Introduction

According to the world health organization (WHO) international agency for research and cancer (IARC), breast cancer is the second most common cancer worldwide and, the most frequent cancer among women with 1.67 million new cancer cases diagnosed in 2012 (25% of all cancers). It is the most common cancer in women both in more and less developed countries. There is an incidence variation across world regions that might reach four folds, with rates ranging from 27 / 100,000 in Middle Africa and Eastern Asia to 92 /100,000 in Northern America. ***(Ferlay et al., 2015)***

Also, breast cancer ranks the fifth cause of death from all cancers (522,000 deaths per year), the most frequent cause of cancer death in women in less developed regions (324,000 deaths, 14.3% of total) and it is now the second cause of cancer deaths in more developed regions (198,000 deaths, 15.4%) after lung cancer. The range in mortality rates between world regions is less than that for incidence because of the more favorable survival of breast cancer in (high-incidence) developed regions, with rates ranging from 6 per 100,000 in Eastern Asia to 20 per 100,000 in Western Africa.(***Ferlay et al., 2015)***

In Egypt and according to the National Cancer Registry Program (NCRP), breast cancer is the second most cancer in both sexes (15.4 %) after liver cancers (23.8%) and the most common cancer in females (32%) with incidence crude rate estimated as 35.8 case per 100,000 females in 2011.***(Ibrahim et al., 2014)***.

Another study in Egypt showed that 68.9% of sampled breast cancer patients have not heard before about the possibility of breast reconstruction options in the first place; an obvious deficit that should be addressed by health education efforts.***(El-Shinawi et al., 2013)***.

In 1889 Sir William Halsted first preformed radical mastectomy operation and his principles discouraged others from the idea of breast reconstruction for about 60 years, but in 1895 Vincent Czerny an Italian surgeon was the first to preform breast reconstruction after breast mastectomy using autologous lipoma from the patient's flank. ***(Uroskie Jr 2002)***

And now after the great improvements and updated surveillance guidelines worldwide for detecting breast cancers, mastectomies became one of the main surgical procedures in which it has been estimated that about 28 – 60

% of women that diagnosed as breast cancer underwent mastectomy operations ***(McGuire et al., 2009)***.

And so breast reconstruction became one of the main concerns for breast cancer patients undergoing mastectomy by which now the patients are aiming to restore the removed breast tissues which can be done by recreating shape, contour, volume, and position of the breast, taking the opposite breast as an aesthetic reference to achieve symmetry, this can be done by several options like autologous methods, Non-autologous methods or combination of both; autologous methods like: Extended latissimus dorsi flap, Transverse rectus abdominus myocutaneous (TRAM) flap and its modifications or Superior gluteal artery perforator (SGAP) flap. Non-autologous methods like: fixed volume breast implants or breast expanders whether subcutaneously or sub pectoral placement .These methods can be done whether immediate at the mastectomy time or delayed in another stage.***(Ahmed et al., 2005)***.

One of the recent techniques that we are concerned about in this study has been introduced in 2005 by Karl H. Breuing and it was by creating an Inferolateral AlloDerm

Slings for coverage of the inferior and lateral poles of an implant after skin sparing mastectomy and sub-pectoral placement. ***(Breuing & Warren 2005)***.

It has been known that implant reconstruction has high patient satisfaction rates, it poses significant challenges for the plastic surgeon. The mastectomy defect often extends laterally beyond the natural borders of the breast, and the implant is at risk for lateral displacement over time. In thin patients, there is risk of implant visibility, rippling, and implant extrusion through their mastectomy skin envelopes. If the pectoralis muscle is damaged or absent, the implant lies in direct communication with the skin flaps, which may provoke subcutaneous scarring and capsular contracture. To help position the implant and provide an additional protective layer between implant and skin, the technique of using AlloDerm evolved to create a hammock-like pocket for the implant. The pectoralis- AlloDerm hammock decreases the mechanical force transmission to the mastectomy skin flaps and prevents implant migration.***(Breuing & Colwell 2007)***

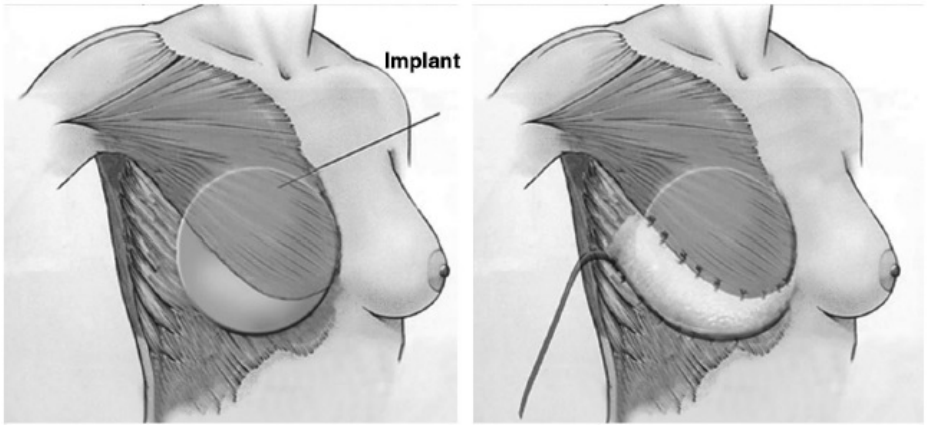

Figure (1): Creation of the AlloDerm sling. The implant is inserted under the pectoralis muscle and fascia. The AlloDerm is then fixed to the chest wall to create the inframammary fold and subsequently to the pectoralis muscle to completely cover the implant. ***(Breuing & Colwell 2007)***

Recently surgical companies started to manufacture new types of surgical meshes for the same purpose of AlloDerm to act like a sling to cover the Inferolateral part of the implant, so we have synthetic matrices made from plastic-like material: absorbable Vicryl, long-term absorbable, or non-absorbable titanium-coated polypropylene mesh. Although these meshes play a similar role to AlloDerm in breast reconstruction, its benefits and adverse effects remains unclear.

Aim of work

- To estimate the pooled benefits and adverse of using surgical meshes as Inferolateral support for sub-pectoral implant-based breast reconstruction for women underwent mastectomy operations.
- To highlight the evidence and quality of the included studies.
- To share in modifying the current guidelines.

Anatomy of the Female Breast

Female breast is formed mainly of mammary glands and fat. The mammary glands are modified sweat glands in structure and function. Their superficial origin accounts for the absence of a true fibrous capsule or sheath surrounding the glands. The glands do not benefit from a specialized vascular supply or innervation, as all these needs are derived from existing structures serving the thoracic wall ***(Lawson, 2010).***

Embryologic Development of the Breast

Embryologic development of the mammary gland consists of a series of highly ordered events involving interactions among several distinct cell types. These interactions are regulated by an array of systemic and local factors such as growth factors and hormones. ***(Forsyth, 2011)***

Breast Development:

I. Prenatal development:

During the 4th week of gestation, paired ectodermal thickenings termed mammary ridges or milk lines develop on the ventral surface of the embryo and extend in a curvilinear fashion convex towards the midline from the axillae to the

pubis. In normal human development, these ridges disappear except at the level of the fourth intercostal space on the anterior thorax, where the mammary gland subsequently develops ***(Forsyth, 2011).***

During the 5th week of gestation, the remnant of the mammary ridge ectoderm begins to proliferate and is termed the primary mammary bud. This primary bud subsequently begins growth downward as a solid diverticulum into the underlying dermis during the 7th week. By the 10th week, the primary bud begins to branch, yielding secondary buds by the 12th week, which eventually develop into the mammary lobules of the adult breast. ***(Medina D, 1996).***

During the remainder of gestation, these buds continue lengthening and branching. During the 20th week, small lumina develop within the buds that coalesce and elongate to form the lactiferous ducts. At term, approximately 15-20 lobes of glandular tissue have formed, each containing a lactiferous duct. Support for the breast comes from both the skin envelope and the fibrous suspensory ligaments of Astley Cooper that anchor the breast to the pectoralis major fascia. ***(Medina D, 1996)***

The lactiferous ducts drain into retro areolar ampullae that converge into a depressed pit in the overlying skin. Each of the 15-20 lobes of the mammary gland has an ampulla with an orifice opening into this mammary pit. Stimulated by the inward growth of the ectoderm, the mesoderm surrounding this area proliferates, creating the nipple with circular and longitudinally oriented smooth muscle fibers. The surrounding areola is formed by the ectoderm during the fifth month of gestation. The areola also contains other epidermal glands, including glands of Montgomery (sebaceous glands that serve to lubricate the areola). ***(Forsyth, 2011)***

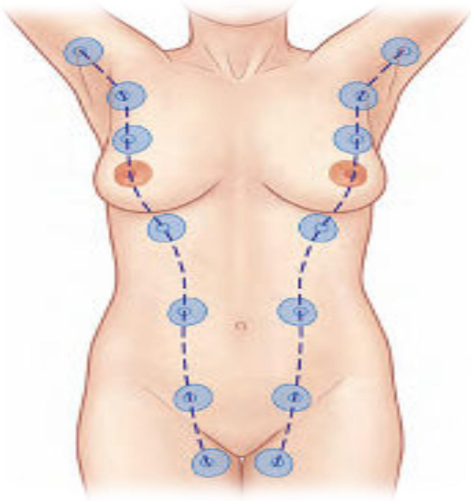

Figure (2): The milk lines ***(Standring et al., 2008)***

II. Postnatal development:

Lobule formation occurs (exclusively in females) after puberty. Externally recognizable breast development from puberty onwards can be divided into 5 separate phases. In **phase1:** there is elevation of nipple. In **phase2:** glandular subareolar tissue is present with both nipple and breast projection from the chest wall as a single mass. **Phase3:** encompasses increase in diameter and pigmentation of the areola, with proliferation of palpable breast tissue. During **phase4:** there is further pigmentation and enlargement of the nipple and areola so that the nipple and areola form a secondary mass anterior to the main part of the breast. Finally, **phase5:** there is development of smooth contour of the breast ***(Standring et al., 2008).***

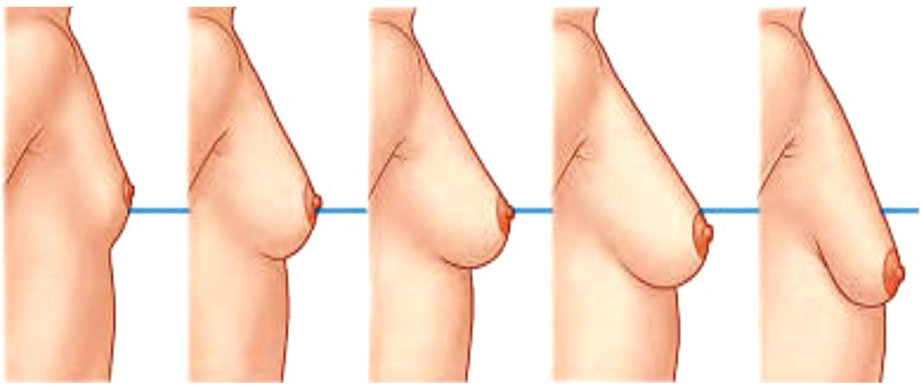

Figure (3): Stages in breast development. Pre-and post-pubertal development and structure of the female breast, demonstrating changes in the contour of the breast ***(Standring et al., 2008).***

Surgical Anatomy of the breast

The female breast is located on the chest wall between the second and sixth or seventh ribs, lateral to the sternum and medial to the anterior axillary line. It is associated posteriorly with the fascia of the pectoralis major, serratus anterior, abdominal external oblique and the most cranial part of the rectus abdominis muscles. It's ideal shape is classically described as a combination of cone and hemisphere. Its volume is determined by the amount of fatty and glandular tis- sue. The glandular tissue is less dominant until the second half of pregnancy. The gland becomes fully developed during lactation. The fatty and glandular tissue is suspended by the fascial-ligamentous system and the skin envelope. The quantity, quality and relationship of these four factors determine the shape of the breast. ***(Westreich M, 1997)***

The glandular tissue consists of 15–20, radially located lobes. They are separated from each other by cell poor, fibrous, interlobular bundles. The lobes consist of lobules. Each lobule has its own duct. The lobules are surrounded by dense fibrous tissue with a significant amount of fatty tis- sue. The 15–20 main ducts branch and finally terminate in

the terminal duct lobular unit (TDLU) that secretes milk during lactation. ***(Ramsay DT et al.,2005).***

The nipple-areola complex (NAC) is located on the most prominent part of the breast mound. There are 15–20 main ducts with 15–20 ductal orifices on the top of the nipple. According to classical anatomical descriptions, each lobe has its own main duct and orifice; however, some publications state less, 5–9 nipple ductal orifices. Possible explanations for the discrepancy may be the sebaceous glands that mimic the appearance of ducts but do not contribute to the ductal lobular infrastructure or that some ducts bifurcate shortly after emerging from the nipple. ***(Ramsay DT et al., 2005)***

The ducts have a zone which expands (lactiferous sinus) directly underneath the nipple. They serve as a milk reservoir during lactation; however, recent studies doubt their existence. The pigmented areola contains several prominences. They are modified accessory glands, so-called glands of Montgomery. Numerous sweat and sebaceous glands can be found among these, which keep the NAC lubricated and protected. ***(Love SM et al., 2004)***

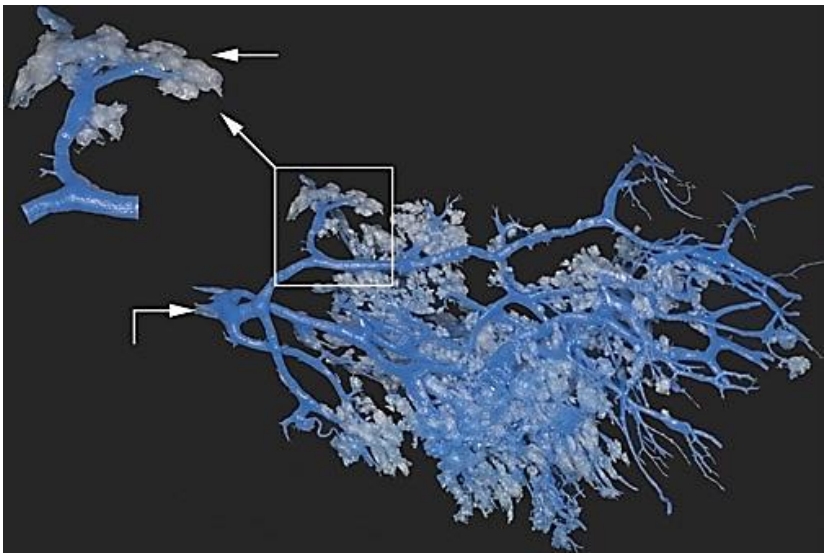

Figure (4): The lactiferous ducts of a premenopausal breast lobe are filled with plastic. *Blue color* indicates the ductal structure, while *white color* indicates the TDLUs

The breast can be divided practically into six portions. According to horizontal and vertical axes, four quadrants can be differentiated. The central substance is located behind the areola, while an extension of the breast extends into the axilla (Spence's tail). ***(Williams PL et al., 1998)***

Fascial and Ligamentous Structure

The breast integrates into the superficial fascial system of the trunk, which is located between the chest musculature and the skin***. (Lockwood TE, 1991)***

The superficial fascia of the breast encases the glandular tissue with its anterior and posterior lamella. The

anterior lamella is located superficial to the gland at varying distances from the dermis. It is important to note that the superficial fascia of the breast is not a unified demarcation sheet, but a pitted cloak-like structure. The anterior lamella has clinical significance during skin-sparing mastectomies. The posterior lamella covers the undersurface of the gland and continues as Scarpa's fascia inferiorly.

Between the posterior lamella and the pectoral fascia, the retromammary space (Chassaignac's bursa) can be found. This space contains fine areolar tissue, which can be dissected bluntly and serves as a pocket during sub-glandular breast augmentation***. (Romrell LJ et al., 1998)***

The main suspensory ligaments of the breast course from the pectoral fascia through the glandular tissue to the skin. These are the so-called Cooper's ligaments. These ligaments have three distinct segments (deep, middle, superficial) created by the aforementioned anterior and posterior lamella of the superficial fascia of the breast. The deep segment is between the pectoral fascia and the posterior lamella, the middle segment is between the posterior and anterior lamella, and the superficial segment is between the anterior lamella and the skin. Cooper's ligaments have

significant oncologic importance. Their deep segment anchors the breast to the pectoral fascia, so total removal of the gland is facilitated by removal of the pectoral fascia. A tumour may also infiltrate these ligaments causing skin retraction, which is an important diagnostic sign of breast cancer. By contraction of the pectoralis major muscle, this skin sign can be provoked, which is an important clinical indicator of malignancy. (***Cooper AP, 1840)***

The posterior lamella of the superficial fascia continues as Scarpa's fascia inferiorly. The anterior lamella also connects to the posterior lamella at the level of the fifth rib. This junction is fixed to the pectoral fascia, because the posterior lamella and the pectoral fascia get close to each other side to side. From this point several strong ligaments can be observed towards the dermis of the inferior pole and also the inframammary fold. They are considered the inframammary fold ligaments. This anatomical feature may explain the fixed position of the inframammary fold during ageing***. (Bayati & Seckel, 1995)***

There is a clinically important fibrous septum in the breast, called the septum fibrosum. It is located horizontally at the level of the fifth rib towards the nipple. It divides the