Research Article

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Research into the Value of B-Mode Ultrasound, CT and MRI Examinations in the Diagnosis of Preoperative Myometrial Infiltration of Endometrial Cancer and Lymph Node Metastasis

Abstract: This study is conducted to observe the diagnostic value of B-mode ultrasound, CT and MRI examinations in preoperative myometrial infiltration of endometrial cancer and lymph node metastasis. Retrospectively analyze 50 cases of the patients from Oct. 2010 to Aug. 2013. Before operation all the patients received dilatation & curettage to determine pathological diagnosis and clinical staging. There were 150 cases of patients who received B-mode ultrasound examination, wherein, 93 cases received CT examination and 57 cases received MRI examination as well. In the diagnosis of MIEC the diagnostic indicies of individual MRI examination were higher than that of individual B-mode ultrasound and CT examinations. Consistency of individual MRI examination with pathological diagnosis was significantly higher than that of B-mode and CT examinations. The sensitivity of CT and MRI was significantly higher than that of B-mode ultrasound examination. However, diagnostic indicators of B-mode ultrasound and CT joint examination were higher than B-mode ultrasound examination alone. The consistency of both with pathological diagnosis was significantly increased. B-mode and CT can significantly improve the diagnostic accuracy and has a good consistency with pathological diagnosis, thereby applicable to the clinical diagnosis of preoperative myometrial infiltration of endometrial cancer and lymph node metastasis.

Keywords: B-mode ultrasound, CT, MRI, endometrial cancer, myometrial infiltration, lymph node metastasis

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1 Introduction

Endometrial cancer is one of the most common malignant tumors in gynecology. Its incidence continues to rise [1]. The pathogenesis of endometrial cancer remains uncertain. At present, FIGO staging criteria are mainly adopted for clinical staging of endometrial cancer [2-3]. However, FIGO staging criteria can neither truly reflect the actual size of a tumor, nor the conditions of the myometrial infiltration of endometrial cancer and the lymph node metastasis prior to operation. Therefore, the staging by means of FIGO staging criteria cannot correctly guide the scope of a clinical operation. Seeking effective preoperative diagnosis methods of myometrial infiltration of endometrial cancer and lymph node metastasis to accurately diagnose their conditions at the early stage plays an important role in the curative effect and prognosis of endometrial cancer. So far, the imaging examination methods clinically used in endometrial cancer mainly include B-mode ultrasound, CT and MRI [4-6]. Through retrospectively analyzing 150 cases of the patients with endometrial cancer receiving surgical treatment from Oct. 2010 to Aug. 2013, the research discusses the diagnostic value of B-mode ultrasound, CT and MRI examinations in preoperative myometrial infiltration of endometrial cancer and lymph node metastasis, trying to find effective diagnosis methods for preoperative myometrial infiltration of endometrial cancer and lymph node metastasis.

2 Data and methods

2.1 General conditions of the patients

150 cases of patients with endometrial cancer receiving surgical treatment from Oct. 2010 to Aug. 2013 were selected

to receive retrospective analysis and research. The age of the patients ranges from 28 to 70, averaging (46.45±25.72). These 150 cases were divided into 42 premenopausal cases and 108 postmenopausal cases. Before operation, all the patients underwent clinical examinations and fractional curettage to make a definite diagnosis, and received clinical staging in accordance with the FIGO staging criteria of 2009. All the patients received B-mode ultrasound examination, wherein, 93 cases received CT examination and 57 cases received MRI examination as well. See Table 1 for the general conditions of the patients.

Table 1: General Conditions of the Patients

Features	Number of cases
Menstrual condition	
Pre-menopause	42
Post- menopause	108
Pathological type	
Endometrioid adenocarcinoma	139
Other pathological types	11
Tumor differentiation degree	
Poorly differentiated	90
Moderately differentiated	42
Highly differentiated	18
Myometrial infiltration condition	
With infiltration	42
Without infiltration	108
Lymphatic metastasis	
No	132
Yes	18
Tumor stages	
Stage I	109
Stage II	19
Stage III	15
Stage IV	7

2.2 Inclusion and exclusion criteria

150 cases of patients diagnosed with endometrial cancer and endometrial primary tumor after undergoing postoperative pathological examinations were selected. Before receiving B-mode ultrasound, CT and MRI examinations, none of the patients received chemotherapy, radiotherapy,

nor had any contraindication with respect to the aforesaid examinations. The patients with the aforementioned diseases combined with other malignant tumors were excluded.

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study.

2.3 Examination methods

Colour Doppler ultrasonic diagnostic apparatuses such as Simenssequoia512 and PhilipsHnI5000 were adopted to conduct B-mode ultrasound examination. The patients receiving non-transvaginal examination need to get their bladders filled before undergoing examination. The abdominal transducer frequency is 3.5MHz. The transducer frequency of the patients undergoing trans-vaginal examination is 5.5-7.5MHz, with a scanning depth of 8cm and a scanning angle of 150°. The 16-row spiral CT scanner of Philips Company was adopted for CT examination. GE 1.5T MRI scanner was adopted for MRI examination.

2.4 Statistical method

SPSS 16.0 statistical analysis software was adopted for data processing. Kappa analysis method was adopted to check whether the two diagnosis methods are consistent.

3 Results

3.1 Myometrial infiltration conditions of the patients with endometrial cancer

Among the 150 cases of the patients with endometrial cancer, 108 cases were found with myometrial infiltration by postoperative pathology, wherein, 68 cases were found with myometrial infiltration in preoperative B-mode ultrasound examination, while 40 cases were found without myometrial infiltration in preoperative

B-mode ultrasound examination; 42 cases were found without myometrial infiltration by postoperative pathology, wherein, 27 cases were found without myometrial infiltration in preoperative B-mode ultrasound examination, while 15 cases were misdiagnosed with myometrial infiltration. Among the 93 cases of patients with endometrial cancer undergoing CT examination in the meantime, 66 cases of patients were found with myometrial infiltration by postoperative pathology, wherein, 45 cases were found with myometrial infiltration in preoperative CT examination while 21 cases were found without myometrial infiltration in preoperative CT examination; 27 cases of patients were found without myometrial infiltration by postoperative pathology, wherein, 19 cases were found without myometrial infiltration in preoperative CT examination, while 8 cases were misdiagnosed with myometrial infiltration. Among the 57 cases of patients with endometrial cancer undergoing MRI examination in the meantime, 43 cases of patients were found with myometrial infiltration by postoperative pathology, wherein, 34 cases were found with myometrial infiltration in preoperative MRI examination, while 9 cases were found without myometrial infiltration in preoperative MRI examination; 14 cases of patients were found without myometrial infiltration by postoperative pathology, wherein, 11 cases were found without myometrial infiltration in preoperative MRI examination, while 3 cases were misdiagnosed with misdiagnosed with myometrial infiltration. In the joint assessment on B-mode ultrasound and CT examination, 66 cases of patients were found with myometrial infiltration by postoperative pathology, wherein, 50 cases of patients were evaluated as the patients with myometrial infiltration in the joint examination, 16 cases were found without myometrial infiltration. Among the 27 cases of the patients found without myometrial infiltration by postoperative pathology, 18 cases were found without myometrial infiltration in preoperative joint examination, while 9 cases were misdiagnosed with myometrial infiltration.

In the joint assessment on B-mode ultrasound and MRI examination, 43 cases of patients were found with myometrial infiltration by postoperative pathology, wherein, 39 cases were found with myometrial infiltration in preoperative joint examination, while 4 cases were found without myometrial infiltration in preoperative joint examination; 14 cases of patients were found without myometrial infiltration by postoperative pathology, wherein, 9 cases were found without myometrial infiltration in preoperative joint examination, while 5 cases were misdiagnosed with myometrial infiltration. See Table 2.

3.2 Lymph node metastasis of the patients suffering from endometrial cancer

Among the 150 patients suffering from endometrial cancer, there were 18 patients with lymph node metastasis indicated by postoperative pathology, of which 3 had pelvic lymphadenectasis indicated by preoperative B-mode ultrasound; there were 132 patients without lymph node metastasis indicated by postoperative pathology and there was no pelvic lymphadenectasis indicated by preoperative B-mode ultrasound. Meanwhile, among the 93 patients undergoing CT examination, 10 patients suffered lymph node metastasis indicated by postoperative pathology (9 patients without pelvic lymph node metastasis and 1 with aorta abdominalis lymph node metastasis), 3 patients had no lymph node metastasis found by preoperative CT examination; there were 83 patients without lymph node metastasis indicated by postoperative pathology, among which 2 patients were misdiagnosed with pelvic lymph node metastasis before operations. Among the 57 patients undergoing MRI examination, 6 patients had pelvic lymph node metastasis indicated by postoperative pathology and 1 had missed diagnosis in MRI examination; there were 51 patients without lymph node metastasis indicated by postoperative pathology, among which

Table 2: Diagnostic Indicators of B-Mode Ultrasound, CT and MRI Examinations to the Myometrial Infiltration of Endometrial Cancer

Method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Misdiagnosis rate (%)	False negative rate (%)	Youden index (%)	Coincidence rate (%)
B-mode ultrasound	62.96	64.29	81.93	40.30	35.71	37.04	27.25	63.33
CT	68.18	70.37	84.91	47.50	29.63	31.82	38.55	68.82
MRI	79.07	78.57	91.89	55.00	21.43	20.93	57.64	78.95
B-mode ultrasound +CT	75.76	66.67	84.75	52.94	33.33	24.24	42.42	73.11
B-mode ultrasound +MRI	90.70	64.29	88.64	69.23	35.71	9.30	54.98	84.21

2 patients were misdiagnosed with pelvic lymph node metastasis before operations. During the joint assessment of B-mode ultrasound and CT, there were 10 patients with lymph node metastasis indicated by postoperative pathology (9 patients without pelvic lymph node metastasis and 1 with aorta abdominalis lymph node metastasis), among which 3 patients had no lymph node metastasis found by the preoperative joint examination; there were 83 patients without lymph node metastasis by postoperative pathology, among which 2 patients were misdiagnosed to be pelvic lymph node metastasis before operations. During the joint assessment of B-mode ultrasound and MRI, there were 6 patients with pelvic lymph node metastasis indicated by postoperative pathology and one patient had missed diagnosis; there were 51 patients without lymph node metastasis indicated by postoperative pathology, among which 2 patients were misdiagnosed to be pelvic lymph node metastasis before operations. See Table 3.

3.3 Kappa analysis results of B-mode ultrasound, CT and MRI examinations in estimating the consistency of myometrial infiltration

Indicate that the consistency between the myometrial infiltration estimated through individual B-mode ultrasound or CT examination and that estimated through pathological diagnosis is poor. Their K values are 0.231 and 0.338, respectively; the consistency between the myometrial infiltration estimated through individual MRI examination and that estimated through pathological diagnosis is relatively good. The K value is 0.504. Joint examination of B-mode ultrasound and CT can improve the consistency between the myometrial infiltration estimated through examinations and that estimated through pathological diagnosis. See Table 4.

Table 3: Diagnostic Indicators of B-Mode Ultrasound, CT and MRI Examinations to the Lymph Node Metastasis of Endometrial Cancer

Method	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Misdiagnosis rate (%)	False negative rate (%)	Youden index (%)	Coincidence rate (%)
B-mode ultrasound	16.67	100.00	100.00	89.80	0.00	83.33	16.67	90.00
CT	70.00	97.60	77.78	96.43	2.41	30.00	67.59	94.62
MRI	83.33	96.08	71.43	98.00	3.92	16.67	79.41	94.74
B-mode ultrasound +CT	70.00	97.60	77.78	96.43	2.41	30.00	67.59	94.62
B-mode ultrasound +MRI	83.33	96.08	71.43	98.00	3.92	16.67	79.41	94.74

Table 4: Consistency of B-mode ultrasound, CT and MRI Examinations in Estimating Myometrial Infiltration

Method	Kappa analysis indicators		
	K value	Z value	P value
B-mode ultrasound	0.231	3.014	0.003
CT	0.338	3.409	0.001
MRI	0.504	3.925	0.000
B-mode ultrasound +CT	0.394	3.856	0.000
B-mode ultrasound +MRI	0.563	4.259	0.000

Table 5: Consistency of B-mode Ultrasound, CT and MRI Examinations in Estimating Lymph Node Metastasis

Method	Kappa analysis indicators		
	K value	Z value	P value
B-mode ultrasound	0.260	4.738	0.000
CT	0.707	6.830	0.000
MRI	0.740	5.606	0.000
B-mode ultrasound +CT	0.707	6.830	0.000
B-mode ultrasound +MRI	0.740	5.606	0.000

3.4 Kappa analysis results of B-mode ultrasound, CT and MRI examinations in estimating the consistency of myometrial infiltration

Indicate that the consistency between individual B-mode ultrasound examination and pathological diagnosis in estimating lymph node metastasis is poor. The K value is 0.260. The consistency of joint examinations of B-mode ultrasound and CT or MRI in estimating lymph node metastasis is the same with the results of CT or MRI examination. See Table 5.

4 Discussion

The incidence of endometrial cancer is always on the rise, and its pathogenesis is uncertain. Therefore, the targeted treatment for the pathogenesis of endometrial cancer is impossible. Now the clinical treatment is mainly based on surgery, supported by chemotherapy [7-10]. FIGO staging criteria are mainly adopted for clinical staging of endometrial cancer [2-3]. However it can't reflect the real situation of myometrial infiltration of endometrial cancer and lymph node metastasis. So the staging based on FIGO staging criteria can't correctly guide the scope of clinical operation. Now imaging examination methods are popular in preoperative diagnosis of myometrial infiltration and lymph node metastasis. The most common methods are B-mode ultrasound, CT and MRI [4-6]. Although MRI examination is relatively accurate in diagnosing preoperative myometrial infiltration of endometrial cancer and lymph node metastasis, it is not popular because its high costs and various contraindications. B-mode ultrasound examination is popular in clinical treatment because it is easy to operate and has low costs, but its accuracy is low. So the use of the examination is limited in diagnosing preoperative myometrial infiltration of endometrial cancer and lymph node metastasis. CT examination has high resolution but it has no diagnostic value for it is limited to the lesion of endometrium layer. Therefore, the research aims to find effective methods suitable in diagnosing preoperative myometrial infiltration of endometrial cancer and lymph node metastasis, through B-mode ultrasound, CT and MRI examinations. The research results indicated that in the respect of diagnosing myometrial infiltration of endometrial cancer, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), misdiagnosis rate, false negative rate, Youden index and coincidence rate of individual MRI examination were significantly higher than that of individual B-mode

ultrasound and CT examination, and the consistency of individual MRI examination with pathological diagnosis was significantly higher than that of B-mode ultrasound and CT examinations. In the respect of diagnosing lymph node metastasis, the sensitivity of CT and MRI examination was significantly higher than that of B-mode ultrasound examination, and the false negative rate of CT and MRI examinations was significantly lower than that of B-mode ultrasound examination. Moreover, the research found that the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), misdiagnosis rate, false negative rate, Youden index and coincidence rate of B-mode ultrasound and CT joint examination in diagnosing preoperative myometrial infiltration of endometrial cancer and lymph node metastasis were higher than that of individual B-mode ultrasound examination, and the consistency with pathological diagnosis was significantly improved as well. So the research suggests that in diagnosing preoperative myometrial infiltration of endometrial cancer and lymph node metastasis, the B-mode ultrasound and CT joint examination can overcome the shortcomings of individual B-mode ultrasound examination and improve the accuracy and consistency of diagnosis. Furthermore, the examination is easier to popularize than MRI, so it is applicable to the clinical diagnosis of preoperative myometrial infiltration of endometrial cancer and lymph node metastasis.

Conflict of interest statement: Authors state no conflict of interest

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