ROLE OF DIFFUSION AND SPECTROSCOPY MR IMAGING IN DIAGNOSIS OF BREAST CANCER

Essay

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List of Abbreviations

ADC	The apparent diffusion coefficient (ADC)
ACR	American College of Radiology
ALND	Axillary lymph node dissection
BI-RADS	Breast imaging reporting and data system
CE	Contrast-enhanced
CM	Contrast material
CSI	Chemical shift imaging
DCE-MR	Dynamic contrast enhanced magnetic resonance
DCIS	Ductal carcinoma in situ
DTPA	Diethylene triamine penta acetic acid
DWI	Diffusion weighted imaging
EIC	Extensive intraductal component
FA	Flip angle
FOV	Field of view
Gd	Gadolinium
Gd-DTPA	Gadolinium-DTPA
GE	Gradient echo
HPF	High-power field
HR	High-resolution
IDC	Invasive ductal carcinoma
LCIS	Lobular carcinoma in situ

LN Lymph node

Ms Millisecond

MIP Maximum intensity projection

MPR Multiplanar reconstruction

MR Magnetic resonance

MRI Magnetic resonance imaging

MRS Magnetic resonance spectroscopy

Post-CM After contrast administration

Pre-CM Before contrast administration

PRESS Point-resolved spectroscopy

ROI Region of interest

SS-EPI Single shot-EPI (SS-EPI)).

S/N Signal –to –noise ratio

STEAM Stimulated echo acquisition mode

SUV Standardized update value

T Tesla (unit of magnetic field strength)

T1-WI T1-weighted image

T2-WI T2-weighted image

TDLU Terminal ductal lobular unit

TNM Tumor-node-metastasis staging system

US Ultrasound

VOI Volume of interest

WHO World health organization

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Introduction& Aim of work

INTRODUCTION

Breast cancer is most prevalent and is the leading cause of cancer related deaths among women worldwide ***(Greenlee et al. 2001; NRCP 2001***).

Recent advances in MRI have shown the potential in bridging the gap between sensitivity and specificity. Methods based on differences in physiological ,cellular and biochemical characteristics of malignant, benign and normal tissues were developed to monitor changes in diffusion***(Woodhams et al. 2005; Manton et al. 2006 and Yankeelov et al.2007),*** perfusion , tissue elasticity **(Sinkus et al. 2007)** and metabolic activity ***(Cecilet al. 2001; Yeung et al. 2001).***

Application of diffusion weighted imaging (DWI) in differentiating malignant and benign breast tissues (***Woodhams et al***. 2005) as well as in monitoring the treatment response were reported***(Manton et al. 2006; Yankeelovet al. 2007 and Sharma et al. 2008).*** For unambiguous and early diagnosis of breast cancer with high specificity, it is desirable to have a standardized protocol with a combination of techniques.

Various methods discussed above provide wealth of information on tumor anatomy and physiology, however, an insight into the underlying biochemical processes associated with tumor progression and regression could be achieved through the use of in-vivo magnetic resonancespectroscopy (MRS). In addition, information on

the alterations of metabolic pathways during disease processes by detection and quantification of metabolites could be obtained. Several centers have begun to supplement breast MRI studies with MRS to increase the specificity. To distinguish cancer from benign and normal breast tissues, the presence of composite choline (tCho) signal observed in proton (1H) MRS was used ***(Cecil et al. 2001; Yeung et al. 2001)*** and is shown to increase the specificity of diagnosis.

The specificity of MRS was reported to be around 88%,however, the poor sensitivity and requirement of slightly larger lesion to detect a tCho signal is one of the limitations. The ability of MRS to follow the metabolic profile of malignant cells before, during, and after drug treatment also helps in predicting the response of the tumor to treatment. The present review focuses certain aspects of the development of breast MR imaging and spectroscopy. The continual efforts made to improve the specificity of MR in diagnosis, and the assessment for screening, are also presented here.

Aim of the Work:

To assess the role of Diffusion and Spectroscopy MR imaging in cancer Breast.

Anatomy of the Female Breast

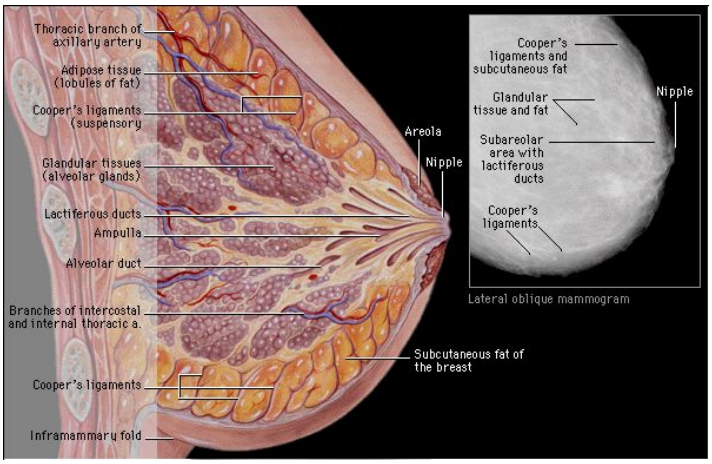
Anatomy of the Female Breast

Gross Anatomy:

The breast is a modified, differentiated apocrine sweat gland with a functional purpose of secreting milk during lactation. It is located in the superficial tissues of the anterior chest wall. The surface of the breast is dominated by the nipple and the surrounding areola ***(Glenn, 2001).***

The mature breast has an eccentric configuration, with the long axis diagonally placed on the chest wall largely over the pectoralis major muscle and extending into the axilla. The peripheral anatomic boundaries of the breast are not precisely defined, except at the deep surface where the gland overlies the pectoralis fascia. Superficially, the breast extends over portions of the serratus anterior muscle, inferiorly over the external oblique muscle and superior rectus sheath, and medially to sternum ***(Rosen, 2001)***.

The protuberant part of the human breast is generally described as overlying the second to the sixth ribs, and extending from the lateral border of the sternum to the anterior axillary line. Actually, a thin layer of mammary tissue extends considerably farther from the clavicle above to the seventh or eighth ribs below and from the midline to the edge of latissimus dorsi muscle posteriorly ***(Russell et al., 2000)***.



(Fig.1): Anatomy of the breast ***(Quoted from Moore et al., 1999)***

The axillary tail

The axillary tail of the breast (tail of Spence) is a breast extension towards the lateral margin of the chest and into the axilla. It has a duct, which drains into the ductal system of the major gland. In some normal cases it is palpable, and in a few it can be seen premenstrually or during lactation. A well-developed axillary tail is sometimes mistaken for a mass of enlarged lymph nodes or a lipoma ***(Hendriks et al., 2002.)***

The internal structure of the mammary gland

The normal adult female breast **(Fig.1)** is composed of an admixture of epithelial and stromal elements with variable adipose tissue typically present in the interlobular stroma, and not amongst the lobules. The epithelial elements are glandular tissue or tubulo-alveolar type consisting or a series or branching ducts which connects the structural and functional units of the breast, the lobules, to the nipple. The stroma is