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Application value of transvaginal ultrasonography combined with abdominal ultrasonography in the diagnosis of gynecological acute abdomen

Y. Zhang*

Department of Ultrasound, Tangshan Maternal and Child Health Hospital, Tangshan, Hebei, China

► ***Short report***

Corresponding author:
Ying Zhang, B.A.,
E-mail:
m18331591022@163.com

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ABSTRACT

Background: To explore the value of transvaginal ultrasonography (TVUS) combined with abdominal ultrasonography (AUS) in gynecological acute abdomen diagnosis. ***Materials and Methods:*** One hundred patients with gynecological acute abdomen admitted to our hospital from January 2022 to January 2023 were enrolled in this study. Patients were separated into observation group (OG, n=50) and control group (CG, n=50). The OG underwent routine abdominal ultrasound examination. On the basis of the OG, the CG received transvaginal ultrasound examination. The diagnosis of all patients was confirmed by pathological examination after ultrasound examination. The detection rate of diseases (acute pelvic inflammatory disease, ectopic pregnancy, rupture of ovarian cyst, and torsion of the pedicle of ovarian cyst) as well as the coincidence rate of ultrasonic diagnosis with pathological examination were assessed in the two groups. ***Results:*** OG showed significantly higher disease detection rate relative to CG (P<0.01). The total coincidence rate of diagnosis of gynecological acute abdomen in the OG was 96.00%, which was also higher than that of 74.00% in the CG (P<0.01). ***Conclusion:*** Transvaginal ultrasonography combined with abdominal ultrasonography can improve the overall diagnostic coincidence rate of gynecological acute abdomen.

INTRODUCTION

Gynecological acute abdomen is a common disease with high incidence in clinic. It can affect females at any age, and more prevalent in women at reproductive age [1]. The common gynecological causes include ectopic pregnancy, corpus luteum rupture, adnexal torsion, and pelvic inflammatory disease [2]. As an acute abdominal disease, gynecological acute abdomen shows typical clinical symptoms such as acute abdominal pain, with rapid onset, rapid disease development and high risks, and delayed diagnosis may lead to adverse prognostic events such as ovarian necrosis and affect the life quality and reproductive health of patients [3]. Thus, timely and effective diagnosis and intervention are critical to improve the prognosis of patients [1]. In the clinical diagnosis of acute abdomen, it is difficult to diagnose the patient condition only based on the clinical symptoms and signs of patients, and laparoscopy is a routine procedure in the acute abdomen diagnosis. However, laparoscopy as an invasive procedure is limited by certain contraindications [4]. Therefore, effective diagnostic strategies such as imaging examination is required for the early and accurate detection of diseases.

Diagnostic ultrasound refers to an imaging modality using sound waves to for the production of images reflecting the structure of human body since different locations and different tissues of the human body show great differences in the occurrence of reflection [5]. Ultrasound examination has become the preferred imaging examination method for gynecological acute abdomen with the advantages of non-invasiveness, no radialization, and low cost [6], and transvaginal ultrasound (TVUS) examination and transabdominal ultrasound examination are the main methods for ultrasonic diagnosis. Abdominal ultrasound is a common method for clinical diagnosis of gynecological acute abdomen, with wide field of vision, and the lesions of various organs in the abdominal cavity can be observed [7]. However, some studies have shown that abdominal ultrasonography imaging can be affected by fat and gas in the intestinal cavity, with the display of some small lesions in low quality [8]. With the continuous development of ultrasound technology, transvaginal ultrasound has been gradually applied to clinical practice [9]. Studies have shown that transvaginal ultrasound probes can avoid subcutaneous fat, and are not easily affected by gas in the intestinal cavity, and can show small diameter lesions [10]. Single imaging diagnosis is accompanied by increased missed diagnosis and misdiagnosis rate, while the combined treatment can improve the diagnostic accuracy in clinical practice [10].

Therefore, our study aimed to explore the application value of transvaginal ultrasonography

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combined with abdominal ultrasonography in the diagnosis of gynecological acute abdomen. The findings of our study might provide novel insight into the diagnosis and guide the clinical intervention of gynecological acute abdomen in clinical practice.

MATERIALS AND METHODS

General data

Totally 100 patients with gynecological acute abdomen who visited our hospital from January 2022 to January 2023 were enrolled in this study, and patients were divided into observation group (OG, 50 cases) and control group (CG, 50 cases) based on their treatment options. No statistical difference was found in the baseline characteristics of patients in OG and CG (P>0.05) (table 1). All patients in this study signed informed consent.

Inclusion criteria: (1) Patients complained of irregular vaginal bleeding, acute lower abdominal pain, irregular menstruation, etc., and was confirmed as gynecological acute abdomen by pathological examination after surgery; (2) Age >18 years old. Exclusion criteria: (1) Unmarried or in the menstrual period unsuitable for transvaginal ultrasound examination; (2) Patients with a history of mental illness, consciousness disorders, etc., who could not cooperate with the examination.

Table 1. Clinical characteristics of patients.

Characteristics	Control group (n=50)	Observation group (n=50)	P
Age (years)	32.38±5.59 (22-49)	32.42±6.03 (23-50)	0.973
Onset of abdominal pain (h)	6.14±2.29 (1-18)	6.18±2.32 (1-17)	0.931
History of pregnancy	26	28	0.688
Menopause	10	11	0.806

Methods

The CG underwent routine abdominal ultrasound examination. The instrument was Voluson10 ultrasonic diagnostic instrument (GE Company, US). The frequency of transabdominal probe (C1-6-D type) was 3.5-5.0 Mega Hertz (MHz). Before the abdominal ultrasound examination, patients drank 500 ml of water. After the bladder was filled, the abdominal ultrasound examination began. Patients took a supine position and were told to stretch the upper limbs. After applying appropriate amount of coupling agent to the probe, the probe was placed on the lower abdomen of the patient, and multi-angle and all-round scanning was performed on the lower abdomen region of the patient from the symphysis pubis. The patient's uterus, double adnexal area and pelvic cavity were observed, such as uterus size and shape, presence or absence of pregnancy sac, location of pregnancy sac, presence or absence of embryo fetal heart, cervical lesions, mass in the adnexal area and pelvic effusion, etc., and images of key parts were obtained and saved (figure 1A).

On the basis of the CG, the OG adopted transvaginal ultrasound examination, and transvaginal ultrasound examination was performed after abdominal ultrasound examination. The frequency of transvaginal probe (RIC5-9-D type) was 5.0 ~ 8.0 MHz. Before the examination began, the bladder was emptied. The bladder lithotomy position was taken. The probe was applied with an appropriate amount of coupling agent, and a condom of appropriate size was put on, and the probe was slowly inserted through the vagina to the position of the posterior vaginal fornix of the patient. The angle of the probe was appropriately adjusted to probe the pelvic cavity of the patient, and multiple sections were scanned with longitudinal, transverse and oblique incision. Satisfactory images were obtained and saved by pumping and rotating the probe.

All patients in 2 groups were confirmed by pathological examination after ultrasound examination.

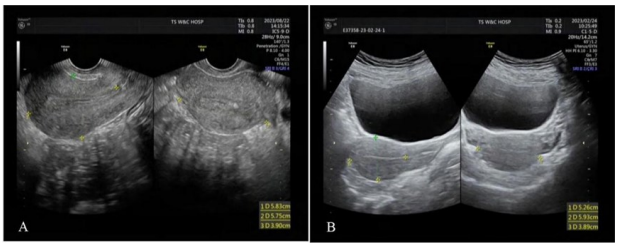


Figure 1. Representative images of **(A)** abdominal ultrasound examination and **(B)** transvaginal ultrasound examination for gynecological acute abdomen.

Observation indicators

The detection rate of diseases (acute pelvic inflammatory disease, ectopic pregnancy, rupture of ovarian cyst, and orsion of the pedicle of ovarian cyst) and the coincidence rate of ultrasonic diagnosis and pathological examination were observed in the two groups.

Statistical analysis

SPSS 14.0 statistical software (SPSS Inc., USA) was applied for statistical analyses, and the counting data are shown as percentage (%). The results were tested by χ^2, and P<0.05 was considered statistically significant.

RESULTS

Disease detection rate in both groups

The detection rate of AUS and TVUS for gynecological acute abdomen was evaluated. In the CG, there were 11 patients (22%) diagnosed of acute pelvic inflammatory disease, 16 patients (32%) diagnosed of ectopic pregnancy, 7 patients (14%) diagnosed of rupture of ovarian cyst, and 4 patients (8%) diagnosed of torsion of the pedicle of ovarian

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cyst, and the total detection rate was 76%. For patients in the OG, there were 14 cases (28%) of acute pelvic inflammatory disease, 20 cases (40%) of ectopic pregnancy, 9 cases (18%) of rupture of ovarian cyst, and 5 cases (8%) of torsion of the pedicle of ovarian cyst. The total detection rate of OG was 96%, and was higher relative to CG (P<0.01, table 2).

Table 2. Detection accuracy of AUS or AUS combined with TVUS for gynecological acute abdomen.

Groups	Cases	Acute pelvic inflammatory disease	Ectopic pregnancy	Rupture of ovarian cyst	Torsion of the pedicle of ovarian cyst	Detection rate
Control	50	11	16	7	4	38
Observation	50	14	20	9	5	48
χ^2						8.31
P						<0.01

AUS, abdominal ultrasonography; TVUS, transvaginal ultrasonography.

Diagnostic accordance rate in the two groups

The diagnostic accordance rate in the two groups was also assessed. For patients in the CG, totally 7 missed diagnosis cases (14%) and 6 misdiagnosis cases (12%) were found, with a total coincidence rate of 74%. For patients in the OG, there was only 1 missed diagnosis case (2%) and 1 misdiagnosis case (2%). The total coincidence rate of OG was 96%, and was higher relative to the 74.00% in the CG (P<0.01, table 3).

Table 3. Diagnostic accordance rate of AUS or AUS combined with TVUS for gynecological acute abdomen.

Groups	Cases	Missed diagnosis	Misdiagnosis	Total coincidence rate
Control group	50	7	6	37 (74.00%)
Observation group	50	1	1	48 (96.00%)
χ^2				9.49
P				<0.01

AUS, abdominal ultrasonography; TVUS, transvaginal ultrasonography.

DISCUSSION

Gynecological acute abdomen represents the severe abdominal pain induced by gynecological diseases with similar clinical symptoms, mostly severe lower abdominal pain, irregular vaginal bleeding, etc. [11]. Due to the rapid onset and progression and multiple complications of gynecological acute abdomen, early and differential diagnosis is of positive significance for improving prognosis.

Ultrasonography is an important imaging modality for the diagnosis of gynecological diseases. It is noninvasive and easy to operate. Abdominal ultrasound is a commonly used auxiliary means of diagnosis in obstetrics and gynecology. It has a wide range of scanning and can widely probe the lesions in the pelvic cavity, identify the abnormal fluid accumulation, mass and accessories in the pelvic cavity, and is easy to operate [12]. Abdominal ultrasound is also revealed to be susceptible to the interference of subcutaneous fat and intestinal gas in the examination process, which has certain impact on image clarity, and the location, nature and boundary of lesions cannot be clearly defined [13]. Some deep lesions, such as ovarian cysts, are difficult to find. In addition, some studies have shown that transabdominal ultrasound takes the bladder as the sound transmission window, but in some patients with acute abdomen, the bladder is often in an unfilled state, and temporary bladder filling may delay the rescue time and affect the prognosis of patients [14].

With the continuous development of ultrasound technology, transvaginal ultrasound has been gradually applied in clinical practice. Compared with transabdominal ultrasound, it has the following advantages: (1) By placing the probe in the vagina, the probe is closer to the pelvic organs, and the ultrasound image obtained is clearer, which is more suitable for patients with lesions with unclear boundaries between normal tissues and diseased tissues, and also for patients with smaller lesion tissues [15]. (2) Transvaginal ultrasound scan avoids the reflection interference of subcutaneous fat and intestinal gas on ultrasound during transabdominal scan, and improves image quality [16]. (3) The bladder does not need to be filled during the examination, which prevents the bladder from squeezing the diseased tissue and reduces the impact of multiple bladder reflexes on ultrasound images [17]. However, transvaginal ultrasound also has certain limitations, such as a small field of view, a relatively insufficient depth of detection, and a relatively limited scope of exploration to make a comprehensive exploration of the pelvic cavity, so there are some cases of missed diagnosis and misdiagnosis of lesions [18]. Moreover, transvaginal ultrasound is not available in some patients, such as women with no sexual life history, vaginal deformities, and menstruation [19].

The results of our study indicated that the disease detection rate of the OG was significantly higher than that of CG, and the total coincidence rate of diagnosis of gynecological acute abdomen in the OG was 96.00%, which was also higher than the 74.00% in the CG, suggesting that transvaginal ultrasonography combined with abdominal ultrasonography could improve the diagnostic coincidence rate of gynecological acute abdomen, which was consistent with previous study [20].

In conclusion, transvaginal ultrasonography combined with abdominal ultrasonography can improve the overall diagnostic coincidence rate of gynecological acute abdomen. However, this study has relatively small sample size, and the study results

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may be biased, and the specific efficacy of transvaginal combined abdominal ultrasonography diagnosis needs to be studied with larger samples.

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Author contribution: Ying Zhang conceptualized the study, collected and analyzed the data, wrote the original draft, reviewed and edited the manuscript. The author read and approved the final version of the manuscript.

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