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Original Research Article

Diagnosing ovarian masses by using nuclear magnetic resonance

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Abstract: In the research, nuclear magnetic resonance (NMR) was used in order to study and diagnose ovarian tumour patients. A total of 80 cases of ovarian tumour patients who admitted to hospital in February 2014 to May 2016 were selected and randomly divided into 2 groups, with 40 cases in each group, namely; the experimental- and contrast group. The experimental group used NMR to diagnose whereas the contrast group utilized B-mode ultrasound in order to compare the character of masses and ascertain accuracy, sensitivity, and specificity of the clinical diagnostic afterwards. The accuracy, sensitivity, specificity, and characteristic of tumour masses in the experimental group was 95.84%, 94.75%, 90.92%, and 100%, respectively, which is apparently higher than the contrast group with 64.28%, 77.78%, 75.08%, and 70.83%, respectively. Both groups were found to be statistically significant different ($p < 0.05$). In comparison to NMR and ultrasound, former diagnostic method was better in terms of accuracy, sensitivity, and specificity which lead to significant detection and better diagnostic.

Keywords: Nuclear magnetic resonance; Ovarian tumour; Clinical value; Diagnostic value

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Introduction

Nowadays, NMR and B-mode ultrasound methods are utilized by hospitals to diagnose ovarian tumour in patients even though B-mode ultrasound is not outstanding as it lacks of accuracy, sensitivity, and specificity; on the other hand, diagnostic errors by NMR were usually low. Thus, a total of 40 cases of tumour patients who admitted to our hospital in February 2014 to May 2016 were chosen for ultrasound method while another 40 cases used NMR in order to evaluate the diagnosed ovarian tumour as well as to compare its clinical value. The report is as follows.

Materials and methods

General information

A total of 80 cases of ovarian tumours patients who admitted to our hospital in April 2014 to May 2016 were selected as the research subject. Patients with incomplete data, multiple disabilities, unstable vitals, non-ovarian tumour patient, and unwilling to sign letter of consent were not included in this study. Members of experimental- and contrast groups were randomly picked with 40 members each. The experimental group consists of participants ranging from 25 to 74 years old, averaging at 49.5 ±25.5; while the contrast group's age ranging from 24–75 years old, and averaging at 49.5

± 25.5 years old. Early diagnosis discovered that all the participants have the following symptoms: Abdomen pain, abdominal masses, and vaginal bleeding. Basic data and selection standard were not statistically significant ($P > 0.05$).

Contrast Group:

1) Chose B-mode ultrasound.
2) Used ProSound 3500 ultrasound developed by ALOKA Company that emits 3.5 mhz by using vertical and horizontal sweeps to form images.

Experimental Group:

1) Chose NMR diagnostic method.
2) NumberLastUsed ESpreee 1.5T MRI developed by Siemens to diagnose ovarian tumour via conventional axial, sagittal, and coronal scan. If stronger scan is needed, 1.5 mm thick alternate wall with 5 mm thick and 32–36 cm visual is preferred.

Observation indicator

After tests were carried out using both methods listed above, the following characteristics were applied as comparative indicators:

1) Accuracy
2) Sensitivity
3) Specificity
4) Tumour characteristics

Statistical analysis

SPSS 18.0 statistic application software was used for analysis of data. The data collected were measured by mean ($\bar{x} \pm s$), and applied t-test for the calculation of variance (%) and employed $\chi 2$ test for the comparison of data. $P < 0.05$ indicates clear different between two groups, which has statistic significant.

Results

Laparoscopic surgery and two pathological outcomes

There were 47 cases of benign ovarian cyst and 33 malignant ovarian cysts among 80 patients. This includes 56 lesions in benign and 43 lesions in malignant cases. Results of two surgeries and laparoscopic surgery were as follows:

1) Experimental Group has 51 lesions, chocolate cysts in 3 cases, simple cyst in 9 cases, 4 cases involving serous, 3 cases of mucinous adenoma, 3 cases of mature cystic teratoma, 2 cases of fibroma, ovarian abscess in 2 cases, 1 theca cell tumour, papillary serous adenocarcinoma in 3 cases, mucinous adenocarcinoma in 2 cases, 2 cases of endometrial carcinoma, clear cell carcinoma in 1 case, undifferentiated carcinoma in 2 cases, 2 cases of metastatic carcinoma, and 1 case malignant teratoma.

2) Contrast Group has 48 lesions, chocolate cyst in 2 cases, simple cyst in 8 cases, 3 cases involving serous, mucinous adenoma in 1 case, mature cystic teratoma in 1 case, 2 cases of fibroids, ovarian abscess in 2 cases, 1 case of theca cell tumour, papillary serous adenocarcinoma in 4 cases, 3 cases of mucinous carcinoma, endometrial carcinoma in 2 cases, 2 cases of clear cell carcinoma, undifferentiated carcinoma in 3 cases, 4 cases of metastatic cancer, 1 malignant teratoma, and 1 carcinoma in situ. Not much difference was found between benign and malignant from both groups; therefore, it was statistically to be insignificant different ($P > 0.05$).

Experimental Group possessed accuracy, sensitivity, and specificity of 95.84%, 94.75%, and 90.92%, respectively; while Control Group was having 64.28%, 77.78%, and 75.08%, respectively. Apparently, the accuracy, sensitivity, and

specificity in Experimental Group were significantly higher, and the difference was significant ($P < 0.05$) as shown in (*Table 1*)

Table 1. Diagnostic results of two ovarian cancer patients groups.

Group	Lesions	True Positive	False Negative	False Positive	True Negative	Accuracy (%)	Sensitivity (%)	Specificity (%)
Experimental	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 Experimental Group and Contrast Group was characterized 100% and 70.83%, respectively. The difference was statistically significant ($P < 0.05$) as shown in (*Table 2*).

Table 2. Comparison in characteristic rate of ovarian tumour between two groups ($P < 0.05$)

Groups	Benign	Malignant	Total
Experimental	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]. NMR can provide multi-angle, full range of imaging efficiency, and high resolution of soft tissue. NMR can effectively observe 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 is mainly accompanied by endometriosis. This is caused by stimulation of endometrium lining by hormone of estrogen and progesterone which led to bleeding. This commonly occurs in the ovaries. Because chocolate cyst was caused by bleeding in ectopic endometrium, lesions would be gradually expanded and increased the thickness of the wall after gradual accumulation of menstrual bleeding. Chocolate cyst can provide diverse NMR signals, which is typically characterized by high signal $T_1^{WI}:T_2^{WI}$ is the representation of low signal and mixed signals are usually characterized by $T_1^{WI}:T_2^{WI}$[4,5]. In this study, the diagnostic sensitivity of NMR was 90% to 92% with specificity of 91% to 98%.

Simple ovarian cysts

Simple ovarian cysts mainly exist as round or circular shaped. T_1^{WI} represents low signal, T_2^{WI} represents signal that is very high which enhanced resolution of images with the boundaries clearly expressed. Smooth and thin walls are shown. NMR images of simple cyst and corpus luteum are very similar, but the former signal is uneven with 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 repetitive diagnosis.

Ovarian granulosa cell tumor

If estrogen is secreted by the tumour, then feminization syndrome symptoms would be expressed which showed an 85% increased during estrogen level detection with NMR. Increased in uterine volume, appearance of uterine fibroids, endometrial hyperplasia and other complications would occur during the estrogen level's increment. In addition, the state of granular cell tumors is determined by the size of the tumour; whereby, a small tumour is solid while the larger tumour will be cystic tumours.

Ovarian cystadenoma

Ovarian cystadenoma belongs to the more common form of benign epithelial neoplasia which mainly found in the female pelvic area. Ovarian pelvic cystic mass is a large cyst that grows from the pelvic till the abdomen area with relatively slow growth. T_1^{WI} is a low signal while T_2^{WI} is high signal. In this study, ovarian cystadenoma was detected within 4 patients from the Experimental Group while 3 patients in Contrast Group were detected with 2 patients have been misdiagnosed with ovarian cystadenoma.

Mature ovarian teratoma

Mature teratoma is a more common type of cystic tumour that contains liquid fats that are yellow, hairy, and viscous. T_1^{WI}: T_2^{WI} is a high signal. This cyst normally contains more sebum and some fatty tissues which are useful in characterization, especially when used to differentiate between it and chocolate cyst.

T_1^{WI}: T_2^{WI} signal identification and pathological features are normally used in NMR diagnosis of ovarian tumours. In this study, NMR diagnosis from Experimental Group possessed the accuracy, sensitivity, and specificity of 95.84%, 94.75%, and 90.92%, respectively, which is higher than that of Contrast Group utilizing B-mode ultrasound with the accuracy, sensitivity, and specificity of 64.28%, 77.78%, and 75.08%, respectively. The result was statistically significant different ($P < 0.05$). NMR shows that Experimental Group has a characterization rate of 100% for diagnosing ovarian tumours; of which, is significantly higher than the use of B-mode ultrasound diagnosis with a characterization rate of 70.83% in the Contrast Group. There was a statistical significant difference between these groups ($P < 0.05$). In addition, the result in this study was found to be no difference in comparison to other researches[6,7].

In summary, the use of NMR for diagnosis of ovarian cancer is capable of providing high detection rate, accuracy, sensitivity, specificity and thus, offers valuable clinical values.

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