New Advances in Magnetic Resonance Imaging of Prostate cancer

Essay

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Summary & conclusion

Prostate cancer being one of the relatively controllable, slowly progressive, and one of the least morbid cancers in its early stages, has provoked many studies to try, predict, diagnose, and stage it.

Diagnostic assessment of the prostate on MRI was improved with the introduction of the endorectal surface coil which improves the image quality and accuracy in the preoperative staging of prostate cancer compared with the whole body-coil. However, the accuracies obtained with the endorectal coil in staging prostate cancer vary widely, from 51% to 89%. An improvement of the staging accuracy was also achieved using the combination of endorectal coil and body phased-array coil.

Magnetic resonance spectroscopic imaging has shown very promising results, being a method of obtaining biochemical information from a series of voxels placed over the prostate gland, and can be performed as part of endorectal prostate MRI with a commercial MRI scanner.

Combined endorectal MR imaging and MR spectroscopic imaging has an accuracy rate similar to that of biopsy for prostate cancer sextant localization, and is more accurate than biopsy of the prostate apex.

It is unclear how specific the ADC is for prostate cancer. The ADC then reflects various physical and physiologic characteristics of tissue but is not specific for cancer itself. This non specificity of ADC for cancer tissue may result in an overlap of ADC between cancer and noncancerous tissue. Therefore, we suggest that the ADC map is helpful

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LIST OF ABBREVIATIONS

3D	*Three Dimensional*
3D MRSI	*Three Dimensional Magnetic Resonance Spectroscopy Imaging*
AAH	*Atypical Adenomatous Hyperplasia*
ADC	*Apparent diffusion coefficient*
AUC	*Area under the receiver operating characteristic curve*
BAC	*Body-array coil*
BASING	*Band-selective inversion with gradient dephasing*
BPH	*Benign Prostatic Hyperplasia*
C/C	*Choline to creatine*
CART	*Classification and regression tree*
CC/C	*Choline-creatine–to-citrate ratio*
CG	*Central gland*
Cho	*Choline*
CI	*Confidence interval*
Cit	*Citrate*
Cr	*Creatine*
CZ	*Central Zone*
DCE MRI	*Dynamic Contrast Enhanced Magnetic Resonance Imaging*
DRE	*Digital rectal examination*
DW	*Diffusion weighted*
ECE	*Extra Capsular Extension*
En MRI	*Endorectal coil Magnetic Resonance Imaging*
ERC	*Endorectal coil*
FDG	*Fluorodeoxyglucose*
FLASH	*Fast low-angle shot*
FOV	*Field of view*
FSE	*Fast Spin Echo*
GRASS	*Gradient-recalled acquisition in the steady state*
HGPIN	*High-grade prostatic intraepithelial neoplasia*
LN	*Lymph Node*
LNM	*Lymph node metastasis*
Lt	*Left*
Min	*Minute*
MIP	*Maximum intensity projection*
MRI	*Magnetic Resonance Imaging*
MRSI	*Magnetic Resonance Spectroscopy Ima*

NPV	*Negative predictive value*
NVB	*Neurovascular Bundle*
OCPC	*Organ confined prostate cancer*
PA	*Polyamine*
PACS	*Picture archiving and communication system*
PCa	*Prostate Carcinoma*
PIN	*Prostatic Intraepithelial Neoplasia*
PNI	*Perineural invasion*
PPA	*Pelvic phased array*
PPV	*Positive predictive value*
PRESS	*Point resolved spectroscopy*
PSA	*Prostatic Specific Antigen*
PZ	*Peripheral Zone*
RF	*Radiofrequency*
ROC	*Receiver operating characteristic*
ROI	*Region of interest*
Rt	*Right*
SE	*Spin echo*
Sec	*Seconds*
SI	*Signal intensity*
SNR	*Signal-to-noise ratio*
STEAM	*Stimulated echo acquisition mode*
SUV	*Standardized uptake value*
SV	*Seminal vesicle*
SVI	*Seminal vesicle invasion*
TE	*Echo time*
TEıff	*Effective Echo time*
TIC	*Time Intensity Curve*
TR	*Repetition time*
TRUS	*Transrectal Ultrasound*
TZ	*Transitional Zone*

INTRODUCTION

Carcinoma of the prostate is an important health problem **(Engelhard et al., 2001)**. The incidence of prostate cancer has increased in the past ten years and is now the second cause of cancer related deaths in males **(Parker et al., 1997)**.

The major goal for prostate cancer imaging in the next decade is more accurate disease characterization through the synthesis of anatomic, functional, and molecular imaging information **(Hricak et al., 2007)**.

The ability to identify early organ-confined and therefore potentially curable disease has improved considerably by prostatic specific antigen (PSA) serum testing and transrectal ultrasound (TRUS) guided needle biopsy **(Schlemmer and Corvin, 2004)**.

For years the diagnosis of PCa has depended on the combination of digital rectal examination (DRE), serum PSA concentrations, TRUS and ultimately TRUS guided biopsies **(Oyen, 2003).**

It is unfortunate that there is no single imaging method that embodies all of the optimal characteristics for the integration of diagnostic and interventional procedures for prostatic cancer detection and staging **(Atalar and Menard, 2005)**.

Routine tools for early diagnosis and localization of cancer within the prostate include digital rectal examination and assessment of serum

prostate-specific antigen followed by transrectal ultrasonographically (US) guided biopsy **(Testa et al., 2007)**.

TRUS being widely applied can provide a complete overview of the prostatic zonal anatomy as well as that of the bladder and seminal vesicles. Hence, visualization and sometimes diagnostic information on many pathological conditions of the prostate **(Patel and Rickards, 2002)**.

However, ultrasound techniques suffer from several disadvantages e.g. being subjective, non specific and inaccurate in staging **(Oyen, 2003)**.

The sensitivity of systematic sextant ultrasonography (US)-guided biopsy for prostate cancer detection is low (39%-52%) because more than 40% of prostate cancer lesions are isoechoic and central gland tumors are difficult to detect. Use of magnetic resonance (MR) imaging may result in higher localization rates **(Futterer et al., 2006)**.

Magnetic resonance (MR) imaging has shown great promise as a non invasive diagnostic tool in the evaluation and management of prostate cancer. By aiding in the detection, localization, and staging of prostate cancer, multiplanar T2-weighted endorectal MR imaging can facilitate more appropriate treatment selection and planning **(Mazaheri et al., 2008)**.

Metabolic information from 3D 1H MR spectroscopic imaging has been shown to improve tumor localization and volume estimation with MR imaging and to provide valuable information about the aggressiveness of prostate cancer **(Mazaheri et al., 2008)**.

Aim of the work

To assess the value of the advanced MRI techniques in accurate detection, localization, staging and post treatment follow-up of prostate cancer.