Endovaginal magnetic resonance imaging of Stage 1A/1B1 cervical cancer with a T2- and diffusion-weighted magnetic resonance technique: Effect of lesion size and previous cone biopsy on tumor detectability

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Introduction: Tumor detection within the cervix is dependent on T2-W contrast, with endovaginal imaging offering significant improvement in spatial resolution [1]. Often, the cone or large loop excision of the transformation zone (LLETZ) biopsy on which the diagnosis is made removes a large amount of the disease. The determination of residual disease is crucial in treatment planning: fertility sparing procedures demand a precise knowledge of the site and extent of any residual disease in order to ensure a curative and optimal surgical strategy. The use of diffusion-weighted imaging has potential to discriminate between tumor and granulation tissue in patients following cone biopsy [2]. The purpose of this study therefore was to evaluate the effect of previous cone biopsy and lesion size on the accuracy of detecting Stage 1A/1B1 cervical cancer using endovaginal T2- and diffusion-weighted magnetic resonance imaging.

Method: 113 patients with cervical tumor were imaged using an endovaginal coil with T2-W and diffusion-weighted single-shot echo-planar sequences; 85 (60 with prior cone biopsy/LLETZ) treated with extended cone biopsy /LLETZ (24), tracheectomy (29), hysterectomy (32) were evaluated. ADC maps and T2-W images viewed simultaneously were scored positive or negative for tumor and compared with histology at surgery. MRI tumor volumes (summed areas of regions of interest around lesion on each T2-W slice multiplied by slice thickness); maximum radiological and histological dimensions were recorded. ROC analysis was used to determine cut-off volumes for detecting tumor in those without and with prior cone biopsy/LLETZ and the maximum histological dimension correctly identifiable with MRI. Mean apparent diffusion coefficients (ADCs) calculated from tumor and adjacent normal epithelium were compared.

Results: T2-W and DW-MRI images in patients (Figure 1) and with (Figure 2) previous cone biopsy are illustrated. Sensitivity and specificity for detecting tumor in those without and with prior cone biopsy/LLETZ (Table 1) were significantly different (p=0.001). Following cone biopsy/LLETZ, MRI tumor volume of 83 mm³ detected tumor with 80% sensitivity, 94.7% specificity; a 5.3 mm maximal histological dimension was detected on MRI with 100% sensitivity, 100% specificity. Tumor ADCs were significantly lower (p=0.001) than paired normal epithelial tissue (median, 988×10⁻⁶ mm²/s vs. 1564×10⁻⁶ mm²/s) but neither tumor nor epithelial ADCs differed significantly between patients with or without prior cone biopsy/LLETZ (p=0.48 and 0.15, respectively, Figure 4).

†Table 1 Sensitivity, specificity, positive and negative predictive values for identifying invasive cervical carcinoma using T2-W and ADC maps in patients without or with previous cone biopsies.

<table>
<thead>
<tr>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sens %</th>
<th>Spec %</th>
<th>PPV %</th>
<th>NPV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cone (n=58)</td>
<td>26</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No cone (n=27)</td>
<td>16</td>
<td>31</td>
<td>7</td>
<td>4</td>
<td>80.0</td>
<td>81.6</td>
<td>69.6</td>
</tr>
</tbody>
</table>

Discussion and Conclusion: A combination of T2-W with diffusion-weighted imaging using an endovaginal technique is invaluable for detecting small cervical cancers, prior to fertility sparing procedures although sensitivity and specificity are lower following a previous cone biopsy/LLETZ procedure. However, the size of tumors detected even post cone/LLETZ is of the order where fertility sparing surgery remains a major management option. This procedure remains to be evaluated in multicentre trials, but offers enormous potential in the pre-operative management of this group of patients.


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