Lymphatic mapping of the breast and its surgical implication

An Essay

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In

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Axillary lymph node status of metastases has very important role in the management of breast cancer regarding; staging and prognosis.

As the concept of conserving breast surgery in early breast cancer is getting wider acceptance, the matter of axillary status was the most important question, as the axillary dissection carries several serious morbidities, such as nerve injury, seroma formation, lymphaedema, and wound infection.

Axillary lymph node random sampling did not solve the problem. As we need to get ٤ to ٦ nodes in this process, so it carries some sort of axillary dissection and it does not represent the state of the ٣ levels of axillary lymph node.

The concept of sentinel lymph node sampling provided very good solution for the study of the state of the axilla in early breast cancer without axillary lymph node dissection.

Actually the idea of conserving breast surgery and sentinel node sampling is targeting early stages of breast cancer to apply minimal excision of breast tissues and to avoid unnecessary axillary lymph node dissection in free axilla. So the patient can get the benefit of early diagnosis and treatment.

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Introduction

Breast cancer is the commonest cancer among women worldwide. It accounts for ٣٣% of all female cancers at the National Cancer Institute, Cairo University **(El-Bolkainy,** ٢٠٠٠).

For nearly a century axillary lymph node dissection has been considered an essential component of breast cancer management, Thus ALND has been the gold standard in axillary staging, providing information for decision-making about adjuvant therapy. ALND is considered as a treatment leading to loco-regional control, when axillary lymph nodes are involved **(Ronka et al., ٢٠٠٤).**

It was found that; half of patients with total axillary dissection have a negative lymph node and they may developed a major complications in the form of edema of the arm, shoulder dysfunction, may develop thrombosis of axillary vein and also injury to the motor nerves of the axilla (**Cady, ١٩٩٨).**

Several noninvasive techniques can be used as a predictor for presence of positive axillary lymph node in breast cancer such as sentinel lymph node, MRI and ultra sound (**Fisher, ١٩٩٩).**

Lymphatic mapping with sentinel node biopsy (SNB) has been proposed to provide even more accurate lymphatic staging with less morbidity than with diagnostic axillary clearance **(Ronka et al., ٢٠٠٤).**

Because the sentinel node is the first regional lymph node to receive tumor cells that metastasize along the lymphatic pathway from a primary breast cancer, its tumor status should reflect the status of the entire axillary basin. Sentinel lymphadenectomy hold promise as a staging technique to replace formal level I and level II axillary lymph node dissection in selected patients with breast cancer, thus avoiding an unnecessary procedure that has no role in many patients with tumor free axilla **(Giuliano, ٢٠٠٣).**

Sentinel lymph node biopsy is a method applied for the first time in patients with carcinoma of the penis in ١٩٧٠. Later, the method has also been used to detect invaded lymph nodes in malignant melanoma, breast cancer, thyroid carcinoma and other cancer sites **(Dordevic, ٢٠٠٢).**

Krag et al.,١٩٩٣ published their pilot study on successful SLN identification in ١٨ out of ٢٢ evaluated breast cancer patients using non-filtrated technetium-sulphur colloid and hand-gamma probe**.**

Giuliano et al.,١٩٩٤ applying ١%-isosulphane blue stain, precisely identified SLN in١١٤ (٦٦%) assayed patients.

The identified SLN reflects precise axillary status in ١٠٩ (٩٦%) patients **(Dordevic, ٢٠٠٢).**

Albertini et al.,١٩٩٦ used vital blue solution and filtered technetium-sulphur colloid to mark SLN. Out of ٦٢ evaluated patients, SLN was identified in ٥٧ (٩٢%). Metastases were found in (١٨) SLNs, which were all marked with blue stain and radioactive colloid, there were no false negative SLNs in this study **(Dordevic, ٢٠٠٢).**

Veronesi et al., ١٩٩٧ used human albumin labeled with technetium to label SLN, and radioisotope was applied superficially into tumor. Identification was performed with gamma-counter. These authors identified SLN in ١٦٠ out of evaluated cases, identified SLN reflect axillary status in ٩٧%**.** . Regardless of the precisely defined nodal status, these authors prefer the combination of blue stain and radio-isotopic colloids in SLN identification **(Dordevic, ٢٠٠٢).**

Motomura et al.,١٩٩٩ successfully identified SLN in ١٢٧ (٧٣.٨%) out of ١٧٢ patients with indocyanine green stain (Diagnogreen ٠.٥%). Association between SLN and axillary node status was demonstrated in ٩٦.١% of the cases, with false negativity rate of ١١.١% Tumor size, surgical procedure and tumor histology did not affect SLN identification. However, the level of success was markedly higher in patients

without (٧٩%) than in those with involved axillary lymph nodes (٦٥.٧%). Success was also dependent on the presence or absence of lymphatic or vascular invasion and patient age. SLN detection level was higher in patients without (٧٨.٩%) than in those with lymphatic or vascular invasion (٦٣.٨%), as well as in those aged below ٥٠ years (٨٣.٣%) compared the patients aged over ٥٠years (٦٤.٨%) **(Dordevic, ٢٠٠٢)**.

Authors point out that the successfulness of the technique depends primarily on the proper patient selection, injection technique, dissection technique and histopathlogic evaluation **(Dordevic, ٢٠٠٢)**.

EMBRYOLOGY OF THE FEMALE BREAST

Embryologic development of the mammary gland consists of a series cell types. These interactions are regulated by an array of systemic and local factors such as growth factors and hormones. (**McCarty et al., ١٩٩٠**).

The epithelium of the ducts and acini of the breast is developed from ectoderm and the supporting tissue is derived from the mesenchyme ***(McGregor, ٢٠٠٣).***

During the fourth 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 axilla to the medial thigh. This is the first morphological evidence of mammary gland development. In the 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 ***(Revis et al., ٢٠٠٦).***

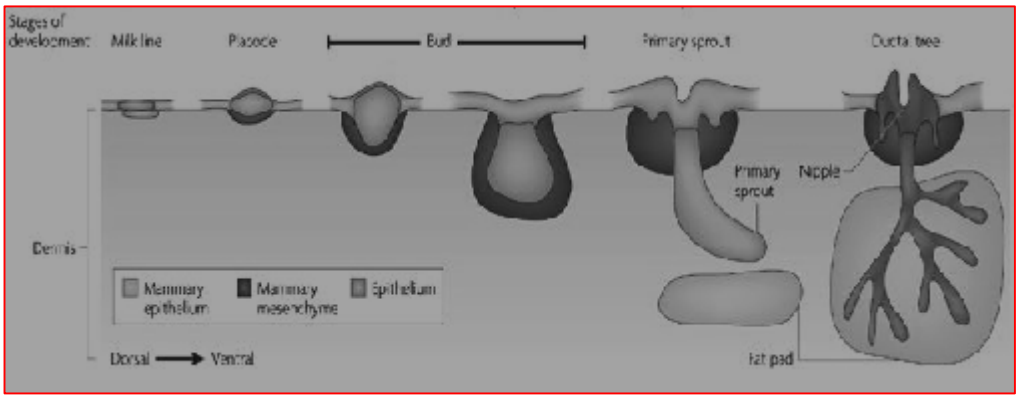

Figure ١: stages of the developement *(Hans, ٢٠٠٦).*

Each breast develops when an ingrowth of ectoderm forms a primary tissue bud in the mesenchyme **(Fig. ١).** The primary bud, in turn, initiates the development of ١٥ to ٢٠ secondary buds. Epithelial cords develop from the secondary buds and extend into the surrounding mesenchyme. Major (lactiferous) ducts develop, which opens into a shallow mammary pit. During infancy, a proliferation of mesenchyme transforms the mammary pit into a nipple. If there is failure of a pit to elevate above the skin level an inverted nipple results. This congenital malformation occurs in ٤% of infants. At birth, the breasts are identical in male and females, demonstrating only the major ducts. Enlargement of the breast may be evident and a secretion, referred to as witch's milk, may be produced. These transitory events occur in response to maternal hormones that cross the placenta ***(Bland et al., ٢٠٠٥).***

Congenital breast malformations range in severity from the relatively minor to major chest wall deformities. Minor malformations may not even be recognized, while major deformities may cause significant functional, psychological, and aesthetic concerns. The affected individual may present for consultation at any ages, often early in childhood as a result of parental concern. These malformations generally fall into ١ of ٢ categories, the presence of supernumerary breast tissue or the absence or underdevelopment of breast tissue ***(Revis et al., ٢٠٠٦).***

An extra breast (polymastia) or extra nipple (polythelia) occurs in approximately ١% of the population. It may be an inheritable condition**.** Supernumerary nipples are slightly more common in males than in females. Extra breasts or nipples most commonly occur along the milk line, usually just underneath the normally located breasts or nipples, however, they have also been noted in ectopic sites such as the back or the buttock. Accessory or ectopic breast tissue responds to hormonal stimulation and may cause discomfort during menstrual cycles. These tissues have also been reported to undergo malignant transformation and should be removed ***(Arca et al., ٢٠٠٨).***

Poland's syndrome is an uncommon congenital chest wall deformity characterized by unilateral absence of the sternal head of the pectoralis major muscle, deficiency of the breast and nipple, chest wall deformity and abnormalities of the upper extremity including finger-shorting and syndactyly ***(Sainsbury, ٢٠٠٦).***

The breasts are specialized accessory glands of the skin that are capable of secreting milk. They are present in both sexes. In males and immature females, they are similar in structure. The nipples are small and surrounded by a colored area of skin called the areola. The breast tissue consists of little more than a system of ducts embedded in connective tissue that does not extend beyond the margin of the areola ***(Snell, ٢٠٠٤).***

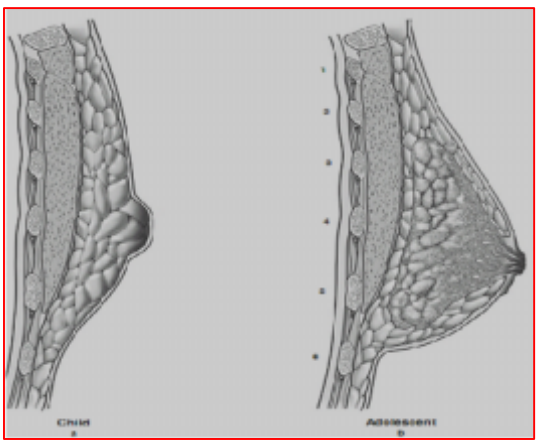

Figure ٢ A&B: Breast development. **A:** In a prepubertal girl, the mammary glands grow and branch slowly. **B:** In adolescence the mammary glands develop rapidly, with the growth of the duct system influenced by estrogen and progesterone *(Hans, ٢٠٠٦).*