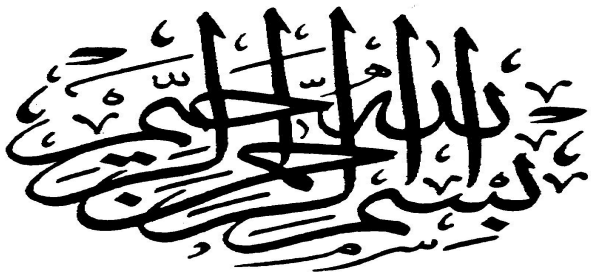

وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ

صدق الله العظيم

ROLE OF DIGITAL TOMOSYNTHESIS IN IMAGING BREAST CANCER

Essay of

Submitted for Partial Fulfillment of Master Degree
In Radiodiagnosis

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List of Abbreviations

Abbrev.	Full Term
2D	Two-dimensional
3D	Three-dimensional
ACR	American College of Radiology
AJCC	American Joint Committee on Cancer
ALH	Atypical lobular hyperplasia
BIRADS	Breast Imaging Reporting and Data System
BRCA1	Breast cancer gene 1
BRCA2	Breast cancer gene 2
BSE	Breast self-examination
CBE	Clinical breast examination
CC	Craniocaudal
CT	Computed Tomography
DBT	Digital Breast Tomosynthesis
DCIS	Ductal carcinoma in situ
DM	Digital Mammography
EGFR	Human epidermal growth factor receptor
ERs	Estrogen receptors
ERT	Estrogen replacement therapy
FFDM	Full field digital mammography
FNA	Fine needle aspiration
FPD	Flat panel detector
IBC	Inflammatory breast cancer
IDC	Invasive ductal carcinoma

List of Abbreviations (Cont…)

Abbrev.	Full Term
ILC	Invasive lobular carcinoma
LCIS	Lobular carcinoma in situ
LM	Latero-medial
LMLO	Left Medio-Lateral Oblique
MGH	Massachusetts's General Hospital
ML	Medio-lateral
MLO	Mediolateral oblique
NPV	Negative predictive value
NSAIDs	Non-steroidal anti-inflammatory drugs
OCPs	Oral contraceptive pills
PCR	Polymerase chain reaction
PPV	Positive predictive value
PRs	Progesterone receptors
TDLU	Terminal ductal lobular unit
US	Ultrasound
WHO	World Health Organization

Introduction

Breast cancer is the most frequent malignancy among women; the chance of developing breast cancer in some time in women's life is little less than one in eight (12%). Breast cancer in women is the leading cause of death ***(Baker, 2012).*** Death rates from breast cancer have been declining since about 1990 with larger decrease in women younger than 50. That decrease is believed to be the result of earlier detection through screening and increased awareness, as well as improved treatment ***(American Cancer Society, 2011).***

Early detection of breast cancer can save time and reduce treatment cost. This has been successfully proven over the years ***(Tabar et al., 2010).***

In the past decade breast cancer screening programs have helped to reduce mortality of breast cancer patient by 20 percent but still determined to find new technologies that have potential to even further improve breast cancer statistics ***(Saslow et al., 2012).***

As mammography is considered the most effective screening and diagnostic tool for early detection of breast cancer, about 10%-30% of cancer may be missed. The nature of 2D mammography makes it difficult to distinguish a cancer from overlying breast tissue. A higher rate of false positive and

false negative test results exist because the dense tissue interferes with identification of tumors ***(Pisano et al., 2011)***.

Advances in techniques for imaging the breast continue to drive the rapid development of modalities for diagnosis and screening.

A team of researchers at ***Massachusetts's General Hospital [MGH] (2010)*** has developed a new weapon for fight against breast cancer: (Breast Tomosynthesis)

Breast tomosynthesis is one of most exciting research developments in radiology in recent years. It is a 3 dimensional imaging technique that acquires images of a stationary compressed breast ***(Poplack et al., 2011)*.**

Breast tomosynthesis should resolve the tissue –overlap reading problems that are a major source for recalling women for additional diagnostic mammograms with 2D mammography after abnormality detected in the first one ***(American Roentgen Ray Society*, *2009)*.**

Digital breast tomosynthesis offers a number of exciting opportunities including the possibility of reduced compression, improved diagnostic and screening accuracy. New digital technologies in tomosynthesis will advance the diagnosis of breast cancer even further ***(Smith, 2010)***.

Aim of the Work

The purpose of this essay is to describe digital breast tomosynthesis and its value in imaging of breast cancer, highlighting its advantages over digital mammography.

Anatomy of Female Breast

General Anatomy

Development:

The mammary line (crest) is ectodermal thickening that appears during 4^{th}-5^{th} week of development. It extends from axilla to groin, on each side of body (Fig 1). Only a small portion of the line persists in thoracic region ***(Slader, 2007)***

Invasion of the underlying mesenchyme (dermis) in the 6^{th} week gives rise to the mammary buds. These lengthen, branch and canalise to from the lactiferous ducts. The lactiferous ducts come together in a depression on the surface of the skin called the mammary pit. Shortly after birth the pit is converted to the nipple ***(Moore and Persuad, 2007).***

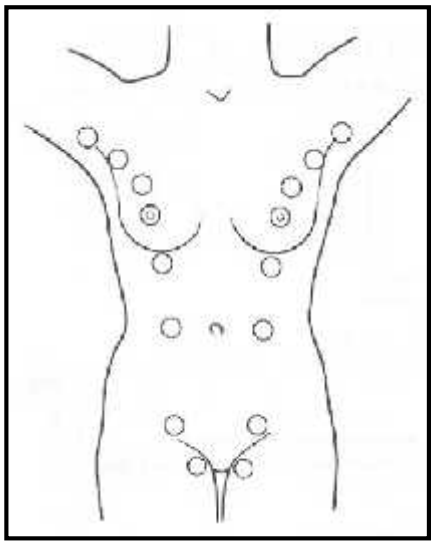

Fig. (1): Supernumerary nipples are sometimes mistaken for skin tags or moles ***(Quoted from Hindle, 1999).***

Breast Anatomy

The breast lies on top of the pectoralis major muscle. Fibrous stroma provides the background architecture of the breast.

Cooper's ligaments are attached to both the fascia of the skin and the pectoralis major muscle. Carcinoma invading these ligaments may result in skin dimpling which could be subtle or obvious during visual inspection (Fig. 2) ***(Maxwell and Gabriel 2010).***

A- Ducts

B- Lobules

C- Dilated duct to hold milk

D- Nipple

E- Fat

F- Pectoralis major muscle

G- Chest wall (ribs)

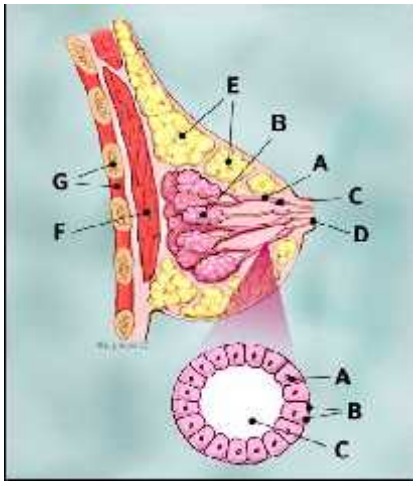

Fig. (2): Anatomy of the breast ***(Quoted from Moore, 2007)***

Microscopic Anatomy

The breast is composed of lobules or glands; milk ducts; connective tissue, and fat, with most of the benign and malignant pathology arising in the duct and lobular network (Fig. 3). Specifically, most breast cancer is thought to originate in the terminal ductal lobular unit (TDLU) ***(Bostwick, 2009).***