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The usefulness of magnetic resonance imaging (MRI) in cervical carcinoma assessment – a preliminary report

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Aim. The aim of diagnostic imaging is not so much the detection of cervical carcinoma, but the evaluation of its stage. In view of this the aim of this study included: 1) comparison of MR results with the results of histological examinations after operations with reference to the dimensions of cervical carcinoma; 2) assessment of the sensitivity and specificity of MRI in the evaluation of parametrium infiltration; 3) analysis of the sensitivity and specificity of MRI in the evaluation of infiltration of the vagina and uterus; 4) assessment of the usefulness of this method in the detection of metastases to lymph nodes.
Material and method. The material consisted of pelvic MRI, obtained with 2T Elscint unit in 15 patients with cervical carcinoma, aged 37 to 73 years. All patients underwent surgical treatment within 30 days after MR.
During the MR examination the following sequences were performed: SE (spin echo) T1 (longitudinal relaxation time) in axial projection before administration of gadolinium (Gd-DTPA); SE T1 in axial, frontal and sagittal projections after contrast injection and FSE (fast spin echo) T2 (transversal relaxation time) in axial, frontal and sagittal projections.
Results. 1) in the assessment of cervical carcinoma dimensions MRI results are highly concordant with the results of postoperative histological examination (p=0.9389); 2) in the assessment of parametrium infiltration sensitivity and specificity of MRI are 75% and 100% respectively; 3) in the assessment of the infiltration of the vagina and uterine corpus the sensitivity and specificity of MR imaging were respectively 100% and 85%; 100% and 100%; 4) in the detection of lymphnode metastases MRI sensitivity was 67% and its specificity 100%.
Conclusion. In patients with cervical carcinoma MRI is a valuable method for the assessment of tumour dimentions, parametrium infiltration, infiltration of the vagina and uterine corpus.

Wartość diagnostyczna rezonansu magnetycznego (MR) w ocenie raka szyjki macicy – doniesienia wstępne

Cel. Zadaniem diagnostyki obrazowej nie jest wykrywanie raka szyjki macicy, lecz ocena stopnia zaawansowania.
Celem pracy było: 1) porównanie badania MR z wynikami histopatologicznymi uzyskanymi po operacji, w ocenie wymiarów raka szyjki macicy; 2) analiza czułości i specyficzności badania MR w ocenie naciekania przymacicza; 3) ustalenie czułości i specyficzności badania MR w ocenie naciekania pochwy i macicy; 4) ocena przydatności badania w wykrywaniu przerzutów do węzłów chłonnych.
Materiał i metoda. Materiał stanowiły badania MR miednicy, wykonane aparatem 2T firmy Elscint, u 15 chorych na raka szyjki macicy. Wiek chorych od 37 do 73 lat. Wszystkie chore były operowane w okresie nie dłuższym niż 30 dni od badania MR. Podczas badania MR wykonywano następujące sekwencje: przed podaniem środka kontrastowego (Gd DTPA) SE T1 w projekcji poprzecznej, po podaniu gadolinu SE T1 w projekcjach: poprzecznej, czołowej i strzałkowej, FSE T2 w projekcjach: poprzecznej, czołowej i strzałkowej.
Wyniki. W ocenie wymiarów raka szyjki macicy badanie MR odznacza się wysoką zgodnością (p=0.9389) z wynikami pooperacyjnego badania histopatologicznego. W ocenie naciekania przymacicza czułość i specyficzność badania MR wynoszą odpowiednio: 75% i 100%. W ocenie naciekania pochwy i trzonu macicy czułość i specyficzność badania MR wynoszą odpowiednio: 100% i 85% oraz 100% i 100%. Badanie MR jest mało czułą (67%), lecz wysoce specyficzną (100%) metodą oceny przerzutów do węzłów chłonnych.

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Wnioski. Badanie MR jest wartościową metodą oceny wymiarów raka szyjki macicy. Badanie MR jest użyteczną metodą diagnostyczną w ocenie naciekania przymacicza, pochwy i trzonu macicy.

Key words: MRI, cervical carcinoma, staging
Słowa kluczowe: MR, rak szyjki macicy, zaawansowanie

The aim of imaging examinations is not the finding of cervical carcinoma but rather the assessment of its stage. Information from MRI is obtained mostly during the evaluation of the sequences T2 (transversal relaxation time) weighted [1], MRI protocols include also routine T1 (longitidinal relaxation time) sequences in which the signal from the tumour has the same intensity as the cervical tissue, but it helps in the differentiation of bleeding areas, detection of calcifications in the tumour. T1 weighted sequences after gadolinium (Gd-DTPA) administration contribute only scant additional information, although certain authors regard them helpful in the diagnosis of small tumours (especially dynamic examinations) and in the evaluation of tumour structure (necrosis areas) [1, 2].

The assessment of cervical carcinoma stage is based on FIGO criteria. Pre-invasive carcinoma (stage 0) and invasive in stage Ia are recognized exclusively in microscopic examination, and are not recognizable in MRI. The most important criteria of MRI diagnosis in stages higher than Ia are: tumour dimensions and infiltration of the vagina, uterus and parametrium. An important element in the evaluation of 5-year survival is the presence of metastases to lymph nodes.

Study aim:

1. Comparison of MRI results with those of postoperative histological examinations in the assessment of cervical carcinoma dimensions.
2. Analysis of the sensitivity and specificity of MRI in the evaluation of parametrium infiltration.
3. Assessment of the sensitivity and specificity of MRI in the evaluation of the infiltration of the vagina and uterus.
4. Evaluation of MRI applicability in the detection of the metastases to lymph nodes.

Material and method

The material consisted of pelvic MR examinations carried out in 15 patients with cervical carcinoma, aged 37 to 73 years. They were operated on within 30 days after MR examination.

Protocol of pelvic MRI:

before gadolinium administration:

SE (spin echo) T1 sequences in axial projection with large field of view:

– imaging parameters: TR (repetition time)=950 ms, TE (echo time)=18 ms, FOV (field of view) 34x42 cm, matrix 252x306, 6 mm layers, 20% gap;

FSE sequences with fat saturation, axial projection with large field of view:

– imaging parameters: TR=7200 ms, TE=126 ms, FOV 37x42 cm, matrix 252x306, 5 mm layers, 20% gap;

SE T1 sequences in sagittal projection, FSE T2 in axial, sagittal and frontal projection with small field of view:

– imaging parameters: SE sequences TR=500 ms, FSE sequences TR=7300 ms, TE=126 ms, FOV 21x21 cm, matrix 252x296, layers 4 mm, 20% gap;

SE T1 sequences in axial, frontal and sagittal projections after administration of Gd-DTPA in amounts of 0.1-0.2 mmol/kg body weight with small field of view – parameters as above.

In SE T1 sequences with large field of view the pelvis was surveyed, special attention being paid to lymph nodes and organs in the small pelvis. In the evaluation of lymph nodes involvement longitudinal dimension over 15 mm was accepted as the limit value.

In the remaining sequences the genital organs were examined in detail, with particular reference to lesions in the cervix, uterine corpus, vagina and parametrium. Tumour dimensions were measured in the cervix in sagittal, transverse and frontal planes.

The results of these measurements were compared with postoperative histological examinations. Student T test was used for statistical analysis comparing the mean values of three tumour dimensions; $p=0.05$ as statistically significant. Standard deviations of mean value of volume differed statistically, due to which the Student T test for situations where variance distribution is non-parametric was used.

The results of the assessment of the infiltration of the vagina, parametrium and uterine corpus were compared with postoperative histological examinations and the sensitivity and specificity of MRI in the evaluation of these parameters were calculated.

Results

In 4 cases MRI failed to show malignant lesions in the cervix. In histological examinations in 3 of these patients *in situ* planoepithelial carcinoma was found, in 1 case histological examination also failed to disclose malignant lesions, but this patient had earlier been treated by radiotherapy. In 1 case MRI also failed to demonstrate malignant infiltration in the cervix while in histological examination a flat infiltration was revealed 10 mm long and 0.4 mm broad. In 11 cases the dimensions of the dimensions were compared. In the comparative analysis of cervical tumour dimensions the following results were obtained: mean tumour dimension in MRI 33.29 mm ±19.05, in histological examination 32.66 mm ±20.89, $p=0.9389$. These results evidence a high agreement of the results of tumour dimensions measurements.

In parametrium assessment in 15 studied cases MRI and histological examination failed to detect parametrium infiltration in 11 cases, and found it in 3 cases. In 1 case a false negative result was obtained in MRI. The sensitivity of MRI in the assessment of parametrium infiltration was 75% and its specificity 100%, accurancy 93%.

In MRI and histological examination no vaginal infiltration was found in 11 cases. In 2 cases both methods revealed infiltration presence. In 2 cases false positive re-

sults were obtained in MRI. MRI sensitivity in vaginal infiltration assessment was 100%, specificity – 85%, accurancy – 87%.

Uterine corpus infiltration was found in 4 cases. In 11 cases both methods demonstrated infiltration absence. MRI sensitivity and specificity was 100%.

Absence of lymph node involvement was correctly recognized in 12 patients. In 2 cases lymph nodes were enlarged over 15mm and histological examination showed metastases. In 1 case the MRI result was falsely negative and histological examination showed micrometastases. MRI sensitivity was 67%; specificity – 100%, accurancy – 93%

Discussion

Literature reports show that MRI is the method of choice in the assessment of cervical carcinoma stage [1-4]. MRI had higher sensitivity and specificity in relation to clinical, ultrasonographic and computed tomography (CT) examinations [5]. According to literature data the concordance of MRI and CT results in the assessment of parametrium infiltration was 94% and 76% respectively [5]. Other authors reported worse results. In the study of Yang [7] MRI sensitivity in the general assessment of cervical carcinoma stage below IIb was 65%. In parametrium involvement assessment MRI sensitivity was 33% [7]. According to our own experience MRI sensitivity in parametrium involvement assessment reached 75%, specificity – 100%, accurancy – 93%.

Infiltration of the internal orifice of corpus of the uterus in own material was recognized correctly in all cases, with sensitivity and specificity of 100%. Other authors have reported similar values; MRI sensitivity and specificity in the assessment of internal orifice and uterine corpus involvement ranged respectively from 86% [8] to 100% [6], and from 96% [6] to 100% [8]. This assessment is an important element of the examination, especially in view of the difficulty of uterine corpus infiltration assessment in clinical examination [9]. In recent years various authors have reported interesting results of operations on the uterus in cases of cervical carcinoma [6]. In such cases precise assessment of the extent of uterine corpus infiltration is impossible.

In the assessment of vaginal infiltration in own material the sensitivity, specificity and accurancy of MRI was 100%, 85% and 87%, respectively. The vaginal extension and range of infiltration are one of the elements of cervical carcinoma stage in FIGO criteria. The obtained results agree with those of other authors [11].

In the evaluation of the involvement of lymph nods both methods (MR and CT) are equivalent (86% of concordance) [5]. Other authors, accepting the limit value of lymph nodes involvement to be their transverse dimension over 5mm, report MRI sensitivity of 57% and specificity of 83% [6]. In own material MRI sensitivity was 67%, specificity 100% and its accurancy 93% in the assessment of lymph node involvement.

To summarise, it can be stated that MRI is a valuable method for imaging cervical carcinoma and its stage evaluation. The method is, however, not optimal for the assessment of parametrium infiltration and involvement of lymph nodes. The protocols of MRI in cervical cancer imaging are improving. In the literature one may find reports of interesting results of dynamic MRI examinations inpatients with low grade malignancies [10].

The presented results must be considered preliminary, due to the fact that they have been derived from a relatively small group of examined patients. Therefore, studies in this subject have not been brought to an end yet and will be continued in order to confirm currently presented results with further examinations performed on larger scale.

Conclusions

1. MRI is a valuable method for the assessment of cervical carcinoma dimensions and shows a high concrdnce (p=0.9389) with the results of postoperative histological examinations.
2. MRI is a useful method in the assessment of parametrium involvement.
3. In the assessment of the infiltration of the vagina and uterine corpus MRI sensitivity, specificity and accurancy are high.
4. MRI shows low sensitivity and high specificity and accurancy in the assessment of lymph node metastases.

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