

9. Abstract

Background: Endometrial cancer is the most common gynecologic malignancy in Europe and the second most common worldwide. Preoperative evaluation is crucial for selecting optimal, patient-tailored treatments, leading to better outcomes and reduced complications. Magnetic resonance imaging (MRI) is considered the best method for local staging of endometrial cancer.

Objectives: This study aimed to determine the usefulness of MRI in the preoperative evaluation of endometrial cancer, assess diagnostic parameters for specific staging characteristics, and explore whether radiological characteristics could serve as biomarkers for cancer histological characteristics.

Study Group, Material, and Methods: The study enrolled 150 women with histopathologically confirmed endometrial cancer, surgically treated at the Frederic Chopin University Clinical Hospital in Rzeszow between 2021 and 2022. All participants underwent preoperative MRI.

Diagnostic parameters for MRI in evaluating endometrial cancer staging were established by statistically comparing radiological imaging evaluations with postoperative histopathological results.

An attempt was made to identify radiological biomarkers for the histological grade of endometrioid carcinoma and the histological type of endometrial cancers, based on the evaluation of uterine and tumor characteristics in T2-weighted images, ADC maps, and pre-contrast and contrast-enhanced T1-weighted images. Dynamic contrast-enhanced images were used to evaluate the cancer's contrast enhancement curves.

Patients were dichotomously divided into subgroups based on histopathological findings, which were considered the true state, and the presence or absence of particular features. Statistical methods were used to compare the prevalence and values of each characteristic among the subgroups.

Results: A total of 150 patients, aged 36 to 90, were eligible for analysis, with a median age of 65 years. Among them, 136 were postmenopausal. Histopathological examination diagnosed endometrioid carcinoma in 123 women and other histological types in 17 patients. Cancer was confined to the endometrium in 11 patients, while deep myometrial invasion was confirmed in 74 patients. Significant lymphovascular space

invasion was found in 45 patients, and lymph node metastases were confirmed in 12 patients.

MRI demonstrated good to very good accuracy, high specificity, and negative predictive value in assessing staging features of endometrial cancer. It showed high accuracy (91%, CI 85-95%) and negative predictive value (96%, CI 91-98%) in excluding myometrial infiltration. MRI had high sensitivity (86%, CI 77-93%) and specificity (89%, CI 80-95%) in diagnosing deep myometrial invasion. Cervical stromal invasion was diagnosed with a sensitivity of 65% (CI 44-83%) and specificity of 93% (CI 87-97%). Sensitivity for evaluating features of locally advanced endometrial cancer was low, with the lowest sensitivity (36%, CI 11-69%) observed in detecting parametrial and vaginal involvement. Sensitivity for detecting adnexal lesions was also quite low (60%, CI 15-95%).

MRI features can potentially serve as biomarkers for the grade of endometrioid carcinoma and histological types of endometrial cancer. High-grade endometrioid carcinomas, compared to low-grade carcinomas, were characterized by larger tumor size ($p = 0.01$ and $p < 0.01$), tumor volume ($p < 0.01$), uterine volume ($p = 0.02$), and the percentage of tumor volume to uterine volume ($p = 0.01$). The minimum measured tumor ADC value was lower in high-grade than in low-grade endometrioid carcinomas ($p = 0.04$). ROC analysis indicated that the smallest tumor size and tumor volume were good predictors of low-grade carcinomas (AUC 0.83 and 0.82).

Patients with endometrioid carcinomas had a thicker myometrium ($p < 0.01$) compared to those with non-endometrioid carcinomas, which had a higher equilibrium enhancement factor ($p = 0.03$). Low-grade endometrioid carcinomas were smaller ($p < 0.01$) than high-grade carcinomas and other histological types, showing lower T2-weighted signal relative to mesorectal fat tissue ($p = 0.03$). Patients with low-grade endometrioid carcinoma had a smaller uterus ($p = 0.01$) and thicker wall ($p < 0.01$). The largest tumor dimension of ≤ 24 mm allowed exclusion of lesions other than low-grade endometrioid carcinoma with 96% specificity.

Lesions with deep myometrial invasion were larger ($p < 0.01$), with greater uterine volume ($p = 0.01$) and smaller thickness of the tumor-free myometrium ($p < 0.01$). The T2-weighted signal intensity ratio between the tumor and tumor-free myometrium was lower ($p < 0.01$). The minimum measured tumor ADC value was lower in cancers with deep myometrial invasion ($p = 0.01$). The smallest tumor size (AUC 0.81), tumor volume

(AUC 0.81), and ratio of tumor volume to uterine volume (AUC 0.83) were good predictors of deep myometrial invasion.

In patients with significant lymphovascular space invasion, all tumor size parameters were greater ($p < 0.01$), and the thickness of the tumor-free myometrium was lower ($p = 0.02$). There was a lower T2-weighted signal intensity ratio between the tumor and tumor-free myometrium ($p = 0.04$). Lymph node metastases were more common if the tumor was larger ($p < 0.01$) and uterine volume was greater ($p = 0.04$).

The presence of a washout enhancement curve had a high positive predictive value as a biomarker of less aggressive cancers. It was more common in low-grade than high-grade endometrioid carcinomas ($p < 0.01$). The washout enhancement curve predicted low-grade vs high-grade endometrioid cancers with a sensitivity of 64% (CI 55-72%) and specificity of 86% (CI 53-98%), endometrioid vs non-endometrioid cancer with a sensitivity of 61% (CI 51-69%) and specificity of 67% (CI 38-88%), and low-grade endometrioid vs other histologic types with a sensitivity of 64% (CI 54-73%) and specificity of 74% (CI 52-90%).

Conclusions: MRI is a valuable tool in the preoperative evaluation of endometrial cancer staging, characterized by high accuracy and negative predictive value. However, its sensitivity for diagnosing staging features of locally advanced endometrial cancer is quite low. The diagnostic parameters of MRI performed at our center are similar to those reported in the literature. Radiological imaging features can potentially serve as good biomarkers for the grade of endometrioid carcinomas, histological types of endometrial cancer, presence of deep myometrial invasion, significant lymphovascular space invasion, and lymph node metastases.