Preoperative evaluation of uterine isthmus-cervical infiltration in patient with cervical cancer using nuclear magnetic resonance

Aljoša Mandić¹, Tamara Vujkov², Nataša Prvušović³, Bojana Gutić⁴, Slavica Knežević Ušaj⁵

SUMMARY

Background: During the last three decades, fertility preservation has been established as a new treatment modality for young patients with early cervical cancer. In preservation of the uterine corpus in fertility sparing surgery one of the most important factors is evaluation of absence of internal uterine ostium or uterine corpus tumor infiltration. The aim was to evaluate the accuracy of nuclear magnetic resonance (NMR) in detection of infiltration of uterine isthmus-cervical part in cervical cancer patients without fertility preservation.

Methods: In 60 patients with cervical cancer FIGO stage IA-2 – IVA, NMR was performed before the operation. Radical hysterectomy Piver class III was performed in 57 patients and pelvic exenteration in three patients with FIGO stage IVA. The histopathological material was examined at the Department of pathology and cytology and it was used as a gold standard.

Results: The patient average age was 44.7, (range: 25-65 years). Squamous cervical cancer was diagnosed in 53 (88.3%), adenocarcinoma in 4 (6.7%), and adenosquamous carcinoma in 3 (5%) patients. According to NMR findings, 7 (11.7%) patients were with uterine isthmus-cervical infiltration when compared with histopathological examination, which established infiltration in 10 (16.7%) patients. Sensitivity of NMR was 60%, specificity 98%, positive predictive value 85.7%, and negative predictive value was 92.5% with overall accuracy 91.7%.

Conclusion: Sensitivity of NMR was low compared with other studies but with high specificity and overall accuracy. The positive predictive value was relatively acceptable. Negative findings of NMR for corporal infiltration and precise evaluation of the depth of stromal infiltration and length of the proximal cervix without infiltration are important in preoperative diagnostic for fertility preservation surgery.

Key words: Uterine Cervical Neoplasms; Diagnosis; Magnetic Resonance Imaging; Sensitivity and Specificity; Preoperative Period; Fertility

INTRODUCTION

Cervical carcinoma represents one of the major problems in developing countries where the cervical population-screening program is still not developed (1). Approximately 45% of surgically treated stage IB cancers occur in women under the age of 40 years (2). However, in developed countries, screening enables the detection of cancer in its early phase, which suggests a new approach in comprehension and surgical treatment of early invasive cervical carcinoma. Radical trachelectomy is a surgical method, together with the pelvic lymphadenectomy, for treating invasive forms of cervical carcinoma in its early stage in women who are in their fertile ages and who want to keep their reproductive function (3-8). The general eligibility criteria for radical trachelectomy include the following: women less than 40 years of age who have a strong desire to preserve fertility, no clinical evidence of impaired fertility, lesion size less than 2 cm, International Federation of Gynecology and Obstetrics (FIGO) stages IA –IB-1, no involvement of the upper endocervical canal, and negative regional lymph nodes (9). The absence of metastatic disease in lymph nodes and parametrial involvement allow continuation of the procedure. Another crucial point of the procedure is the level where the cervix has to be incised. In the preservation of uterine corpus in fertility-sparing surgery, the most important factor is the absence of internal uterine ostium or uterine corpus tumor infiltration (10). When computed tomography (CT) and NMR are compared, NMR is significantly more accurate in the evaluation of tumor volume, local tumor stage, and parametrial invasion due to its distinctive tissue contrast and multiplanar capability (11). Cervical tumor is best shown in T2W sequence, which gives the most evident difference between normal structures in the body and cervix of the uterus. The same sequence is determined by the integrity of the stromal ring and its deficiency is explained by the penetration of the tumor to the parametrium. The aim was to evaluate the accuracy of NMR in detection of infiltration of uterine isthmus-cervical part in cervical cancer patients without fertility preservation.

PATIENTS AND METHODS

Sixty patients with cervical cancer FIGO stage IA-2 - IVA were preoperatively examined and conventional NMR before the operation was made. Cervical cancer was confirmed by histopathological specimen obtained by cervix biopsy. The results of NMR findings for presence or absence of infiltration of uterine isthmus-cervical part, such as diameter of the tumor, were compared with the results of histological examination of the surgical specimens. Radical hysterectomy Piver Class III with pelvic lymphadenectomy was performed in 57 patients and pelvic exenteration in three patients with FIGO stage IVA. The histopathological material was examined at the Department of pathology and cytology of the Oncology Institute of Vojvodina and it was used as a gold standard.

The NMR examinations were performed at the Center for imaging diagnostics of the Oncology Institute of Vojvodina. T2W tomograms
targeted perpendicular to the axis of the cervix were used (the technique of multiple-echo (TSE) with 9 intersections, of 5 mm thickness and flashover 0.5 mm; field of view 360°; minimum range resolution 259 x 512 pixels and acquisition time 5:50 minutes). The sagittal T2W images identify the best penetration of the tumor in the body of the uterus and its spread beyond the level of the internal uterine osium. For statistical analysis, T-test and test for sensitivity, specificity, and accuracy were used in SPSS 6.0 statistical program.

RESULTS
The patient average age was 44.7 years (range 25-65 years) (Figure 1).

Squamous cervical cancer was diagnosed in 53 (88.3%), adenocarcinoma in 4 (6.7%), and adenosquamous carcinoma in 3 (5%) patients (Table 1).

Table 1. Histopathological type of the cervical tumor

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Number of patients (%)</th>
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<tbody>
<tr>
<td>Adenocarcinoma</td>
<td>4 (6.7)</td>
</tr>
<tr>
<td>Adenosquamous carcinoma</td>
<td>3 (5.0)</td>
</tr>
<tr>
<td>Planocellular carcinoma</td>
<td>53 (88.3)</td>
</tr>
<tr>
<td>Total</td>
<td>60 (100.0)</td>
</tr>
</tbody>
</table>

Mean tumor diameter on NMR finding was 31.8mm (range: 5 mm to 60 mm) and mean value found by histopathological examination of the cervical specimen was 27 mm (range: 0 mm to 70 mm). Tumor diameter measured by NMR was greater in comparison with tumor diameter defined by the histopathological examination of the specimen with statistically significant difference of \( p=0.0102 \) (Table 2).

Table 2. Diameter of the cervical tumor measured by NMR and pathologist

<table>
<thead>
<tr>
<th>Tumor diameter (mm)</th>
<th>Parameters</th>
<th>NMR</th>
<th>PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value</td>
<td>31.8*</td>
<td>27.1</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>14.1</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>The smallest diameter</td>
<td>5.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>The greatest diameter</td>
<td>60.0</td>
<td>70.0</td>
<td></td>
</tr>
</tbody>
</table>

*\( p < 0.05 \); PH - pathologist

NMR findings showed uterine corpus infiltration in 7 (11.7%) patients when compared with histopathological examination, which established infiltration in 10 (16.7 %) patients. NMR sensitivity was 60%, specificity 98%, positive predictive value 85.7% and negative predictive value was 92.5 % with overall accuracy 91.7 % (Figures 2-4).
DISCUSSION

Uterine corpus infiltration was found in 7 (11.7%) patients using NMR when compared with histopathological examination, which established infiltration in 10 (16.7%) patients, in our study. Computed tomography (CT), NMR, or ultrasonography (US), such as PET/CT can be used as pretreatment evaluation of patients with cervical cancer (12-15).

Evaluation of tumor size, stromal infiltration, and cranial border of tumor is essential in the early stages for treatment individualization, including the planning of fertility-sparing procedures. The NMR staging criteria for cervical cancer was first introduced at the end of the 1980s by Hricak and Togashi (16, 17). Today, NMR is widely accepted as a method for evaluation of tumor volume, uterine corpus involvement, parametral invasion, and metastatic lymph node involvement (18). Exquisite high-resolution images of the female pelvis can be obtained by using current state-of-the-art NMR technology. The routine use of high-resolution, sagittal and axial, T2-weighted, fast spin-echo (FSE) sequences and axial, T1-weighted, spoiled gradient-echo sequences is advocated. The sagittal, T2-weighted images facilitate the evaluation of the primary cervical tumor and of the tumoral extension into the uterine corpus, vagina, bladder, or rectum. The axial images are critical for evaluating the extent of stromal penetration and for detecting parametral invasion (19).

Despite the results of the accuracy, NMR is not officially incorporated in the International Federation of Gynecology and Obstetrics (FIGO) staging system, but it is already widely accepted as the reliable imaging technique. The reported accuracy of NMR in detecting tumor size within 0.5 cm was 70%–93% (20). In recent study by Manfredi et al. (21), fifty-three patients with biopsy-proven carcinoma of the uterine cervix and eligible for conservative surgery prospectively underwent NMR imaging. In 75% of cases, there was agreement between NMR imaging and histopathology in the assessment of cervical stroma infiltration. NMR imaging had 67% sensitivity, 92% specificity, and 91% diagnostic accuracy in assessing infiltration of the vaginal fornices. In the evaluation of the infiltration of the internal os, NMR imaging had 86% sensitivity, 93% specificity, and 92% accuracy. NMR and histopathology findings in the evaluation of the infiltration of the internal os in our study showed that NMR sensitivity was lower (60%) but specificity was 98%, with overall accuracy 91.7% and they were similar to Manfredi. The magnetic resonance (MR) whole-body diffusion-weighted imaging (WB-DWI) was used in the staging of uterine cervical carcinoma by Chen YB et al. Twenty-six patients received preoperative conventional MR and WB-DWI scans and 30 healthy volunteers were scanned by WB-DWI. Mean ADC value of uterine cervical carcinoma was significantly lower than the 3 layers of normal uteri, but specificity and overall accuracy were high. The positive predictive value was relatively acceptable. The evaluation of NMR findings for parameters such as depth of the stromal infiltration, tumor volume, could also be an important issue for fertility preservation surgery.
Conflict of Interest
We declare no conflicts of interest

REFERENCES