Name (First, last) | Neda Gholizadeh
---|---
Mailing address (including province/state, country, postal/zip code) | University Drive, Callaghan, NSW, Australia 2308
Institution/organization | The University of Newcastle
Position | PhD student
Telephone (including country prefix) | +61415788319

Email

The submission is to be considered in the following category
- [ ] Oral presentation preferred
- [ ] Poster presentation only

Trainee status
- [ ] I am a trainee (student or postdoctoral fellow)
- [ ] I wish to be a candidate for best student paper/poster

PRESENTATION TITLE
Multiparametric magnetic resonance imaging for the detection and localisation of prostate cancer

AUTHOR(S)

N. Gholizadeh1; P.B. Greer2,4; J. Simpson2,4; P. Lau3; S. Ramadan1,3

1 University of Newcastle, School of Health Sciences, Newcastle, NSW, Australia.
2 Calvary Mater Newcastle, Radiation Oncology, Newcastle, NSW, Australia.
3 Hunter Medical Research Institute (HMRI) Imaging Centre, New Lambton Heights, NSW, Australia
4 University of Newcastle, School of Mathematical and Physical Sciences, NSW, Australia

ABSTRACT

Purpose:
The objective of this study was to determine the diagnostic performance of multiparametric MRI (mp-MRI) using T2 weighted MR imaging (T2WI), diffusion weighted imaging (DWI), diffusion tensor imaging (DTI), magnetic resonance spectroscopy imaging (MRSI) for prostate cancer patients.

Materials & Methods:
12 PCa patients (71.16 ± 8.17 years were analysed and three patients were excluded from the study due to the low MRSI data quality. Ethics approval for the study was obtained and written informed consent was obtained from all patients. Participants were scanned using a 3 tesla MRI scanner (Skyra, Siemens Healthineers, Germany) equipped with an phase array coil. T2WI was obtained using a two-dimensional turbo spin echo (TSE). DWI was obtained using single shot echo planar imaging (EPI) and b-values of 0, 400 and 800 s/mm². DTI was also obtained using a single shot EPI. Thirty non-collinear directions of the diffusion sanitizing gradient were used with a b-values of 0 and 1600 s/mm². 3D 1H MRSI data was acquired using a GOIA-sLASER sequence with a voxel size of 7×7×7 mm³. A total of 41 cancer and 27 healthy region of interests (ROI)s were manually outlined in the peripheral zone (PZ) on T2WI by a radiologist. A two tailed t-test was used to compare the mean values of cancer and healthy regions using IBM SPSS statistic version 0.24.0 software. The area under receiver operating characteristic (ROC) curve of T2WI+DWI+DTI+MRSI images was measured to evaluate the performance of mp-MRI for discriminating cancer and healthy regions.

Results:
The quantitative parameters from each image for healthy and cancer ROIs and the corresponding p-values are summarized in Table 1.

Table 1. Mean ± standard deviation of the DWI, DTI, MRSI quantitative parameters for peripheral zone at healthy and cancer region of interests.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Healthy</th>
<th>Cancer</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC (× 10⁻³mm²/sec)</td>
<td>1.52 ± 0.33</td>
<td>1.08 ± 0.17</td>
<td>0.000</td>
</tr>
<tr>
<td>MD (× 10⁻³mm²/sec)</td>
<td>1.45 ± 0.36</td>
<td>0.99 ± 0.25</td>
<td>0.000</td>
</tr>
<tr>
<td>FA</td>
<td>0.25 ± 0.08</td>
<td>0.32 ± 0.10</td>
<td>0.002</td>
</tr>
<tr>
<td>Cho+Cr+PA/Cit</td>
<td>0.31 ± 0.05</td>
<td>0.77 ± 0.43</td>
<td>0.032</td>
</tr>
<tr>
<td>Cho/Cit</td>
<td>0.11 ± 0.02</td>
<td>0.43 ± 0.37</td>
<td>0.020</td>
</tr>
</tbody>
</table>

Mean ADC values of DWI and mean diffusivity (MD) values of DTI in healthy regions were significantly higher than cancer regions (p-value < 0.01), whereas mean fractional anisotropy (FA) values of DTI in healthy regions was significantly lower than cancer regions (p-value < 0.01).

For MRSI, the concentration of choline (Cho), creatine (Cr), polyamine (PA) and citrate (Cit) were measured using LCmodel and the ratio of Cho+Cr+PA/Cit and Cho/Cit were calculated. The mean Cho+Cr+PA/Cit and Cho/Cit ratios in the cancer regions were significantly higher than the healthy regions (p-value < 0.05). T2WI+DWI and T2WI+DWI+DTI+MRSI yielded an area under the ROC curve of 0.854 and 0.895, respectively (Figure 2).

![Figure 1](image1.png)

**Figure 1.** A prostate cancer in a 63-year-old patient with serum PSA of 10.04 ng/ml, who was diagnosed with bilateral biopsy-proven Gleason grade 4+3 in the right peripheral zone. Axial images are as follows: (a) MRI T2WI (b) ADC map (c) DWI (d) MD (e) FA and (f) Spectroscopy.

**Conclusions:**
Our results suggest that mp-MRI using DTI and MRSI in combination with DWI and structural T2WI improves performance for discrimination of cancer and healthy prostate tissues.