

Comparison of Diffusion Weighted Imaging and Dynamic Contrast Enhanced MRI for assessing the depth of myometrial invasion in endometrial cancer

P. Beddy¹, P. Moyle¹, M. Kataoka¹, A. K. Yamamoto¹, I. Joubert¹, D. J. Lomas¹, R. Crawford², and E. Sala¹

¹Radiology, University of Cambridge, Cambridge, Cambridgeshire, United Kingdom, ²Gynaecological Oncology, University of Cambridge, Cambridge, Cambridgeshire, United Kingdom

Introduction

Endometrial carcinoma is the fourth most common female cancer and the most common malignancy of the female reproductive tract. Incidence of the disease is increasing due to longevity and rising levels of obesity [1]. Endometrial cancer is staged with the FIGO system which was recently been modified and has incorporated MRI into the staging system [2]. The new FIGO staging system has amalgamated stage 1a and 1b into a new stage 1a, representing invasion of less than half of the myometrium, with the new 1b representing invasion of greater than one half of the myometrium but without extrauterine extension. There is little consensus in the literature regarding the best MRI technique for assessing myometrial invasion. We have previously published on the additional benefit of dynamic contrast enhanced (DCE) imaging in staging endometrial cancer and other approaches including diffusion weighted imaging (DWI) have shown promise in improving staging accuracy [3]. The aim of this study was to assess the diagnostic accuracy of DWI at assessing myometrial invasion in preoperative staging of endometrial cancer and to compare it to DCE imaging using surgical pathology as the reference standard.

Materials and Methods

Fifty female patients with a histologically confirmed diagnosis of endometrial cancer underwent an MRI of the pelvis as part of their initial preoperative staging. Each examination consisted of standard pre contrast high resolution Fast Recovery Fast Spin Echo (FRFSE) sequences, with T2W imaging of the pelvis in the sagittal, axial and axial oblique planes and T1W axial sequences of the pelvis and abdomen on a 1.5T MRI system. Axial oblique diffusion weighted imaging (DWI) of the pelvis was then performed [TR/TE 5,000msec/85msec, 128x128 matrix, 28cm FOV, 4.5mm slice thickness, b-value 0,800 sec/mm²]. This was followed by dynamic contrast enhanced MRI (DCE-MRI) after administration of 0.1mmol/kg gadolinium at 2ml/sec using a multi-phase technique (pre-contrast sagittal and axial oblique and post-contrast at 25 sec, 1 min, 2 min in the sagittal plane and 4 min in the axial oblique plane) with a 3D GRE T1W Liver Acquisition Volume Acceleration (LAVA, GE Medical Systems, Milwaukee, Wisconsin) sequence [TR/TE 3.6msec/1.75msec, 288x192 matrix, 36cm FOV, 4mm section thickness interpolated to 2mm].

The studies were retrospectively evaluated by two reviewers who independently assessed the depth of myometrial invasion and the overall disease stage. The standard sequences (T2W and T1W) and DWI were initially evaluated and local and overall staging was assigned for each case based on the FIGO staging system. Six weeks later, an identical scoring system was used to stage the standard sequences and DCE imaging. Surgical histology was available for each case and constituted the gold standard for comparison.

Results

Table 1: Percentage (frequency) of patients with correctly identified myometrial invasion for reader 1 and 2. For reader 1, the depth of myometrial invasion was correctly determined in 68% (34/50) of the cases on DCE, whereas this percentage increased to 90% (45/50) with DWI (95% CI: 5.0% to 39.0%, p=0.013). For reader 2, the depth of myometrial invasion was correctly determined in 76% (38/50) of the cases on DCE, whereas this percentage increased to 84% (42/50) with DWI (95% CI: -4.9% to 20.9%, p=0.289). The inter-reader agreement (Kappa value) for assessing the depth of myometrial invasion was 0.29 for DCE and 0.72 for DWI.

MR Finding	DCE	DWI
Reader 1		
<50% myometrial invasion	51.7 (19/33)	84.8 (28/33)
>50% myometrial invasion	88.2 (15/17)	100.0 (17/17)
Reader 2		
<50% myometrial invasion	72.7 (24/33)	81.8 (27/33)
>50% myometrial invasion	82.4 (14/17)	88.2 (15/17)

Table 2: Diagnostic Accuracy. Sensitivity, Specificity, Positive (PPV) and Negative Predictive Values (NPV) of diagnosing the absence of deep myometrial invasion (myometrial invasion limited to <50%)

	Diagnostic Accuracy %	Sensitivity %	Specificity %	PPV %	NPV %
Reader 1					
DCE	68.0 (34/50)	57.6 (19/33)	88.2 (15/17)	90.5 (19/21)	51.7 (15/29)
DWI	90.0 (45/50)	84.8 (28/33)	100.0 (17/17)	100.0 (28/28)	77.3 (17/22)
Reader 2					
DCE	76.0 (38/50)	72.7 (24/33)	82.4 (14/17)	88.9 (24/27)	60.9 (14/23)
DWI	84.0 (42/50)	81.8 (27/33)	88.2 (15/17)	93.1 (28/28)	71.4 (17/22)

Table 3: Diagnostic Accuracy. Sensitivity, Specificity, Positive (PPV) and Negative Predictive Values (NPV) of detecting deep myometrial invasion (myometrial invasion greater than 50%)

	Diagnostic Accuracy %	Sensitivity %	Specificity %	PPV %	NPV %
Reader 1					
DCE	68.0 (34/50)	88.2 (15/17)	57.6 (19/33)	51.7 (15/29)	90.5 (19/21)
DWI	90.0 (45/50)	100.0 (17/17)	84.8 (28/33)	77.3 (17/22)	100.0 (28/28)
Reader 2					
DCE	76.0 (38/50)	82.4 (14/17)	72.7 (24/33)	60.9 (14/23)	88.9 (24/27)
DWI	84.0 (42/50)	88.2 (15/17)	81.8 (27/33)	71.4 (17/22)	93.1 (28/28)

Conclusions:

Diffusion weighted imaging (DWI) has superior diagnostic accuracy compared to dynamic contrast enhanced MRI (DCE-MRI) in assessing the depth of myometrial invasion in endometrial cancer. DWI also has a significantly higher inter-reader agreement.

References:

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- Lin G et al. 2009 Radiology 250:784-92. Myometrial invasion in endometrial cancer: diagnostic accuracy of diffusion-weighted 3.0-T MR.

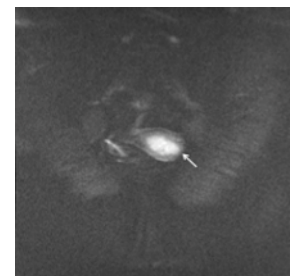


Fig 1. Axial Oblique DWI showing deep myometrial invasion (>50%) confirmed as stage 1b on histology

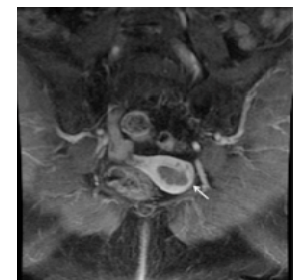


Fig 2. Axial Oblique DCE in same patient as Fig.1 showing myometrial invasion, staged as 1a but confirmed as 1b on histology