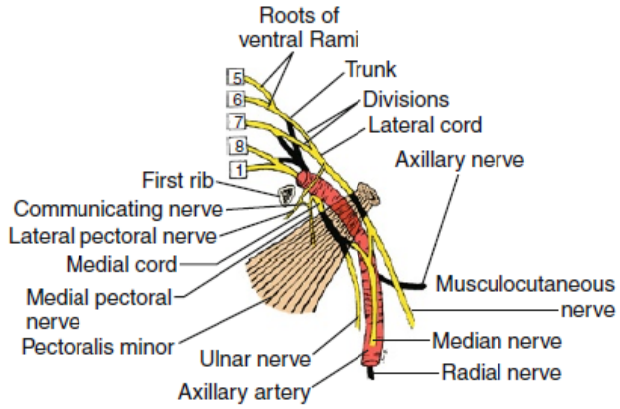

Figure3: The brachial plexus & its basic components.(Bland Kirby I. and Copeland Edward M. (2009): The Breast: Comprehensive Management of Benign and Malignant Diseases. Elsevier; 4th edition, chapter 54, page 28)

Axillary Fascia:

The anterior wall of the axilla is composed of the pectoralis major and minor muscles and the fascia that covers them. The fasciae occur in two layers: (1) a superficial layer investing the pectoralis major muscle, called the pectoral fascia, and (2) a deep layer that extends from the clavicle to the axillary fascia in the floor of the axilla, called the clavipectoral (or costocoracoid) fascia. The clavipectoral fascia encloses the subclavius muscle located below the clavicle and the pectoralis minor muscle ***(Fig.4)***.

The upper portion of the clavipectoral fascia, the costocoracoid membrane, is pierced by the cephalic vein, the lateral pectoral nerve, and branches of the thoracoacromial artery. The medial pectoral nerve does not pierce the costocoracoid membrane but enters the deep surface of the pectoralis minor muscle, supplying it, and passes through the anterior investing layer of the pectoralis minor muscle to innervate the pectoralis major muscle.

The lower portion of the clavipectoral fascia, located below the pectoralis minor muscle, is sometimes called the suspensory ligament of the axilla. ***(Bland and Copeland, 2009).***