Role of Sonoelastography and MR-Elastography in Differentiation of Breast Lesions

ESSAY
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دور قياس المرونة بالموجات فوق الصوتية والرنين المغناطيسي في التفرقة بين إصابات الثدي

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List of Abbreviations

ACR	American College of Radiology
AUC	Areas Under Curve
BIRADS	Breast Imaging Reporting And Data System
CAM	Combined autocorrelation method
CeMRI	Contrast enhanced magnetic resonance imaging
DCIS	Ductal carcinoma in situ
FN	False negatives
FOV	Field Of View
Gd	Elasticity
Gl	Viscosity
GRE	Gradient-recalled echo
Hz	Hertz
IBC	Inflammatory breast cancer
IDC	Invasive ductal carcinoma
ILC	Invasive lobular carcinoma
kpa	Kilopascals
LCIS	Lobular carcinoma in situ
µ	The shear modulus (stiffness)
MEG	Motion Encoding Gradient
MHz	Mega Hertz
MRE	Magnetic Resonance Elastography

NPV	Negative Predictive Value
POD	Probability of disease
PPV	Positive Predictive Value
RF	Radio-frequency
ROC	The receiver operating characteristic curve
ROI	Regions of interest
SE	Sonoelastography
SENSE	Sensitivity Encoding Sequence
SP	Specificity
SR	Strain Ratio
TDLUs	Terminal Ductal-Lobular Units
TE	Time of Echo
TI	Time of Inversion
TR	Time of Repetition
T.S	Tsukuba elasticity Score
TP	True positives
US	Ultrasonography

List of Tables

List of Figures

List of Contents

Introduction

Elastography is a newly developed method which was introduced in 1991 and started to be used in a clinical setting in 1997 ***(Garra et al., 1997).***

Sonolastography is the technique of imaging the hardness of soft tissue. The resultant strain images show the behavior of tissue when subjected to mechanical stress ***(Tan et al., 2008).***

With the use of sonoelastography, the difference in hardness between normal and diseased tissue of the breast can be estimated by measuring the tissue strain induced by probe compression. Several clinical studies have reported that sonoelastography has the potential to differentiate between breast lesions ***(Regner et al., 2006).***

Sonoelastography of the breast allows an objective analysis of the viscoelastic properties of breast tissues and, therefore, corresponds to an improved and user-independent clinical breast examination that gives measurable physical quantities ***(Tan et al., 2008).***

Sonoelastography represents a simple, fast, and non-invasive diagnostic method that may be a useful complement to US for less experienced radiologists in assessing solid nonpalpable breast lesions where specificity has proven higher ***(Scaperrotta et al., 2008).***

Preliminary results suggest that real-time sonoelastography is a promising new approach for diagnosis of breast cancer with fair sensitivities and specificities ***(Itoh et al., 2006).***

In a clinical trial, Sonoelastography is considered equal or superior to mammography in differentiation of breast lesions. A combination of elastography and sonography had the best results in detecting cancer and potentially could reduce unnecessary biopsy ***(Zhi et al., 2007).***

MR elastography (MRE) of the breast represents a novel imaging technique that is based on the phase-contrast MRI technique and It can be used in combination with contrast enhanced breast MRI and allows imaging of the 3D propagation of low frequency acoustic waves within tissue ***(Marippan et al., 2010).***

US elastography is typically restricted to the assessment of one-dimensional (1D) displacement data along the beam line. Thus, compared with full 3D techniques like MRE, it yields inherently more imprecise viscoelastic data ***(Marrippan et al., 2010).***