INTRODUCTION

Prostate cancer:
- More common in Western vs Asian countries
- However, high incidence is seen among Asian immigrants to Western countries within one generation – possible predisposing environmental factors
- In Malaysia, 6th most frequent cancer & accounts for 5.7% of cancers in males
- In Malaysia, among the major ethnic groups, the Chinese record the highest incidence of this cancer – possible predisposing genetic factors
- A diet high in fats - also associated with a higher incidence

Source: Malaysian Oncological Society website
URL: http://www.malaysiaoncology.org/article.php?aid=32
PROSTATE MRI

- Is the most accurate non-invasive method for staging local extent of prostate ca
- Has become the definitive test for determining treatment options (e.g. surgery vs radiotherapy)
- Development of the endorectal coil has increased the accuracy of detection to 82% (compared to 66-69% using the body coil)

Source: R Harris, A Schned, J Heaney - Staging of Prostate Cancer with Endorectal MR Imaging: Lessons from a learning curve – Radiographics 1995 Vol 15 No 4

PROSTATE MRI

- The combination of conventional T2-weighted sequences AND MR Spectroscopy has been shown to improve cancer detection, localization of cancers in the peripheral & transitional zones of the prostate
- Combination MR + MRS: Sensitivity 99% Specificity 95%
- MR alone: Sensitivity 77% Specificity 81%

Source: Choi et al – Functional MR Imaging of Prostate Cancer– Radiographics 2007 Vol 27 No 1

PROSTATE MRI – advantages of MRI over other imaging modalities

- It does not use ionizing radiation.
- It can obtain images in sagittal, coronal, axial, and/or oblique planes.
- It provides more soft tissue contrast than other radiological techniques, and PC has low signal intensity as compared to surrounding regions of healthy tissue. This decrease in signal intensity is due to differences in structure between cancerous and normal prostate tissue.
- Endorectal/pelvic phased array coil MRI has demonstrated higher accuracy than other modalities in assessing seminal vesicle invasion and extra-capsular extension (ECE) of PC (96% and 87% respectively).
- Within the same exam, endorectal MRI can also be used to assess the accessibility of PC spread to lymph nodes and bones within the pelvis.

PROSTATE MRI ANATOMY

- On T1-weighted MR images, the normal prostate gland demonstrates homogeneous intermediate to low signal intensity. However T1-weighted MR imaging has insufficient soft-tissue contrast resolution for visualizing the intraprostatic anatomy or abnormality.
- The zonal anatomy of the prostate gland is best depicted on high-resolution T2-weighted images. On T2-weighted images, the normal peripheral zone demonstrates a high signal intensity. The signal intensities in the central and transition zones are lower than those in the peripheral zone. The anterior fibromuscular stroma has low signal intensity.
Appearance of Prostate Ca on MRI

- On T2-weighted images, prostate cancer usually demonstrates low signal intensity in contrast to the high signal intensity of the normal peripheral zone.
- However, this finding is not specific.
- Hemorrhage, prostatitis, scarring, radiotherapy, cryosurgery, and hormonal therapy can all result in low T2-signal intensity in the peripheral zone.
- Secondly, some tumors are isointense to the normal peripheral zone on T2-weighted images, and this accounts in part for the consistent finding that MRI is not 100% sensitive.

MR-Spectroscopy of the Prostate

In routine MRI, only protons from fat and water molecules contribute to tissue signal, because the contribution from nuclei in other molecules is so tiny. Using MRS, the signal from these other molecules can be detected, allowing non-invasive in-vivo assessment of the level of various metabolites within the tissue.

Clinically, this technique has been used most commonly in the brain as in MRI brain spectroscopy.
MR-Spectroscopy of the Prostate

In MRSI, prostate cancer is characterized by elevated levels of choline (a normal cell membrane constituent, which is elevated in many tumors) or reduced levels of citrate (a constituent of normal prostatic tissue) or both.

The ratio of choline and creatine to citrate in normally healthy prostatic tissue has been established as 0.22 ± 0.13.

IMAGING PROTOCOL

IMAGING PROTOCOL – Hardware & software

- MRI – 1.5T
- Body coil
- Endorectal coil
- Software for MR Spectroscopy
- No contrast needed

IMAGING PROTOCOL– Sequences

Standard sequences UMMC
- Axial T1-weighted pelvis
- Axial T2-weighted pelvis
- Sagital T2-weighted pelvis
- Coronal T2-weighted prostate
- MR Spectroscopy of selected volumes of the prostate

Others:
- *Diffusion-weighted imaging
- *Dynamic contrast enhancement

*Data mixed on accuracy/specificity of these techniques

Evaluation of MR Images in Prostate MR/MRS
Evaluation of MR Images in Prostate Carcinoma

- Carcinoma usually from PZ – appear as hypointense lesion
- Extracapsular extension: irregular bulging of the prostatic outline, breach of the capsule with extracapsular spread, asymmetry of the neurovascular bundles, and loss of the rectoprostatic angle.
- Invasion of seminal vesicles - Contiguous areas of low signal intensity extending into the seminal vesicles from the base of the prostate (Note – this also may be seen post-radiotherapy & post-biopsy)
- Invasion of bladder/rectum
- Lymph nodes – lymph nodes >1 cm considered involved
Coronal T2WI –
Hypointensity within the right seminal vesicle – seminal vesicle involvement

Abnormally high Ch+Cr/Ci ratio – carcinoma
Normal: Ci peak higher than Ch_Cr =