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Radiological Diagnostics of Assessing Local and Distant Spread of the Tumour in Patients with Endometrial Cancer

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Abstract Surgical treatment is the primary approach recommended by American and European guidelines for patients with uterine cancer, with the goal of individually tailoring the surgical intervention and deciding on the necessity of lymph node dissection. However, the issue of lymph node dissection remains a subject of debate, and its optimal role in the management of endometrial cancer is still under investigation. This article aims to provide a comprehensive review of the background, purpose, methodologies, principal results, and major conclusions pertaining to the assessment and surgical management of endometrial cancer. It emphasizes the importance of accurate staging using advanced imaging techniques to guide treatment decisions and prognostic evaluation. The limitations and implications of current research are discussed, highlighting the need for further studies to address the controversies surrounding lymph node dissection and refine the selection criteria for this procedure. The findings of this study contribute to the field by providing a comprehensive overview of the current state of knowledge in endometrial cancer management. The insights gained from this research have practical implications for clinicians involved in the treatment of endometrial cancer patients, helping them make informed decisions regarding surgical interventions and lymph node dissection. Moreover, this article raises awareness about the increasing incidence of endometrial cancer and the importance of early detection and accurate staging, thereby emphasizing the social implications of improved management strategies for this disease. This review underscores the significance of imaging modalities and individualized surgical treatment in the management of endometrial cancer. It calls for further research to address the controversies surrounding lymph node dissection and refine the selection criteria, ultimately improving patient outcomes and contributing to the advancement of knowledge in this field.

Keywords Endometrial Cancer, Radiological Planimetry, Staging Procedure

1. Literature Review

Endometrial cancer (EC) ranks the second place among malignant diseases of the female genital organs. EC belongs to tumours, the incidence of which is increasing. The incidence rate of EC in the world is 19,1 per 100,000 of female population, and the mortality rate is 4,6 per 100,000 of female population. In addition, there has been an increase in its frequency over the past 10 years, especially among 30-54 years old young women. Scientists explain this growth with high indicators of urbanization and active socialization. Annually, in the USA, Sweden and Canada, an increase in the incidence of EC is recorded

by about 1%. The overall 5-year survival rate in the world is 95,3%; with a locally advanced process – 67,5%; with isolated metastases – 16,9%, respectively [1].

According to the data of the National Cancer Registry of Ukraine for 2020, the incidence rate of EC was 29,4 per 100,000 of female population, and the mortality rate was 7,2 per 100,000 of female population [2]. In Ukraine, the increase in morbidity for 2010-2020 is 6%. As morbidity increases, so does the mortality rate of the population [3]. The modern stage of the development of medicine is characterized by the widespread introduction of more complex methods of radiation diagnostics (computed tomography (CT), MRI) into clinical practices, which not only significantly facilitate and objectify the visualization of the pathological process, but also change, in a number of cases, the ideas about the specifics of the disease. As a rule, a set of diagnostic procedures is used to establish an accurate diagnosis in order to obtain the required information in full [4]. The issue of early diagnostics of EC is of particular importance. In the case of verified EC, the main objective of radiation examination is the assessment of the spread of the tumour process, forasmuch as this fundamentally affects the choice of treatment tactics and the prognosis of the disease [5, 6].

Magnetic resonance imaging with contrast has significant advantages in determining the size of the tumour, investigating the correlation with neurovascular pathways, and studying complex anatomical areas [7].

Spiral computed tomography has its advantages in application not so much for the early detection and differential diagnostics of tumours of the uterine body, but for assessing the spread of the tumour and detecting distant metastases, forasmuch as this method has a high penetrating ability, enhanced sensitivity for the assessment of parenchymal and hollow organs. Prevenous bolus amplification is supposed to be used, taking into account the phasivity of the contrast [8].

Visualization of pelvic lymph nodes does not solve the problem of choosing the relevant and active tactics for treatment. A successful combination of cooperation between an oncologist and a radiologist is the key to an accurate diagnosis and the correct choice of the type of surgical treatment. After all, in general, with incorrect staging of the disease, the number of unnecessary pelvic lymphadenectomies, or their non-performance, increases.

The purpose of the research lies in increasing the effectiveness of surgical treatment of patients with EC by means of planimetry of pelvic lymph nodes.

2. The Object and Methods of the Research

The research included 152 patients with EC, who were treated at the Prykarpatsky Clinical Oncology Centre of the Ivano-Frankivsk Regional Council in 2021. The age of the patients is from 42 to 80 years old, on average – 61,2 ±8,3 years old. EC staging was performed according to the FIGO classification (2021): T1 - 109 (71,7%), T2 - 13 (8,6%), T3 - 24 (15,8%), T4 - 6 (3,9%), respectively. Morphological verification was performed for all patients – endometrioid adenocarcinoma of various degrees of differentiation was confirmed in 129 (84,9%) patients, as well as other histological variants: mucinous, serous, clear cell adenocarcinoma, and squamous cell carcinoma was detected in 23 patients (15,1%).

In addition, patients' complaints, norm or violation of menstrual and reproductive functions, medical and life anamnesis, body mass index, tumour marker diagnostics (CA-125, HE4, Roma index) were also studied.

CT was performed to detect the spread of the tumour to the pelvic lymph nodes, beyond the pelvis, as well as the presence or absence of metastases in the lungs, liver and possible other localizations. With an increased body mass index (> 30), there are certain difficulties in conducting a CT scan, as well as in further treatment.

The correct assessment of the topography and size of the pelvic lymph nodes plays a significant role in choosing an adequate surgical volume for the operation. Planimetry of the lymph nodes is performed at a workstation by measuring its short diameter with an electronic ruler on DICOM images, on axial sections using intravenous contrast enhancement with non-ionic contrast agents in the venous phase of contrast. The size of the lymph node can be specifically measured when it is larger than 5 mm. Images are analysed in a soft tissue window (window level +35HU, window width 350-500HU). Scanning was performed on a GE optima CT540 computer tomography.

All patients underwent surgical removal of the tumour: type I or II panhysterectomy.

Statistical analysis was performed using the STATISTICA software, version 10.0 (portable). In order to assess the correlation between the results of diagnostic methods and histological results, the Pearson method, or χ^2, was used, while in order to assess the significance of differences between methods, a non-parametric test (McNemar's test), $p \leq 0,05$ was considered statistically significant.

3. Results and Discussion

All patients were female. Characteristics of patients by age are represented in Figure 1.

According to the data represented in Figure 1, the majority of patients were in the age group of 60-69 years old – 59 (38,8%), the group of working age up to 50 years – 15 patients (9,9%): in the I group – 30,2%, in II – 63,5%, in III – 54,3%. There were 31 (20,4%) elderly patients, over 70 years old.

All patients with EC were studied for their family

oncological anamnesis.

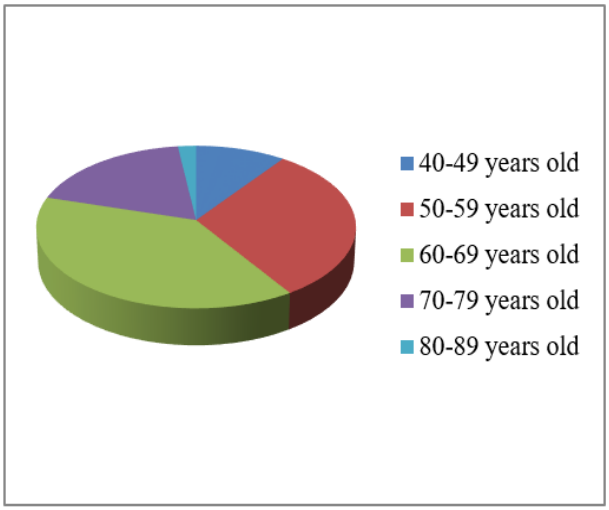

Figure 1. Age structure of female patients

Table 1 represents the analysis of relatives' diseases of I, II, III generations of patients with EC. Oncological gynaecological diseases (endometrial cancer and ovarian cancer) were most often observed in relatives of patients suffering from EC – in 50 (32,9%) cases. A slightly smaller number of breast cancer, colon cancer, prostate cancer, and kidney cancer were detected in 28 (18,4%), 12 (7,9%), 10 (5,2%) and 6 (3,9%) cases, respectively. Aggravated oncological anamnesis was revealed in 102 (67,1%) patients.

By the way, an analysis of the number of pregnancies that ended in childbirth (Figure 2) in patients with EC was carried out. Most often there were 3 or more pregnancies in 79 (52,0%) patients; 2 pregnancies were noted in 46 (30,32%) patients, one pregnancy in 20 (13,2%) and primary infertility in 7 (4,6 %) patients.

When analysing the time of the menopause onset (Figure 3), it was revealed that most often the patients experienced natural menopause - in 77 years old (50,7%) cases.

Early and late menopause were observed in patients with almost the same frequency - in 36 (23,7%) and 39 (25,7%), respectively.

Table 1. Analysis of aggravated oncological anamnesis in patients with EC

Characteristics of relatives' diseases of patients with EC	**Patients with EC**	
	n	**%**
Aggravated oncological anamnesis:	102	67,1
breast cancer	28	18,4
ovarian cancer	19	12,5
endometrial cancer	31	20,4
prostate cancer	6	3,9
colon cancer	12	7,9
kidney cancer	6	3,9
Total	152	100,0

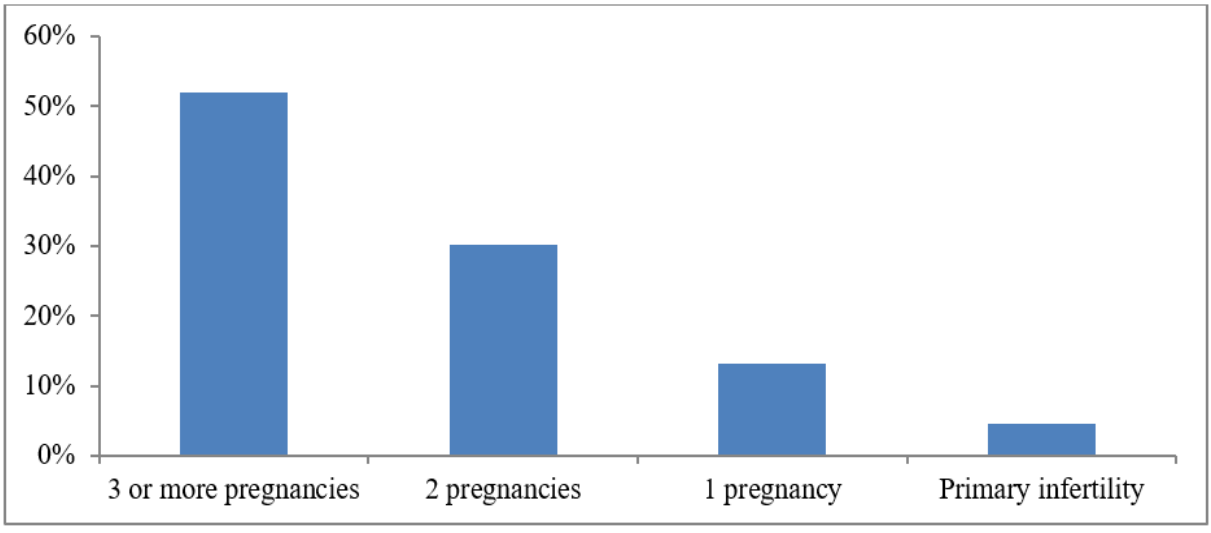

Figure 2. Distribution of patients by the number of childbirths

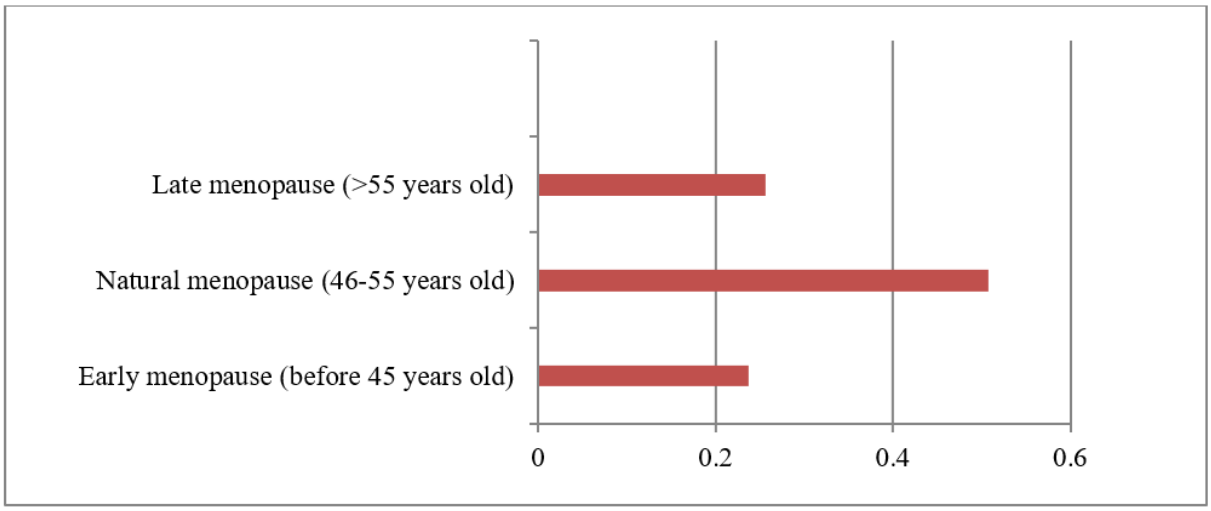

Figure 3. Distribution of patients depending on the time of the menopause onset

The comprehensive examination of patients included the detection of concomitant pathology. The concomitant pathology (Table 2) was observed in 62 (96,9%) patients.

Table 2. Distribution of patients with EC depending on concomitant pathology

Comorbidities*	Patients with EC	
	n=152	
	n	%
Cardiovascular diseases	62	66,7
Diseases of the digestive organs	35	39,7
Diseases of the respiratory organs	7	4,8
Endocrine diseases	45	55,6
Diseases of the genitourinary system	17	26,9
Other	20	31,7

Note.* In some cases, one patient had 2 or more concomitant diseases.

Most patients suffered from cardiovascular diseases (hypertensive disease, coronary heart disease, atherosclerotic cardiosclerosis, angina pectoris), respiratory diseases (chronic non-obstructive bronchitis, diffuse pneumosclerosis, pulmonary insufficiency of the 1st-2nd degree), diseases of the digestive organs (ulcer disease of the stomach and duodenum, chronic gastritis, chronic pancreatitis, chronic cholecystitis, gallstone disease, fatty hepatosis), diseases of the genitourinary system (pyelonephritis, urolithiasis, chronic cystitis, salt diathesis), endocrine diseases (diabetes, nodular goiter, obesity, etc.), as well as other diseases (varicose veins of the lower extremities and post-thrombophlebotic syndrome, neurocirculatory dystonia).

Concomitant diseases of the cardiovascular system prevailed; endocrinological diseases took the second place; diseases of the digestive system, diseases of the genitourinary system were less common. Diseases of the respiratory organs were the least common. The identified concomitant pathology was in the stage of compensation or remission, and it did not require additional symptomatic treatment.

One of the reasons for the EC occurrence is an increase in body mass index. We determined the body mass index of all patients.

According to the data represented in Table 3, patients with excess body weight prevailed: there are 38 (25%) patients with obesity of I degree and 39 (25,7%) patients with obesity of II degree, respectively. There were also 15 (9,9%) patients with obesity of III degree. Normal body weight and pre-obesity with almost the same frequency were observed in female patients – in 28 (18,4%) and 32 (21,1%), respectively.

Determination of tumour marker CA-125 was carried out in all patients with EC. In 86 (56,6%) patients, the CA-125 indicator was higher than normal; the average indicator was 86,3 IU/ml; the minimum value was 4,56 IU/ml, and the maximum value was 2038 IU/ml.

In order to determine locally advanced disease or the presence of distant metastases, all patients underwent CT scan of the chest, CT scan of the abdominal cavity, and CT scan of the pelvic organs with contrast.

Table 3. Distribution of patients with EC depending on the body mass index

Body mass index	Patients with EC	
	n	%
18,5 – 24,99 (normal weight)	28	18,4
25 – 30 (pre-obesity)	32	21,1
31 – 35 (obesity of I degree)	38	25,0
36 – 40 (obesity of II degree)	39	25,7
≥ 40 (obesity of III degree)	15	9,9
Total	152	100

In order to determine locally advanced disease or the presence of distant metastases, all patients underwent CT

scan of the chest, CT scan of the abdominal cavity, and CT scan of the pelvic organs with contrast. With the help of planimetry during computer tomography, it is possible to clearly assess the presence of metastases in the pelvic lymph nodes, which subsequently determines the volume of surgical intervention.

All patients were given a radiological assessment of extra-iliac, intra-iliac, common-iliac pelvic lymph nodes, as well as para-aortic and inter-aortic.

According to the planimetry data, there are metastases in 47 (30,9%) cases in the external iliac pelvic lymph nodes, in 8 (5,3%) intrailiac scans, in 16 (10,5%) – all-iliac and in 9 (5,9%) para-aortic lymph nodes. These patients underwent panhysterectomy and omentectomy of type II.

We performed an analysis comparing radiological lesions of pelvic lymph nodes and their postoperative histological verification (Table 4).

Table 4. Radiological and postoperative histological comparison of pelvic lymph nodes

Pelvic lymph nodes *	**Patients with EC**	
	n=152	
	n	**%**
Preoperative planimetry of pelvic lymph nodes		
Non-target	63	60,1
Target	41	39,9
Histological verification of pelvic lymph nodes		
Metastases in the pelvic lymph nodes (+)	39	25,7

Note.* In some cases, one patient had target and non-target lymph nodes.

Computed tomography was evaluated according to RECIST 1.1, identifying target and non-target lymph nodes. In 48 (31,6%) cases, there were no enlarged target and non-target lymph nodes. 104 patients, according to computed tomography, had pelvic lymph nodes affected. Non-target lymph nodes were identified in 63 (60,1%) patients, and target lymph nodes in 41 (39,9%) cases. During the surgical intervention, the pelvic tissue with lymph nodes was removed. The metastases in the pelvic lymph nodes were histologically verified in 39 (25,7%) cases, in all other cases, lymphohistiocytic changes were noted.

Figure 4 shows the planimetry of patient S., 68 years old. These scans show a metastatic lesion of the lateral external iliac lymph nodes. According to the postoperative histological material, metastases in the lymph nodes were confirmed.

Figure 5 shows a planimetry with a metastatic lesion of the lateral iliac lymph nodes of the patient P., 57 years old. According to postoperative histology, metastatic damage to the lymph nodes was not confirmed.

Figure 4. The patient S., 68 years old, BMI 38, endometrial carcinoma of the uterus

Figure 5. The patient P., 57 years old, BMI 27, serous carcinoma of the uterus

In addition to the specific case studies presented, the overall analysis of computed tomography (CT) imaging in patients with endometrial cancer demonstrated its usefulness in assessing the spread of the tumor to lymph nodes. The identification of target and non-target lymph nodes allowed for a comprehensive evaluation of lymph node involvement. Transvaginal ultrasound (TVUS) is often the initial imaging modality for evaluating endometrial cancer. It provides valuable information on endometrial thickness, myometrial invasion, and the presence of cervical involvement. TVUS is a cost-effective and readily available tool, making it widely used in clinical practice [9]. Computed tomography (CT) is particularly useful in assessing the extent of local invasion, lymph node involvement, and distant metastasis. It provides detailed anatomical information and helps guide surgical planning. However, CT has limitations in detecting microscopic disease and assessing myometrial invasion accurately [10].

Magnetic resonance imaging (MRI) has emerged as a valuable imaging modality in the evaluation of endometrial cancer. It provides excellent soft tissue contrast and superior delineation of tumor characteristics, such as myometrial invasion, cervical involvement, and parametrial spread. MRI is particularly beneficial in preoperative planning and identifying patients who may benefit from fertility-sparing surgery [11]. Positron emission tomography (PET) combined with computed tomography (PET/CT) is increasingly utilized for assessing distant metastasis and detecting recurrence in endometrial cancer. It provides metabolic and anatomical information, aiding in the identification of small nodal or distant metastases. PET/CT has shown promising results in detecting recurrent disease and guiding treatment decisions [12].

The views expressed by other scientists support the significance of radiological diagnostics in endometrial cancer staging. For example, a study by Antonsen et al. [13] highlighted the high accuracy of MRI in assessing myometrial invasion and cervical involvement. Similarly, a meta-analysis conducted by Xiong et al. [14] demonstrated the sensitivity and specificity of PET/CT in detecting lymph node metastasis and distant recurrence. Radiological diagnostics, including TVUS, CT, MRI, and PET/CT, play a critical role in assessing the local and distant spread of tumors in patients with endometrial cancer [15]. These imaging modalities provide valuable information for accurate staging, treatment planning, and prognosis determination. The views and findings of other scientists, as supported by relevant references, further emphasize the importance and effectiveness of radiological assessments in endometrial cancer management [16].

4. Conclusions

Patients suffering from EC with concomitant pathology, aggravated oncological history, increased body mass index (>30), elevated tumour marker CA-125 make up the majority of the population among this pathology. For this, radiological determination of the prevalence of the oncological process, an assessment of the involvement of the pelvic lymph nodes, which further affects the volume of surgical intervention, is of particular importance. At the same time, for the relevant and correct planning and selection of treatment tactics for patients with EC, the mutual work and assistance of the oncologist and the radiologist is required.

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