Recent Trends In

Primary Breast Reconstruction After Mastectomy

Essay

Submitted For Partial Fulfillment Of Master Degree In general Surgery

Presented by

Ramy Magdy Adly

M.B, B.CH

Faculty Of Medicine,

Ain Shams University

Supervised by

Prof .Ashraf Farouk Abadeer

Professor Of General Surgery,

Ain Shams University

Dr. Gamal Fawzy Samaan

Lecturer of General Surgery,

Ain Shams University

2012

Acknowledgement

First of all, I thank **ALLAH** who had blessed me and gave me the power to finish this work,

I would like to express my deepest gratitude and appreciation to **Prof. Ashraf Farouk Abadeer**, Professor of general surgery, Faculty of Medicine, Ain Shams University, for his guidance, supervision, and support.

My best regards to **Dr. Gamal Fawzy Samaan**, Lecturer of General Surgery, Faculty of Medicine, Ain Shams University for his help and encouragement through this work.

Last but not least I would like to express my best regards and thanks to my father, my Mother and my Sister who gave me a hand while working in this research and I would like to dedicate this work to everyone who supported me to complete this work.

Introduction

Breast cancer accounts for the highest prevalence of malignant diseases in the female population of industrialized countries. In the United States breast carcinoma is the most common malignancy among women, with an estimated 215,990 new cases diagnosed in 2004 (**Jacqueline et al., 2008).**

Breast cancer (malignant breast neoplasm) is cancer originating from breast tissue most commonly from the inner lining of the ducts or the lobules that supply the ducts. Prognosis and survival rate varies greatly depending on cancer type and staging. The treatment depends on staging as 10 years disease free survival varies from 10% to 98%. Treatment includes surgery, drugs (hormonal therapy and chemotherapy) and radiation **(Krueger et al., 2009).**

The two main options for the management of primary breast cancer are total mastectomy and partial mastectomy with radiation .Although partial mastectomies (lumpectomy or quadrantectomy) conserve the nipple and areola complex and native breast tissue, asymmetry and distortion of the breast can still occur **(Gui et al., 2008).**

Breast conserving surgery may not be appropriate either because of size or extent of tumor, patient preference for total mastectomy, or, rarely, because of some contraindication to radiotherapy. Most patients for whom total mastectomy is either necessary or is elected are candidates for breast reconstruction **(Cunningham et al., 2007).**

The main issue in reconstruction after mastectomy is the timing of reconstruction, either immediate or delayed reconstruction **(McLaughlin et al., 2007)**.

Surgeons may need two or more operations to achieve a correctly positioned and naturally appearing breast. However, breasts probably won't be completely symmetrical afterward. The breast reconstruction process can also entail reconstruction of the nipple and tattooing to define the dark area of skin surrounding the nipple **(Handel et al., 2007).**

Breast reconstruction may be performed at the time of mastectomy (immediate reconstruction) or at a later date (delayed reconstruction). Options available for the patient when considering breast reconstruction range from skin expansion and flap reconstruction to microsurgical free tissue transfer **(Gamboa, 2006**).

The most common reconstructive techniques involve a two-phase procedure. In the first phase, the breast mound is created and allowed to heal. In the second phase, the breast shape is refined and the nipple-areola is created **(Moustapha H, James W et al., 2007)**.

Commonly, the breast mound is created using either an implant with or without a tissue expander, or an autologous tissue reconstruction procedure. After mastectomy, there is usually not enough remaining skin to allow primary implant placement, and tissue expansion is often required **(Meretoja et al., 2007)**.

The Breast reconstruction by using implants carries the possibility of significant complications such as infection, implant rotation and capsular contracture of scar tissue that forms around the implant and compresses the implant and breast tissue into a hard or unnatural shape. Correcting any of these complications may require additional surgery **(Disa et al., 2008).**

Most patients are reluctant to harbor foreign material in their bodies and thus opt for use of autologous tissue alone. Various parts of the body may serve as donor sites, such as the back as latissmus dorsi flap, the gluteal area and the abdominal wall as transverse rectus abdominis musculo-cutaneous (TRAM) flap **(McLaughlin et al, 2007).**

Surgical Anatomy of the Female Breast

Understanding the anatomy of the breast and its relation to the underlying chest structures is important for the successful management of breast diseases.

The main bulk of the tissue of the breast is concentrated in its upper quadrant, which is thus the most common site for the breast cancer and most benign breast pathologies ***(Harold et al., 1993)***.

The nipple level is usually situated at the level of the fourth intercostal space in men and nulliparous females but its position is inconstant when the breasts are pendulous ***(Moore & Keith 1992).***

The shape of the breast is best represented by as a cone with a spherical surface contour, an arched base and an eccentrically situated top deviated fifteen degrees laterally. Using the nipple as a reference point, each breast is divided into four quadrants, superio-lateral, superior- medial, infero-lateral and infero-medial, in addition to the retro-areolar area and axillary tail ***(Yerra et al., 1997).***

The mature breast lies *cushioned in adipose tissue* between the subcutaneous fat layer and the superficial pectoral fascia, although the adult breast varies greatly in size, its base is fairly constant anatomically, extending from the second to the sixth rib in the mid-clavicular line and overlying the pectoralis major, serratus anterior and external oblique muscles. Laterally, the breast reaches midaxillary line (***Blans et al., 2001)***.

Axillary tail of Spence: This is elongation of the outer part of the gland which passes up to the level of the third rib in the axilla, where it is in direct contact with the lymph nodes of the breast. This process of the breast tissue gets into the axilla through an opening in the axillary fascia, known as the foramen of Lange. It follows that the axillary tail is under the deep fascia, and not, like the rest of the breast, superficial to this layer. When it enlarges it may be mistaken for a lipoma (***Beer 2002)***.

The adult female breast has two components. These are the epithelial elements responsible for milk formation and transport, namely

the acini and ducts, and the supporting tissue, muscles, fascia and fat (***John E. Skandalakis et al., 2006)***.

The epithelial component consists of twenty or more *lobes*. Each lobe drains into a mammary duct, each of which ends separately at the nipple. The lobe consists of lobules, the number of which is very variable (***Lange 1986).***

Each lobule is a collection of between ten and a hundred acini group around, and converging on a collecting duct. Each acinus is a sphere of cells capable of milk secretion, draining into terminal duct. It is the confluence of the terminal ducts which gives rise to collecting ducts. Looking at the breast from the front, the major mammary ducts lie behind the areola. The lobules occupy the most peripheral part of the breast *(Skandalakis et al., 1995)*

The areola contains involuntary muscles arranged in concentric rings as well as radially in the subcutaneous tissue. The areolar epithelium contains numerous sweat glands and sebaceous glands, the latter of which enlarge during pregnancy and serve to lubricate the nipple during lactation (Montgomery's tubercles). The nipple is covered by thick skin with corrugations near its apex lies the orifices of the lactiferous ducts. The nipple contains smooth muscle fibers arranged concentrically and longitudinally; this is an erectile structure which points outwards **(*McVay 1984)***

The nipple is a conical or cylindrical prominence that is located in the center of the areola. In nulliparous females, the nipples are usually situated at the level of the fourth intercostal spaces. However, the position of the nipples varies even in the same woman. The tip of the nipple is formed of circular arranged smooth muscle fibers that compress the lactiferous ducts and erect the nipple when they contract Skin *(Skandalakis et al., 1995).*

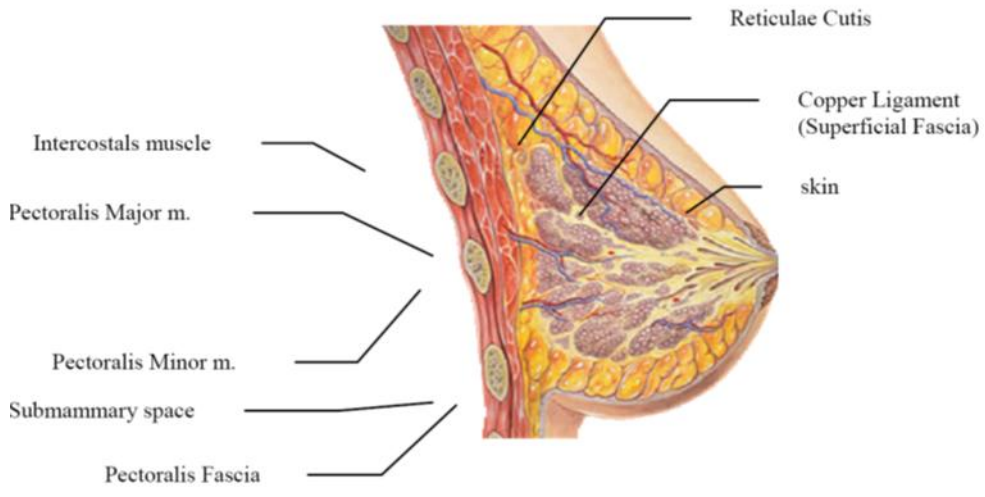
The epidermis of the areola and the nipple is distinguished from that of the surrounding skin by the pink color imparted by blood vessels carried close to the surface in long dermal papillae. In females at puberty, and with each pregnancy, there is an increase in the melanin content of

the basal cells, further darkening the area. The dermis of the skin merges with the superficial fascia, which envelops the parenchyma of the breast. *(John E. Skandalakis 2006).*

The superficial fascia completely envelops the lobes of the breast; each is formed by 15–20 lobes of glandular tissue, fibrous connective tissue that supports its lobes, and the adipose tissue that resides in parenchyma between the lobes. Strands of fibrous tissue forming the suspensory ligaments of Cooper connect the dermis of the overlying skin to the ducts of the breast and the superficial fascia which is condensed to form the posterior capsule. The posterior capsule helps maintain the protuberance of the female breast *(Kirby 2007).*

The deep layers of superficial fascia that lies upon the posterior surface of the breast fuses with the deep (pectoral) fascia of the chest wall. The deep fascia envelops the pectoralis major muscle and travels below with the deep abdominal fascia. ***(Colborn & Skandalakis 1993)***.

Fig. 1: Diagrammatic sagittal section through the non lactating female breast and anterior thoracic wall. *(Skandalakis et al., 1994)*



A posterior extension of this fascia is continuous with the fascia of the latissimus dorsi and forms the so-called suspensory ligament of the

axilla. The suspensory ligament is found in the retromammary space which is a bloodless plane *(Colborn & Skandalakis, 1993)*.

Another bloodless plane lies just deep to the dermis, in thin individuals 2-3 mm deep to the skin. *(Iglehart 1991).*

The axilla is defined as a pyramidal space having an apex, a base, and four walls. The apex is a triangular space bordered by the clavicle, the upper border of the scapula, and the first rib, which is sometimes called the cervico-axillary canal. The base consists of the axillary fascia beneath the skin of the axillary fossa. The anterior wall is composed of three muscles (the pectoralis major, the pectoralis minor, and the subclavius) and the clavi-pectoral fascia, which envelops the muscles and fills the spaces between them. The posterior wall is formed by the scapula and three muscles: the subscapularis, the latissimus dorsi, and the teres major. The medial wall consists of the lateral chest wall, with the second to sixth ribs, and the serratus anterior muscle. The lateral wall is the narrowest of the walls, being formed by the bicipital groove of the humerus. ***(Sinnatamby 2006).***

Three nerves of significance are located in the axilla:-

1) *The long thoracic nerve,* arises in the neck from the fifth, sixth, and seventh cervical roots, and enters the axilla through the cervico-axillary canal. It lies on the medial wall of the axilla, and on the lateral surface of the serratus anterior muscle. It might be accidentally injured during axillary dissection as it's invested by the serratus fascia causing "winged scapula" deformity. ***(John E. Skandalakis et al., 2006).***

2) *The thoraco dorsal nerve* originates from the posterior cord of the brachial plexus and innervates the latissimus dorsi muscle. Its injury causes muscle atrophy hindering autologus reconstruction with the latissimus dorsi muscle and impairs shoulder function. ***(Sinnatamby 2006).***

3) *The intercosto-brachial nerve* is formed by the merging of the lateral cutaneous branch of the second intercostal nerve with the medial cutaneous nerve of the arm; it provides sensory innervation of the skin of the apex and lateral axilla and the upper medial and inner aspect of the arm. ***(Kirby 2007).***

Blood supply of the breast:

Arterial supply:

With considerable variation, the breast is supplied with blood from three sources: the internal thoracic artery, branches of the axillary artery, and the intercostal arteries

1- *The internal mammary artery:* This arises from first part of subclavian artery, gives perforating branches (most notably the second to fifth perforators) supply the breast.
2- *The thoraco acromial artery:* it is a short branch of second part of the axillary artery.
3- *The lateral thoracic artery:* from second part of axillary artery.
4- *The terminal branches of the third to eighth intercostal vessels and the vessels to serratus anterior.*

The internal mammary vessels accounts for 60% of the total breast blood supply. The lateral thoracic supply contributes about 30% of total breast vascularity. *(McMinn 1994)*

The medial breast portion receives from the branches of the internal thoracic artery, especially in the 2nd and 3rd intercostal spaces. The lateral part is supplied by the lateral thoracic artery. Inferiorly, it is supplied by the anterior intercostal arteries, especially in the 4th and 5th intercostal spaces. The superior portion receives perforators of the supra-clavicular and the thoraco acromial arteries. These vessels anastomose below the nipple areola complex (NAC), and then follow the connective tissue framework to penetrate the gland. *(Corduff & Taylor 2003)*

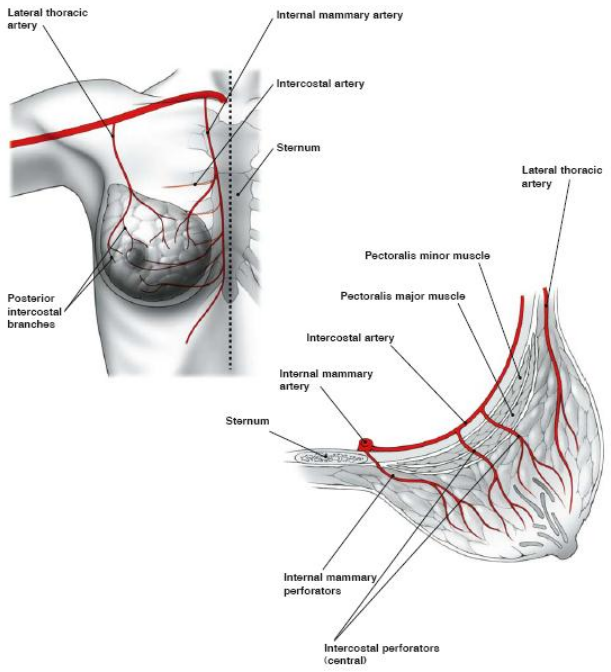


Fig: 2: Arterial supply.*(Ismail Jatoi et al.,2006)*

Venous drainage:

The venous drainage of the breast is divided into two systems: the superficial and the deep system. The venous drainage of the breast is important not only because of the route of hematogenous metastatic spread from carcinomas, but also because of the lymphatic vessels generally follows the same course. *(Haagensen 1986)*

A) The superficial venous system:

The superficial veins lie just deep to the superficial fascia. The superficial and deep veins anastomose with each other through the mammary gland and it may anastomose crossing the midline. *(Herniques, 1982)*

B) The deep venous system:

Venous drainage is mainly by deep veins that run with the main arteries to internal thoracic, axillary, subclavian veins and azygous system via the intercostal veins. The posterior intercostal veins anastomosis with the vertebral veins provides an important link and hence a pathway for metastatic spread to the bone. *(Mc Minn 1994)*

Nerve supply to the breast:

The second to sixth intercostal nerves supply breast innervation.

Lateral innervation is predominantly from the anterior rami of lateral cutaneous branches of the third to the sixth intercostal nerves. Medial innervation arises from the anterior cutaneous branches of the second to the sixth intercostal nerves.

Nerve supply to the nipple is from the third, fourth, and fifth anterior and lateral cutaneous nerves. The fourth intercostal nerve is the most important nipple inner vator. *(Elizabeth & Hall-Findlay 2007).*

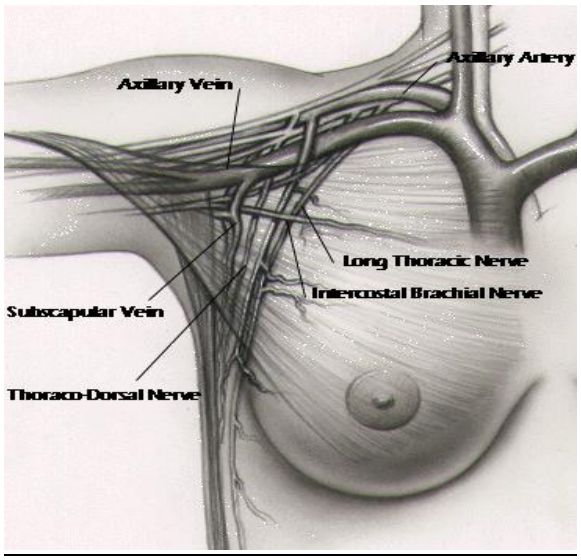


Fig: 3: Nerve supply of the breast.(Marisa Weiss, et a .,2006)

Lymphatic Drainage:

A) *LYMPHATIC VESSELS OF THE BREAST*

(Kirby in 2007) discussed the three interconnecting groups of lymphatic vessels draining the breast:

1- *A primary set* of vessels originate as channels within the gland in the interlobular spaces.
2- *The vessels draining the glandular tissue* and the overlying skin of the central part of the gland passing directly into the sub areolar plexus.
3- A rich *lymphatic plexus lies upon the deep surface of the breast* communicating with lymphatic vessels of the deep fascia. ***(John 2009).***

Current understanding of the lymphatic system of the breast is derived mainly from the work of the anatomist Sappy in the 1850s. *(Hiroo Sumai et al.,2007)*

The major groups of Haagensen are:

1) Axillary 2) Internal thoracic (mammary) (Haagensen et al., 1972).

1) Axillary Drainage:

Group1: External mammary nodes (the anterior pectoral nodes.)

These lie along the lateral edge of the pectoralis minor, deep to the pectoralis major muscle, along the medial side of the axilla following the course of the lateral thoracic artery on the chest wall from the second to the sixth rib. Deep to the areola there is an extensive network of lymphatic vessels, the so-called sub-areolar plexus of Sappy. In the circum-areolar region, large lateral and medial trunks receive much of the lymph from the breast parenchyma. The lateral trunk receives collaterals from the upper half of the breast and the internal trunk drains the lower part of the breast. These vessels pass around the lateral border of the pectoralis major muscle to reach the

external mammary nodes.

Group2: Scapular nodes.

These lie on the subscapular vessels and their thoraco dorsal branches. Lymphatics from these intercommunicate with intercostal lymphatic vessels.

Group 3: Central nodes.

This is the largest group of lymph nodes; they are the nodes most easily palpated in the axilla, because they are generally larger in size. They are embedded in fat in the center of the axilla. When these nodes enlarge, they can compress the inter-costobrachial nerve, the lateral cutaneous branch of the second or third thoracic nerve, causing accompanying pain.

Group 4: Interpectoral nodes (Rotter'snodes).

These lie between the pectoralis major and minor muscles. Often there is a single node. They are the smallest group of axillary nodes and will not be found unless the pectoralis major is removed.

Group5: Axillary vein nodes.

This is the second largest group of lymph nodes in the axilla. They lie on the caudal and ventral surfaces of the lateral part of the axillary vein.

Group6: Sub-clavicular nodes.

These lie on the caudal and ventral surfaces of the medial part of the axillary vein.*(Blans & Vezerids 2001)*

Haagensen considered them to be inaccessible unless the pectoralis minor muscle is sacrificed.*(Marisa Weiss et al.,2006)*.

2) Internal Thoracic (Mammary) Drainage:-

Lymphatic vessels emerge from the medial edge of the breast on the pectoralis fascia. They accompany the perforating blood vessels, which, at the end of the intercostal space, pierce the pectoralis major and intercostal muscles to reach the internal thoracic nodes. These nodes also receive lymphatic trunks from the skin of the opposite breast, the liver, the diaphragm, the rectus sheath, and the upper part of the rectus abdominis. The nodes, about four to five on each side, are small and are usually in the fat and connective tissue of the intercostal spaces. The internal thoracic trunks empty into the thoracic duct or the right lymphatic duct. This route to the venous system is shorter than the axillary route. *(Skandalakis et al. 1995)*

Since dissection of the internal mammary nodes is not done today, Scatarige et al advised lateral chest radiography, computed tomography, high-resolution sonography, magnetic resonance imaging, and radionuclide lympho scintigraphy. *(Scatarige et al., 1990)*

The regional lymph nodes :-

Winer et al expanded the regional lymph node terminology to include a transpectoral route in the axillary group. We present their classification verbatim. *(Winer et al., 2001)*

The breast lymphatics drain by way of three major routes: axillary, transpectoral, and internal mammary. Intramammary lymph nodes are

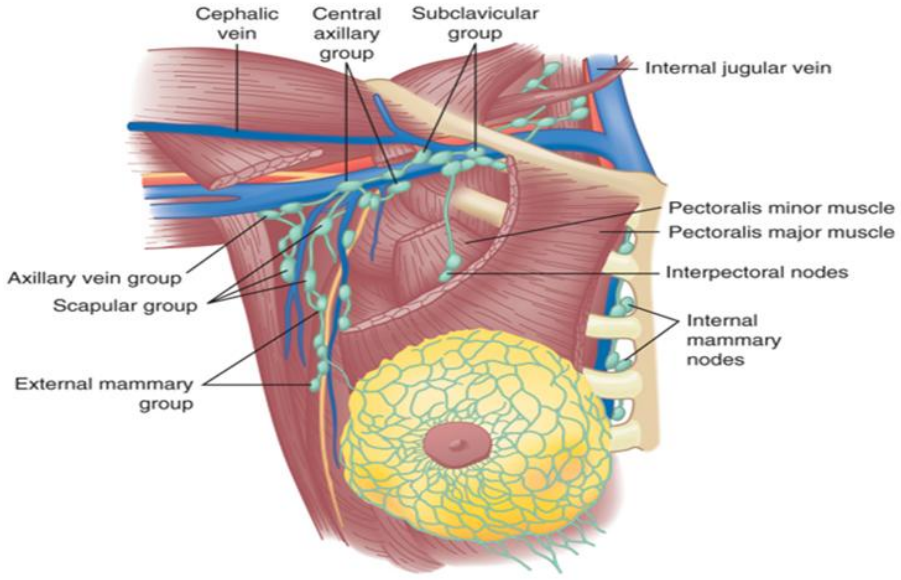
considered with, and coded as, axillary lymph nodes for staging purposes; metastasis to any other lymph node is considered distant (M1), including supraclavicular, cervical, or contralateral internal mammary.

1. Axillary (ipsilateral):

Inter-pectoral (Rotter's) nodes and lymph nodes along the axillary vein and its tributaries that may be (but are not required to be) divided into the following levels:

a) *Level I (low axilla):* lymph nodes lateral to the lateral border of the pectoralis minor muscle.
b) *Level II (mid axilla):* lymph nodes between the medial and lateral borders of the pectoralis minor muscle and the inter-pectoral (**Rotter's**) lymph nodes.
c) *Level III (apical axillary):* lymph nodes medial to the medial margin of the pectoralis minor muscle including those designated as subclavicular, infraclavicular, or apical.

Fig: 4: The Axillary Lymph Nodes. (Donegan WL, Spratt JS,2002)



2. Internal mammary (ipsilateral):

Lymph nodes in the intercostal spaces along the edge of the sternum in the endo-thoracic fascia.