CERVICAL CANCER: VALUE OF AN ENDOVAGINAL COIL MAGNETIC RESONANCE IMAGING TECHNIQUE IN DETECTING SMALL VOLUME DISEASE AND ASSESSING PARAMETRIAL EXTENSION

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INTRODUCTION The soft tissue contrast of MRI enables delineation of cervical tumors with small lesions best demonstrated using an endovaginal or endorectal technique [1-3]. Tumor volume measurements from such images correlate well with those at histopathology and are valuable predictors of outcome. Identification and mapping of small volume disease and parametrial spread is essential in planning fertility conserving procedures such as trachelectomy. The purpose of this study was to determine sensitivity and specificity of endovaginal MRI in detecting small volume disease and parametrial extension in cervical cancer by comparing findings with those at radical hysterectomy in order to establish its role in guiding the surgical decision-making process preoperatively.

METHODS A retrospective review was undertaken of patients referred for endovaginal MR imaging because of cervical cancer or suspected cervical cancer. All patients (n=119) who subsequently underwent radical hysterectomy between Feb 1993-Jan 2002 were included. *Imaging Method:* Over the 9-year period the technique was performed by a single radiologist, and remained essentially unchanged. Details of the endovaginal coil and its use have been described previously [3]. Imaging was performed either at 0.5-T or 1.5-T (Marconi Medical Systems, Highland Heights, OH) using transverse and sagittal to the cervix T1-W (SE 720-820/20 [TR/TE] msec) and T2-W (FSE 2500/80 [TR/TE] msec) sequences. Contiguous slices 2-3 mm thick were acquired with a 192 x 256 matrix, two to four signal averages and a 12-cm FOV. ***Data Analysis:*** All radiologic data was reported prospectively by a single radiologist and not modified. Presence of tumor was assessed on the endovaginal T2-W images. Regions of interest (ROI) were drawn around the lesion on all slices on which it was seen, and tumor volumes obtained by summing ROI areas and multiplying by slice thickness. Tumor infiltration of the parametria was recognized by extension of intermediate signal-intensity tissue into the high signal-intensity of parametrial fat on the T2-W images transverse to the long axis of the cervix. ***Statistical Methods:*** Sensitivity and specificity were calculated against histology for presence of tumor within the cervix and for parametrial extension. A ROC curve was used to evaluate the power of MRI tumor volume as a predictor of lymph node status at histology.

RESULTS: Average age was 43.5 ± 11.0 yrs; FIGO Stage distribution Ia 3; Ib1 85; Ib2 25; IIa 3; IIb 3. A diagnostic cone biopsy or loop diathermy biopsy had been performed on 60 (50.4%) between 2 wks and 10 yrs. previously (median 4 wks, lower and upper quartiles 3 and 7.8 wks). Histological type was squamous 81; adenocarcinoma 28; adenosquamous 6; and neuroendocrine 4. Forty (33.6%) were grade 3 tumors and 49 (41%) had lymphovascular space involvement. Pre-treatment tumor volumes ranged from 0-70 cm^3 (median 2.2cm^3, lower and upper quartiles 0.5 cm^3 and 14.9 cm^3). 43 patients (36.1%) had tumor volumes ≤1cm^3. The smallest tumors identified were 0.1cm^3. Women who had a cone biopsy to determine the diagnosis had smaller tumours than those who did not (median 0.65cm^3 vs. 10.5cm^3, $p < 0.0001$). All women underwent a radical hysterectomy and pelvic lymph node dissection within 4 weeks of MRI. Tumor was identified in the hysterectomy specimen in 97 of 119 cases (81.5%). In 22 cases the tumor was visible only in the initial cone biopsy specimen. Sensitivity and specificity for tumor detection with endovaginal MRI was 96.9% and 59.1% respectively. Tumor volumes in 9 false positive cases ranged from 0.1-1.3 cm^3 (median 0.7 cm^3). In 43 patients with tumor volumes of ≤1cm^3, the sensitivity for detecting tumor was 87.0%; specificity was 65.0%. When patients with and without previous conization were compared, sensitivity and specificity were 95.1% and 57.9% respectively vs. 98.2% and 66.7% respectively. Prior conisation made no statistically significant difference to the sensitivity or specificity of MRI in the detection of tumour. Sensitivity and specificity for parametrial invasion was 80% and 91.3% respectively. An ROC plot of the relation between the MRI estimation of volume and the histological diagnosis of lymph node metastasis showed the area under the curve to be 0.83; using a cut-off volume of 5.2cm^3, lymph node metastasis could be predicted with 78.6% sensitivity and 72.5% specificity.

CONCLUSION: Endovaginal magnetic resonance imaging has high sensitivity in the preoperative staging of uterine cervical cancer even for tumors ≤1cm^3. It is an invaluable technique in planning fertility-conserving or radical surgical treatment of early stage cervical cancer.

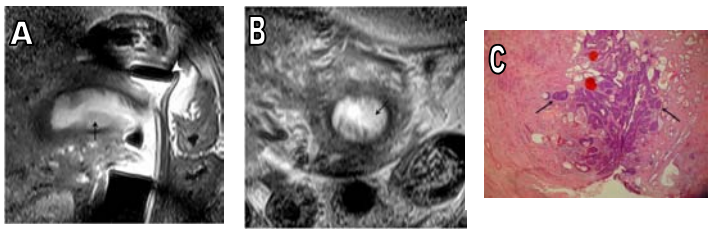

Fig. 1 43 *yr. old female with residual cervical tumor following cone biopsy:* Sagittal [A] and transverse [B] T2-weighted images through the uterine cervix using an endovaginal coil (arrowhead). A nodule within the endocervical mucosa is seen in the left anterolateral position (arrows). On the radical hysterectomy specimen at that level [C], this corresponds to a nodule of residual in-situ and invasive tumor (arrows, magnification X100).

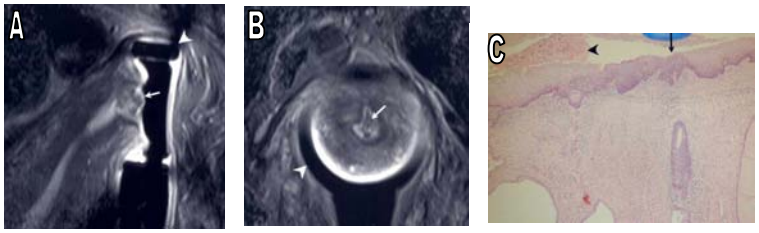

Fig. 2: 31 *yr. old female with no residual cervical tumor following cone biopsy:* Sagittal [A] and transverse [B] T2-weighted images through the uterine cervix using an endovaginal coil (arrowheads). A low signal-intensity heterogenous mass is seen at the ectocervix (arrows), correctly interpreted as granulation tissue and debris, and confirmed on histopathology. The hysterectomy specimen [C, magnification X20] showed only a residual focus of cervical intraepithelial neoplasia (arrow) and debris within the endocervical canal (arrowhead).

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3. Kaji Y, Sugimura K, Kitao M, et al: J Comput Assist Tomogr 1994; 18:785-792.