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Case report

Diagnosing ovarian masses by using nuclear magnetic resonance

Erning Zhang

Correspondence: 729543696@qq.com

The First Affiliated Hospital of Henan University, Kaifeng, Henan Province, China

Abstract: In the research, nuclear magnetic resonance (NMR) was used to study and diagnose ovarian tumour. A total of 80 ovarian tumour patients who were admitted to the hospital from February 2014 to May 2016 were selected and randomly divided into 2 groups, 40 in the case group and 40 in the control group. The case group used NMR whereas the control group utilized B-mode ultrasound to compare the characteristics of tumor masses, accuracy, sensitivity, and specificity of the clinical diagnosis afterwards. The accuracy, sensitivity, specificity, and characteristics of tumour masses by NMR were 95.84%, 94.75%, 90.92%, and 100%, respectively, which were apparently higher than those of the B-mode ultrasound scanning (64.28%, 77.78%, 75.08%, and 70.83%, respectively). Difference of each index among the four between the two methods was statistically significant ($p < 0.05$). Therefore, NMR is superior to ultrasound in diagnosing ovarian tumour.

Keywords: Nuclear magnetic resonance; Ovarian tumour; Clinical diagnosis

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Introduction

Nowadays, NMR and B-mode ultrasound methods are utilized to diagnose ovarian tumour in patients even though the latter is not outstanding due to its limited accuracy, sensitivity, and specificity. On the other hand, diagnostic errors by NMR are usually rare. In this study, a total of 40 cases of tumour patients who were admitted to our hospital from February 2014 to May 2016 were chosen for ultrasound method while another 40 cases used NMR to evaluate the diagnosis as well as to compare its clinical value. The report is as followed.

Materials and methods

General information

A total of 80 cases of ovarian tumour patients who were admitted to our hospital from April 2014 to May 2016 were selected. Patients with incomplete data, multiple disabilities, unstable vitals, or unwillingness to participate were excluded. 40 patients were randomly selected and assigned to the case group, the other half to the control group. Patients in the case group aged from 25 to 74, 49.5±25.5 on average; patients in the control group aged from 24 to 75, 49.5±25.5 on average. The difference in age distribution of the two groups were insignificant ($P > 0.05$). Previous diagnosis discovered that all participants had abdomen pain, abdominal masses, and vaginal bleeding.

Control group

Using ProSound 3500 ultrasound developed by ALOKA Company that emits 3.5 mhz by using vertical and horizontal sweeps to form images.

Case group

Using MAGNETOM Espree eco 1.5T MRI developed by Siemens Healthineers via conventional axial, sagittal, and coronal scan. If a stronger scan is needed, 1.5 mm thick alternate wall with 5 mm thick and 32-36 cm visual is preferred.

Observation indicator

After the operation, the diagnostic accuracy, sensitivity, specificity and tumour characteristics of the two methods were calculated and compared.

Statistical analysis

SPSS v18.0 was used for data analysis. The data collected were presented as (mean ± standard deviation), and applied t-test to calculate the variance (%) and $\chi 2$ test to compare. $P < 0.05$ indicated a statisticall significant difference.

Results

Laparoscopic surgery and two pathological outcomes

There were 47 cases of benign and 33 cases of malignant ovarian cysts among the 80 patients. This includes 56 lesions in benign and 43 in malignant cases. See *Table 1* for detailed tumour distribution in the experiment group and control group.

Table 1. Statistics of the ovarian cysts among the 80 patients.

Items	Case group	Control group
Lesions	51	48
Simple cyst	9	8
Serous issues	4	3
Chocolate cysts	3	2
Mucinous adenoma	3	1
Mature cystic teratoma	3	1
Papillary serous adenocarcinoma	3	4
Fibroma	2	2
Ovarian abscess	2	2
Mucinous adenocarcinoma	2	3
Endometrial carcinoma	2	2
Undifferentiated carcinoma	2	3
Metastatic carcinoma	2	4
Theca cell tumour	1	1
Clear cell carcinoma	1	2
Malignant teratoma	1	1
In situ carcinoma	0	1

This distribution indicated no significant difference between the two groups ($P > 0.05$). The diagnostic accuracy, sensitivity, and specificity for case group were 95.84%, 94.75% and 90.92%, respectively; while those for the control group were 64.28%, 77.78% and 75.08%, respectively (*Table 2*). Apparently those of the case group were significantly higher ($P < 0.05$) so that the NMR method outperformed the B-mode ultrasound examination.

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Table 2. Diagnostic results of two ovarian cancer patients groups.

Group	Lesions	True Positive	False Negative	False Positive	True Negative	Accuracy (%)	Sensitivity (%)	Specificity (%)
Case	51	37	3	2	9	95.84	94.75	90.92
Contrast	48	26	7	4	11	64.28	77.78	75.08
						15.43	12.14	9.96

Comparison between two groups for tumour characterization

Ovarian tumours detected in the case group and control group were characterized 100% and 70.83%, respectively. The difference was statistically significant ($P < 0.05$) as shown in (*Table 3*).

Table 3. Comparison in characterization of ovarian tumour between the two groups.

Groups	Benign	Malignant	Total
Case	100.00 (37/37)	100.00 (14/14)	100.00 (51/51)
Contrast	69.23 (18/26)	72.72 (16/22)	70.82 (34/48)
	13.04	4.58	17.33

Discussion

NMR diagnosis of ovarian cancer is one of the most widely used methods in recent years[3]. It provides multi-angle, full range of imaging efficiency, and high resolution of soft tissue. It can effectively identify abnormality in ovaries as it can clearly show the size of the ovaries, shape and internal structure of the tumor, which is important in clinical diagnosis.

Chocolate cyst

Chocolate cyst often co-occurs with endometriosis. This is caused by stimulation of endometrium lining by hor-mone of estrogen and progesterone which lead to bleeding. This is commonly seen in the ovaries. Because chocolate cyst is caused by bleeding in ectopic endometrium, lesions would gradually expand and increase the thickness of the wall after gradual accumulation of menstrual bleeding. Chocolate cyst can provide diverse NMR signals. The high signal is termed T_1^{WI}, and the low signal is termed T_2^{WI}. The mixed signal, T_1^{WI}:T_2^{WI}, is finally used to diagnose ovarian cancer[4,5]. In this study, the diagnostic sensitivity of NMR was 90-92% and the specificity was 91-98%.

Simple ovarian cysts

Simple ovarian cysts are mainly round or circular shaped. In NMR, the high signal T_2^{WI} can be very high, which will enhance the resolution of images by clearly outlining the cyst boundaries. Smooth and thin walls are shown. NMR images of simple cyst and corpus luteum are very similar, but signal of the former is uneven with a diameter of less than 2 cm. The main basis for the diagnosis of simple cyst is based on ovulation and menstrual cycle as well as repetitative diagnosis.

Ovarian granulosa cell tumor

If estrogen is secreted by the tumour, then symptoms of feminization would develop. Complications during estrogen escalation include increased uterine volume, emergence of uterine fibroids and endometrial hyperplasia. In addition, the state of granular cell tumors is determined by the size of the tumour; a small tumour is solid while a large tumour will be cystic.

Ovarian cystadenoma

Ovarian cystadenoma belongs to one of the common forms of the benign epithelial neoplasia which is mainly found in the female pelvic area. Ovarian pelvic cystic mass is a large cyst that grows slowly from the pelvic to the abdomen area. In NMR detection, T_1^{WI} is the low signal and T_2^{WI} is the high signal. In this study, 4 cases in the case group and 3 in the control group were diagnosed with ovarian cystadenoma. However, 2 cases in the control group were misdiagnosed with ovarian cystadenoma.

Mature ovarian teratoma

Mature teratoma is a common type of cystic tumour: yellow, hairy, viscous, and contains liquid fats. This cyst normally contains more sebum and fatty tissues which make them more recognizable in characterization, especially when differentiating it from the chocolate cyst.

Conclusion

T_1^{WI}: T_2^{WI} signal identification and pathological features are normally used in NMR diagnosis of ovarian tumours. In this study, the accuracy, sensitivity, and specificity of NMR diagnosis were 95.84%, 94.75% and 90.92%, respectively; while those of the B-mode ultrasound were 64.28%, 77.78% and 75.08%, respectively. The former were significantly higher than the latter ($P < 0.05$). In addition, the case group had a characterization rate of 100% for diagnosing ovarian tumours, which was also significantly higher ($P < 0.05$) than that of the control group (70.83%). Therefore, NMR greatly outperformed B-mode ultrasound in the diagnosis of ovarian tumour ($P < 0.05$). Similar conclusions had been drawn by several studies[6,7].

In summary, the use of NMR for diagnosing ovarian cancer provides high detection rate, accuracy, sensitivity, specificity and thus, offers more valuable clinical values.

Conflict of interest

The author declares no potential conflict of interest.

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