

Recent Advances in Early Detection of Breast Cancer

*An Essay
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Ibrahim Fawzy Ibrahim Hassan



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

List of Content

List of abbreviation	I
List of figures	III
List of tables	V
Introduction	1
Aim of the work	3
Anatomy of the breast	4
Pathology of breast cancer	22
Staging and classification of breast cancer	41
Methods of early detection of breast cancer	59
The impact of early detection of breast cancer on the line of treatment and prognosis	99
Summary & conclusion	129
References	132
Arabic summary	

LIST OF ABBREVIATIONS

ADH	Atypical ductal hyperplasia
ALH	Atypical lobular hyperplasia
ANDI	Aberration of Normal Development and Involution
BIRADS	Breast Imaging Data Reporting System
BRCA	Breast cancer gene mutations
BSE	Breast-self examination
CBE	Clinical Breast Examination
CNB	Core Needle Biopsy
DCIS	Duct Carcinoma In Situ
ER	Estrogen Receptor
EGFR	Epidermal growth factor receptor
FISH	Fluorescent in situ hybridization
FNAC	Fine Needle Aspiration Cytology
HER	Human Epidermal growth factor Receptor
IDC	Invasive Duct Carcinoma
ILC	Invasive Lobular Carcinoma
LCIS	Lobular Carcinoma In Situ
MINDACT	The Microarray In Node-negative Disease may Avoid Chemotherapy

MRI	Magnetic Resonance Imaging
MRM	Modified Radical Mastectomy
PET	Positron Emission Tomography
PR	Progesterone receptor
SCNB	Stereotactic Core Needle Biopsy
TLI	Thymidine-labeling index
TNM	T: Tumor N: Regional lymph Node M: Metastasis
TRANSBIG	Translating molecular knowledge into early breast cancer management: Breast International Group
TRAM	The transverse rectus abdominis myocutaneous

List of Figures

<i>Figure number</i>	<i>subject</i>	<i>Page</i>
1	Cut away diagram of a mature resting breast	6
2	Arterial supply of the breast	10
3	Nerve supply of the breast	13
4	Axillary lymph node	14
5	Ductal carcinoma insitu (DCIS)	24
6	DCIS; cribriform type	26
7	DCIS; comedo type	27
8	Lobular carcinoma insitu	27
9	Invasive ductal carcinoma	32
10	Invasive lobular carcinoma	33
11	Invasive tubular carcinoma	34
12	Medullary carcinoma	35
13	Mucinous or colloid carcinoma	37
14	Breast –Self Examination (BSE)	54

15	Showing the role mammogram in diagnosis of breast cancer	58
16	Ductography) lateral-medial &cranio caudad magnified ductogram	62
17	Mammographic, ultrasonographic, and MRI findings in breast disease	65
18	2D mammography , 3D imaging	69
19	FNAC, Equipments required for punction of breast cyst	84
20	High-speed core-cut biopsy instrument	85
21	Radical mastectomy	102
22	Axillary lymph nodes or sentinel node biopsy	102
23	Skin sparing mastectomy	107
24	Breast quadrantectomy.	108
25	Breast lumpectomy	110

Aim of the Work

The aim of the work is to discuss the recent advances in early detection of breast cancer to achieve better management and prognosis.

Introduction

Breast cancer is the most commonly diagnosed malignancy amongst women, breast cancer mortality worldwide is 25% greater than that of lung cancer in women and the second leading cause of cancer death in the united state (*Abeloff et al, 2008*).

Both incidence and death rates for breast cancer have been declining in the last few years. Nevertheless, In 2005 by the Society for Women's Health Research indicated that breast cancer remains the most feared disease, even though heart disease is a much more common cause of death among women. Incidence of breast cancer in men are approximately 100 times less common than in women, but men with breast cancer are considered to have the same statistical survival rate as women *American Cancer Society (2012)*.

Early detection& screening programs must be considered the best choice for reducing mortality from breast cancer (*Letton et al, 2012*).

Early detection means using an approach that allows earlier diagnosis of breast cancer. Early detection improves the chances that breast cancer can be diagnosed at an early stage and treated successfully. Breast cancer that diagnosed during screening examinations is more likely to be small and still confined to the breast. In contrast, breast cancer that is detected because it is causing symptoms tends to be relatively larger and is more likely to have spread beyond the breast (*Silverstien et al, 2012*).

The goal of screening examinations for early breast cancer detection is to find cancer before it start symptoms. Screening refers to tests and invetigations used to find a cancer in people who do not have any symptoms (*Yeatman rt al, 2011*).

Screening reduces mortality from breast carcinoma through its effects in detecting tumors at a smaller size, decreasing the probability of lymph node metastasis and reducing the opportunity for worsening of the grade of malignancy of the tumor (*Smith et al, 2011*).

Anatomy of the Breast

Embryology of the breast

The breast is a group of large glands derived from the epidermis. It lies in a network of fascia derived from the dermis and the superficial fascia of the ventral surface of the thorax. The nipple itself is a local proliferation of the stratum spinosum of the epidermis(*Sauners C et al, 2010*).

At the fifth or sixth week of fetal development, two ventral bands of thickened ectoderm (mammary ridges, milk lines) are evident in the embryo. In most mammals, paired breasts develop along these ridges, which extend from the base of the forelimb (future axilla) to the region of the hind limb (inguinal area). These ridges are not prominent in the human embryo and disappear after a short time, except for small portions that may persist in the pectoral region (**Harold et al, 2009**).

Each breast develops when an ingrowth of ectoderm forms a primary tissue bud in the mesenchyme. The primary bud, in turn, initiates the development of 15 to 20 secondary buds. Epithelial cords develop from the secondary buds and extend into the surrounding mesenchyme. (**Harold et al, 2009**).

Major (lactiferous) ducts develop, which open into a shallow mammary pit. During infancy, a proliferation of mesenchyme transforms the mammary pit into a nipple. At birth, the breasts are identical in males and females, demonstrating only the presence of 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 **(Blans et al, 2009)**.

The breast remains undeveloped in the female until puberty, when it enlarges in response to ovarian estrogen and progesterone, which initiate proliferation of the epithelial and connective tissue elements. However, the breasts remain incompletely developed until pregnancy occurs **(Harold et al, 2009)**.

Anatomical features of the breast:

The mature breast lies cushioned in adipose tissue between the subcutaneous fat layer and the superficial pectoral fascia, the main bulk of the tissue of the breast is concentrated in its upper quadrant, which is thus the most usual site for both breast cancer and most benign breast pathologies **(Ellis H et al, 2010)**.

The nipple 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 **(Ellis H et al, 2010)**.

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 (Muscle, fascia and fat). The epithelial elements consist 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 **(Ellis H et al, 2010)**.

Each lobe is a collection of between ten and a hundred acini grouped 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 a collecting duct. Looking at the breast from the front, the major mammary ducts lie behind the areola. The lobules occupy the more peripheral part of the breast **(Blans et al, 2009)**.

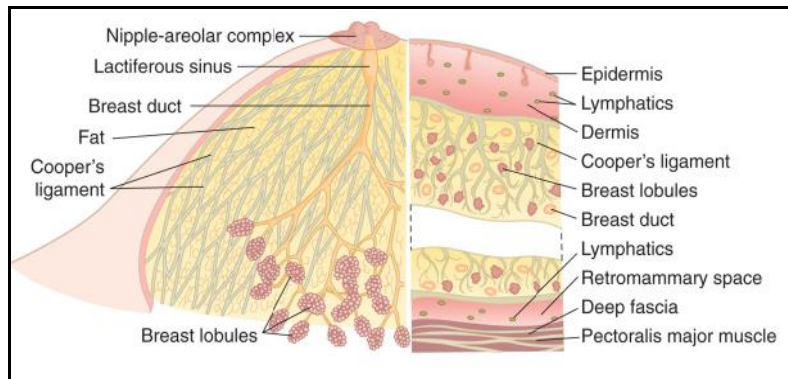


Fig: 1: Cut away diagram of a mature resting breast (**Blans et al., 2009**).

The areola contains involuntary muscle 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) (**Chummy S et al,2011**).

The epithelial lining of the lobule consists of superficial luminal A cells, which are involved in milk synthesis. Basal or B cells, also called“ chief cells” have stem cell activity. Myoepithelial cells constitute the third type. Within each terminal duct lobular unit is a special stroma that is less dense than the general stroma of the breast (**Parks AG et al, 2010**).