Introduction

ℬreast cancer is the commonest cancer among women, the treatment of breast cancer in the second haft of the last century was traditionally performed by radical mastectomy, described by *Halsted* in 1894, which resulted in severe deformities, which were difficulty to reconstruct. From the 1970s. *patey's* mastectomy (modified radical mastectomy) followed by simple mastectomy became the treatment of choice. These operations resulted in less severe deformities but still required reconstruction to be cosmetically acceptable *(Kate et al., 2009).*

Breast reconstruction is now regarded as an integral part of cancer management and is requested with increasing frequency by women at the time of mastectomy. A variety of techniques have been described over the last 35 years including silicone implants, tissue expanders, latissimus dorsi (LD) myocutaneous flaps, transverse rectus abdominus myocutaneous flaps *(Kroll et al., 2007; Carlson et al., 2006).*

Myocutaneous flaps are valuable new techniques that have profoundly changed the contemporary practice of reconstructive surgery. They had been widely used only for the last 15 years and showed a great advantage in the reconstruction of specific defects that were previously difficult to reconstruct *(Elliott et al., 2004).*

The oldest technique is ***the LD flap***; which is a very safe procedure, but may requires prosthesis to match the volume of the opposite breast. The concept of immediate breast volume replacement after breast-conserving surgery using the LD muscle was first described by ***Noguchi et al. (2010).***

Noguchi et al. concluded that the immediate transposition of LD flap is useful for preventing post-quadrantectomy breast deformity ***(Noguchi et al., 2010).***

Recently because of the increased use of the TRAM flap, the LD flap is often reserved for patients in whom TRAM reconstruction is contraindicated. Additionally, LD reconstruction does not compromise the abdominal wall, which may be of issue in patients desiring future pregnancy ***(Kim et al., 2007).***

Areola and nipple reconstruction is the final step after a breast reconstruction. Tattooing is the simplest technique to areole reconstruction. For the nipple reconstruction, a tattooed skin flap or a partial contra lateral nipple graft can be used ***(Omar, 2010).***

Aim of the Work

The aim of this work is to define the perfect criteria for patients who are eligible for breast reconstruction using *latissimus dorsi* (LD) flap and patients those are not good candidates for it, and also to compare different types of myocutaneous flaps in breast reconstruction after mastectomy

Chapter (1):
Mastectomy

Anatomy of the Breast

Embriology

The breast is a modified sweat gland originating from the ectodermal layer of the embryo during the $4^{th} - 6^{th}$ week of intra-uterine life *(Romrell and Bland, 2004).*
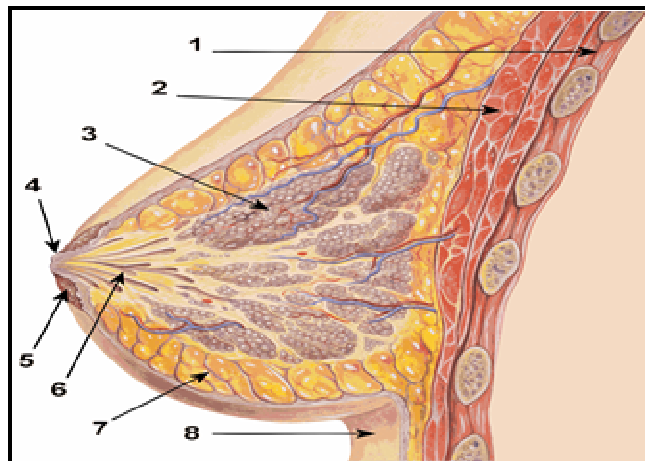
Figure (1): Anatomy of the breast 1. Chest wall 2.Pectoralis muscles 3.Lobules 4.Nipple surface 5. Areola 6. Lactiferous duct 7. Fatty tissue 8. Skin *Grant's Atlas Anatomy 12th Edition*

Consistency of the breast:

Breast tissue includes both epithelial parenchymal elements and stroma. It consists of 15 to 20 lobes of glandular tissue of the tubo-alveolar type. The lobes are subdivided into lobules. Each lobe ends in a lactiferous ducts ending into lactiferous sinuses then open through the constricted orifice into the nipple *(Romrell and Bland, 2004).*

Shape of the breast:

Normal breasts range widely in size and vary greatly in shape. The shape of the breast depends primarily upon the arrangement of the glandular tissue, the fibrous support structures and the skin envelope. In viewing the ideal breast in profile, level of the nipple is usually at or just above the infra-mammary fold *(Ramselaar, 2009).*

Site and Extension:

The adult female breast is located within the superficial fascia of the anterior chest wall. The base of the breast extends from the level of the 2nd rib to the level of 6th rib, and from the sternal border medially to the mid-axillary line laterally.there is a prolongation of the upper lateral quadrant towards the axilla forming the axillary tail of Spense. The breast tissue passes up to the level of the 3rd rib in the axilla, where it is in direct contact with the main lymph nodes of the breast *(Lawson, 2002).*

The deep fascia:

The deep fascia encloses the pectoralis major and pectoralis minor muscles and then is reflected laterally across the axilla to the LD muscle posteriorly. The breast is supported by ligament of Cooper, which gives the young breast its protuberant shape and when atrophic in old age it renders the breast to be pendulous and ptosed *(Romrell and Bland, 2004).*

Nipple and Areola:

The epidermis of the nipple and areola is highly pigmented and somewhat wrinkled. The deep surface of the epidermis is invaded by unusually long dermal papillae that

allow capillaries to bring blood close to the surface giving the region a pinkish color in immature and blond individuals. At puberty this skin becomes pigmented and the nipple becomes more prominent *(Romrell and Bland, 2004).*

Blood supply of the breast:

(I) Arterial supply:
1) Perforating branches of the internal mammary artery (60 %)
2) Lateral thoracic artery (30 %)
3) Intercostal perforators (10%)

(II) Venous drainage:
1) Perforating branches of the internal thoracic vein.
2) Perforating branches of posterior inter-costal veins.
3) Tributaries of the axillary vein.

The vertebral venous tributaries (Batson's plexus) surround the vertebrae from the base of the skull to sacrum. Venous channels exist between this plexus and veins that drained the breast, which explains metastases to the axial skeleton *(Romrell and Bland, 2004).*

(III) Lymphatic drainage of the breast (Fig 3):

A. Lymph vessels:
Which is merged to from sappy's sub-areolar plexus and deep fascial plexus, the sub-areolar plexus drains the skin of the breast, the nipple and the areola in addition to some of the central portion of the gland *(Kummar et al., 2003).*

Lymph flows in one direction from the superficial to the deep plexuses and from the sub-areolar plexus through the lymphatic vessels of the lactiferous ducts to the peri-lobular and

deep subcutaneous plexus. Flow from the deep subcutaneous and infra-mammary lymphatic vessels move centrifugally towards the axillary and internal mammary lymph nodes. Approximately 97% of the lymph from the breast flows to the axillary lymph nodes, whereas 3% of the lymph from the breast is estimated to flow to the internal mammary chain. Drainage of the lymph to internal mammary chain may be observed after injection of any quadrant of the breast with a dye *(Harris, 2010).*
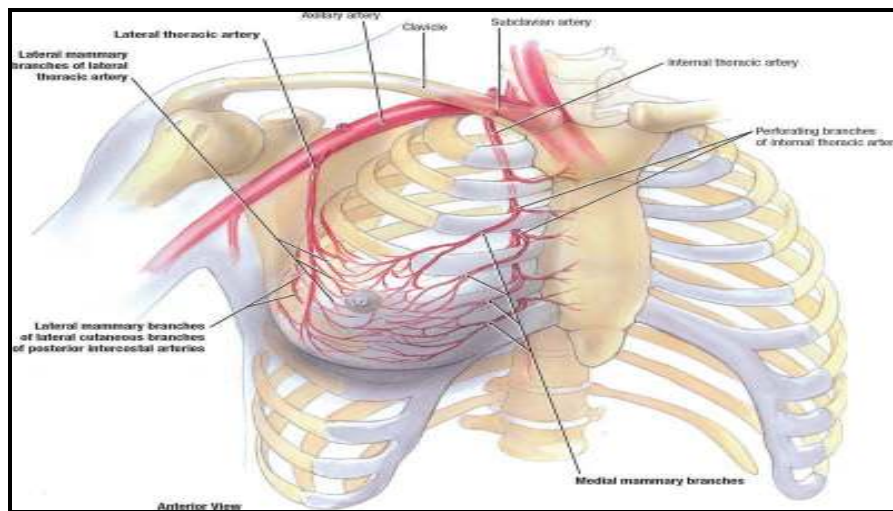

Figure (2): Arterial supply of the breast; Grant's Atlas Anatomy 12th Edition, 1,7
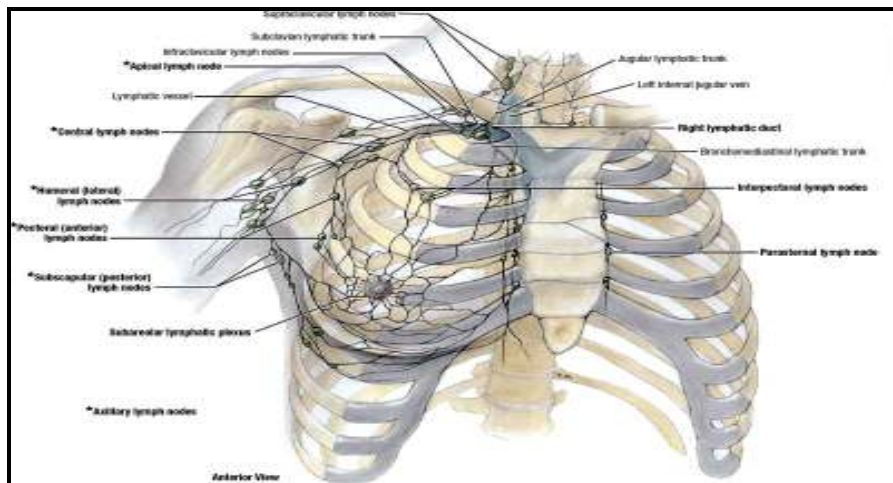

Figure (3): Lymphatic supply of the breast; Grant's Atlas Anatomy 12th Edition,1,8

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B. Lymph Nodes:

Axillary lymph nodes are classified surgically into six groups. The axilla contains up to 54 lymph nodes *(Omar, 2010).*

1) *Lateral (along the axillary vein) group:* 4-6 nodes medial or posterior to the axillary vein.

2) *Anterior (Pectoral or External mammary) group:* 4-5 nodes association with the lateral thoracic vessels.

3) *Posterior (Sub-scapular) group:* 6-7 nodes associated with sub-scapular vessels.

4) *Central group:* 3-4 large nodes embedded in the fat of the axilla,

5) *Apical (infraclavicular) group:* 6-12 nodes; these nodes extend into the apex of the axilla along the medial side of the axillary vein.

6) *Inter-pectoral (Rotter's) group:* 1-4 small lymph nodes in association with pectoral branches of the thoraco-acromial vessels

Nerve supply of the breast:

Skin of the breast is innervated by lateral and anterior branches of the intercostal nerves (T2-T6) and branches from supraclavicular nerves (C3-C4) *(Lawson, 2002).*

Nerves to the mammary parenchyma include both sensory and sympathetic fibers the sympathetic fibers pass to the glandular tissue, the smooth muscles of the areola, nipple, and the blood vessels *(Lawson, 2002).*

Breast Carcinoma

Epidemiology

Breast cancer is the commonest malignancy in women, and comprises 17% of all cancers. In Egypt, Breast cancer represents the most common cancer among females and constitutes 37% of all female cancers incidence *(Omar, 2010).*

Risk factors of breast cancer:

(A) Age:

It is the major identifiable risk factor. More than 80% of breast carcinoma in women over 50 years (*Mc Pherson et al., 2010).*

(B) Family history:

Positive family history of the disease is one of the most important risk factor; it is greater if the unaffected woman has a first-degree relative who was diagnosed with breast carcinoma at a young age *(Dite et al., 2003).*

(C) Hormonal factor:

Estrogen and progesterone affect the rate of epithelial proliferation, (*Cotterchio et al., 2003).* Early menarche and delayed menopause are associated with an increased risk of breast carcinoma, (*Cloditz et al., 2004).* Prolonged lactation has been demonstrated to be protective against breast carcinoma (*Dumitrescu and Cotarla, 2005).* Hormonal replacement therapy after menopause increases the risk of breast cancer depending on the duration of exposure and whether estrogen is used alone or combined with progestin *(Rosenberg et al., 2010).*

(D) Personal history of breast pathology:

History of benign breast diseases is known to increase the risk of developing breast carcinoma *(Hartmann et al., 2005).*

(E) Geographical variations:

Western countries have higher incidence and mortality than countries such as Japan *(Hartmann et al., 2005).*

Pathology:

Distribution:

Carcinoma is more common in the left breast, in a ratio of 110:100. The cancers are bilateral or sequential in the same breast in about 4% of cases. Among breast carcinomas, 50% arise in the upper outer quadrant, 20% in the remaining quadrants, and 30% in the central or sub-areolar region *(Laster and Cotran, 1999).*

Breast Cancer Classification:

Malignant tumors may arise from any of the breast components, Ductal carcinomas are the most common ones, followed by lobular carcinomas, and malignancies arising from other connective tissues. The following is a list of breast cancer histologic classifications from American Joint Committee on Cancer (AJCC).

Ductal

- Intraductal (in situ)
- Invasive with predominant intraductal component

- Invasive, NOS (not otherwise specified)
- Comedo
- Inflammatory
- Medullary with lymphocytic infiltrate
- Mucinous (colloid)
- Papillary
- Scirrhous
- Tubular
- Other

Lobular

- In situ
- Invasive with predominant in situ component
- Invasive

Nipple

- Paget's disease, NOS
- Paget's disease with intraductal carcinoma
- Paget's disease with invasive ductal carcinoma

Other

- Undifferentiated carcinoma

Histopathologic evaluation of a breast cancer is necessary to provide the diagnosis of the tumor, to help determine a patient's prognosis, and to help understand the nature of breast cancer overall *(Harris, 2009).*

Invasive (infiltrating) ductal carcinoma

Is the most common cell type, the tumors occur throughout the age range of breast carcinoma, being most common in women in their middle to late 50s. Invasive ductal carcinoma commonly spreads to the regional lymph nodes and carries the poorest prognosis among various ductal types *(Harris, 2009).*

Ductal carcinoma in-situ (DCIS)

Consists of malignant epithelial cells confined to the mammary ducts, without microscopic evidence of invasion through the basement membrane into the surrounding tissue. According to the tumor differentiation, DCIS can be further divided into low, intermediate, and high grade. Such stratification has prognostic implications *(Harris, 2009).*

There are five histologic subtypes of DCIS, namely comedo, papillary, micropapillary, cribriform, and solid

Invasive lobular carcinoma

Is relatively uncommon characterized by greater proportion of multicentricity in the same or the opposite breast. Patients with infiltrating lobular carcinoma are especially prone to have bilateral carcinoma. Stage by stage, invasive lobular carcinoma has a similar prognosis to infiltrating ductal carcinoma *(Harris, 2009).*

Lobular carcinoma in-situ (LCIS)

Generally lacks specific clinical or mammographic signs, and occurs more frequently in premenopausal women. By definition, these cancer cells are confined to the mammary lobules without invasion *(Harris, 2009).*

Tubular carcinoma

Is also known as a well-differentiated carcinoma. The frequency of axillary lymph node metastases is approximately 10%, lower than that of ductal carcinoma. The prognosis is considerably better than for invasive ductal carcinoma *(Harris, 2009).*

Medullary carcinoma

Is characterized by a prominent lymphocyte infiltrate. Patients with medullary carcinoma tend to be younger than those with other types of breast cancer. The prognosis is also believed to be better than for invasive ductal cancer *(Harris, 2009).*

Inflammatory Breast Carcinoma

Is characterized by diffuse skin edema, skin and breast redness, and firmness of the underlying tissue without a palpable mass. The clinical manifestation is primarily due to tumor embolization to dermal lymphatics (skin lymph channels) with associated engorgement of superficial capillaries. Inflammatory breast cancer carries a poor prognosis *(Harris, 2009).*

Paget's disease of the nipple

Is a rare form of breast cancer that is characterized clinically by eczematoid changes of the nipple. It is believed that Paget's disease represents the migration of malignant cells from subjacent mammary ducts in the nipple. The prognosis of patients with Paget's disease appears to be similar to that of women with other types of breast carcinoma, stage for stage *(Harris, 2009).*

Classification based on stage of cancer:

This is the most commonly used scheme of determining the stage of cancer and the TNM staging that takes into account the **T**umor size, lymph **N**ode involvement and **M**etastasis or spread of the cancer *(Carlson et al., 2007)*.

Protein & Gene status:

All breast cancers these days are tested for expression, or detectable effect, of the estrogen receptor (ER), progesterone receptor (PR) and HER2/neu proteins. These tests utilize principles of immunohistochemistry and once the status of these proteins it known, prognosis can be predicted and certain novel therapies may be chosen for treatment *(Harris, 2009).*

Staging of the breast carcinoma:

Once the cancer is diagnosed, it is divided as per the histological or cellular type. Next the cancer is staged. Early detection means an early stage of cancer that is usually amenable to treatment. Late stage cancers are usually advanced and have already spread to vital organs and may mean a shortened lifespan and non-responsiveness to therapy.

A simplified version of staging is:

- Sometimes, ductal carcinoma in situ (DCIS) is described as Stage 0.

- Stage 1 indicates that the tumour measures less than 2cm and the lymph nodes in the armpit are not affected.

- In stage 2 the tumour measures between 2cm and 5cm or the lymph nodes in the armpit are affected, or both.

- In stage 3 the tumour measures between 2cm and 5cm and may be attached to structures in the breast, such as skin or surrounding tissues. The lymph nodes in the armpit are affected.

- In stage 4 the tumour is of any size and the cancer has spread to other parts of the body.

(Carlson et al., 2007)

Management of cancer breast:

In 33% of breast cancer, women discover a lump in her breast. Other less frequent presenting signs and symptoms of breast cancer include:

- Breast enlargement or asymmetry.
- Nipple changes, retraction or discharge.
- Ulceration or skin erythem a of the skin of the breast.
- Musculo-skeletal discomfort

(Jatoi, 2003)