

Analyzing the Application Value and Detection Rate of Combined Abdominal and Vaginal B-Scan Ultrasound in Diagnosing Acute Abdomen in Obstetrics and Gynecology

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Abstract: *Objective:* To analyze the diagnostic value of combined abdominal and vaginal B-scan ultrasound in obstetrics and gynecology acute abdomen. *Methods:* A total of 80 patients with suspected obstetric and gynecological acute abdomen admitted from February 2021 to October 2023 were recruited. All patients underwent abdominal and vaginal B-scan ultrasound examinations, and the pathological results were compared to explore the joint diagnostic value. *Results:* Obstetric and gynecological acute abdomen was confirmed in 68 cases through pathology, 53 cases through abdominal B-scan ultrasound, 60 cases through vaginal B-scan ultrasound, and 67 cases through combined abdominal and vaginal B-scan ultrasound. The combined abdominal and vaginal B-scan ultrasound had significantly higher diagnostic efficiency than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$). The accuracy of combined abdominal and vaginal B-scan ultrasound in diagnosing obstetric and gynecological acute abdomen is higher than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$). *Conclusion:* The diagnosis of acute abdomen in obstetrics and gynecology by combined abdominal and vaginal B-scan ultrasound may improve the diagnostic efficiency, enhance the accuracy of acute abdomen classification in obstetrics and gynecology, and have high consistency with pathological results.

Keywords: Acute abdomen in obstetrics and gynecology; Abdominal B-scan ultrasound; Vaginal B-scan ultrasound; Diagnostic value

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1. Introduction

The clinical risk of acute abdomen in obstetrics and gynecology (O&G) is high. The typical pathological feature is severe abdominal pain, often acute attacks, and most patients are in critical condition. If not diagnosed and treated as early as possible, it can threaten the patient's life and health and increase the mortality rate of acute abdomen^[1]. Acute abdomen in O&G is related to many triggers, such as ovarian cyst rupture, ovarian cyst pedicle torsion, and ectopic pregnancy. It is easily confused with inflammatory lesions of abdominal organs,

making diagnosis and treatment difficult ^[2]. Currently, ultrasound technology is mainly used in clinics to diagnose acute abdomen in O&G. It can dynamically and continuously monitor the patient's motor function in real-time. Ultrasound has no radiation hazard and is highly safe when used to examine pregnant women ^[3]. This study reports 80 patients with suspected O&G acute abdomen admitted from February 2021 to October 2023 as a sample to explore the diagnostic value of combined abdominal and vaginal B-scan ultrasound.

2. General information and methods

2.1. General information

A total of 80 patients with suspected O&G acute abdomen admitted from February 2021 to October 2023 were recruited, aged 24–40 years old with an average of 26.89 ± 2.48 years old, abdominal pain duration of 15–30 minutes with an average of 22.81 ± 3.21 minutes. Pathological diagnosis was made in 68 cases, including 24 cases of ectopic pregnancy, 18 cases of acute pelvic inflammatory disease, 5 cases of intrauterine pregnancy loss, 10 cases of ovarian cyst rupture, 11 cases of endometriosis, and the remaining 2 cases of inflammatory lesions of abdominal organs.

2.2. Inclusion and exclusion standards

Inclusion criteria included: (1) confirmed O&G acute abdomen; (2) occurrence of amenorrhea, vaginal bleeding, lower abdominal pain, and other symptoms; (3) informed consent; and (4) all have sexual life and can accept vaginal B-scan ultrasound examination.

Exclusion criteria included: (1) those with no sexual history; (2) those with infectious diseases; and (3) those with organ, cardiovascular, and cerebrovascular diseases.

2.3. Methods

The examination was completed with the VINNO G60 color ultrasonic diagnostic instrument, and the abdominal probe and vaginal probe were adjusted to 3.5–5.0 MHz and 5.0–7.0 MHz, respectively. The patients were instructed to fill their bladder for an abdominal B-scan ultrasound examination. If necessary, physiological saline was prepared to be injected into the bladder. When the bladder fullness met the examination standards, the scan began at the pubic bone area of the lower abdomen to obtain multi-angle and all-round scan images of the abdomen, to evaluate the size of the uterus, shape, and degree of inflammatory lesions, and observe the uterine effusion, adnexal mass, gestational sac, fetal heart rate, fetal bud, pelvic effusion, and evaluate whether the internal organs were diseased. The patients were then instructed to empty their bladder for a vaginal B-scan ultrasound examination. In the lithotomy position of the bladder, the probe was placed on the vaginal vault area, longitudinal, transverse, and semi-circular scans were conducted, and tilt, rotation, and pumping programs were used to obtain images to evaluate the uterine size, uterine shape, the degree of inflammatory lesions, pelvic effusion, and abdominal mass. If abnormalities were found, the probe was adjusted and explored to obtain multi-angle images. After obtaining the ultrasound images, two experienced sonographers read the images together and compared the pathological results to calculate the diagnostic accuracy of the O&G acute abdomen.

2.4. Observation indicators

The observation indicators of this study included:

- (1) Diagnostic efficiency: Compare the pathological results, evaluate the detection status of abdominal B-scan ultrasound, vaginal B-scan ultrasound, and combined abdominal and vaginal B-scan ultrasound, and calculate the diagnostic specificity, sensitivity, and accuracy.

- (2) Types of acute abdomen in O&G: including ectopic pregnancy, acute pelvic inflammatory disease, intrauterine pregnancy loss, ovarian cyst rupture, and endometriosis.

2.5. Statistical research

The data of patients with acute abdomen in O&G were calculated using SPSS 21.0; count data were recorded as %, and the χ^2 test was performed; count data were recorded as mean \pm standard deviation (SD), and the *t*-test was performed. There was a statistical difference if $P < 0.05$.

3. Results

3.1. Diagnosis results

Table 1 shows that the O&G acute abdomen was confirmed in 68 cases through pathology, 53 cases through abdominal B-scan ultrasound, 60 cases through vaginal B-scan ultrasound, and 67 cases through the combined abdominal and vaginal B-scan ultrasound.

Table 1. Comparison of different ultrasonography examinations and pathological results (%)

Group	Pathologically positive	Pathologically negative	Total
Abdominal B-scan ultrasound positive	42	11	53
Abdominal B-scan ultrasound negative	26	1	27
Total	68	12	80
Vaginal B-scan ultrasound positive	54	6	60
Vaginal B-scan ultrasound negative	14	6	20
Total	68	12	80
Combined diagnosis positive	66	1	67
Combined diagnosis negative	2	11	13
Total	68	12	80

3.2. Diagnostic performance

The diagnostic efficiency of the combined abdominal and vaginal B-scan ultrasound was higher than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of diagnostic performance [% (*n*)]

Group	Sensitivity	Specificity	Accuracy
Abdominal B-scan ultrasound	61.76 (42/68)	8.33 (1/12)	53.75 (43/80)
Vaginal B-scan ultrasound	79.41 (54/68)	50.00 (6/12)	75.00 (60/80)
Combined diagnosis	97.06 (66/68)	91.67 (11/12)	96.25 (77/80)
χ^2 (abdominal and combined)	25.9048	16.6667	38.5333
<i>P</i> (abdominal and combined)	0.0000	0.0000	0.0000
χ^2 (vaginal and combined)	10.2000	5.0420	16.6747
<i>P</i> (vaginal and combined)	0.0014	0.0247	0.0001

3.3. Types of obstetric and gynecological acute abdomen

Table 3 shows the accuracy of the combined abdominal and vaginal B-scan ultrasound in diagnosing the types

of acute abdomen in O&G was higher than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$).

Table 3. Comparison of diagnosis in types of acute abdomen in O&G [n (%)]

Group	Ectopic pregnancy	Acute pelvic inflammatory disease	Intrauterine pregnancy loss	Ovarian cyst rupture	Endometriosis	Detection rate
Abdominal B-scan ultrasound	15(62.50)	14 (77.78)	5 (100.00)	9 (90.00)	10 (90.91)	53 (77.94)
Vaginal B-scan ultrasound	19 (79.17)	16(88.89)	5 (100.00)	9 (90.00)	11 (100.00)	60 (88.24)
Combined diagnosis	23 (95.83)	18(100.00)	5 (100.00)	10 (100.00)	11 (100.00)	67 (98.53)
χ^2 (abdominal and combined)	-	-	-	-	-	13.8833
P (abdominal and combined)	-	-	-	-	-	0.0002
χ^2 (vaginal and combined)	-	-	-	-	-	5.8303
P (vaginal and combined)	-	-	-	-	-	0.0158

3.4. Ultrasound signs of obstetric and gynecological acute abdomen

The ultrasound signs for each type of acute abdomen in O&G are as follows:

- (1) Ectopic pregnancy: Ultrasound images showed no gestational sac in the uterine cavity, but the thickness of the endometrium increased, and some echoes were thickened and enhanced. Mixed masses were observed in the ovary and adnexal areas. Observations of the yolk sac, gestational sac, fetal heartbeat, and fetal bud were found in some patients; there was free fluid observed in the pelvic and abdominal cavities.
- (2) Acute pelvic inflammatory disease: Ultrasound scans inside the pelvic cavity showed no echo, and the lesions were primarily located in the uterine and rectal lacunae. Observation of the ovaries showed signs of enlargement. Observation of the appendix area revealed the presence of extended, nodal-shaped, echo-free areas.
- (3) Intrauterine miscarriage: Most patients were observed with an increase in uterine volume under ultrasound, and the increase in volume is consistent with the time of menopause. Observation of the inside of the mass showed the presence of regular gestational sacs, and fetal heartbeat and fetal buds were also seen; in a small number of patients, the uterine volume had increased, but there was no embryo inside the mass, and the shape of the gestational sac was irregular. The size did not match the time of menopause.
- (4) Ovarian cyst rupture: Ultrasound showed no abnormality in the size of the uterus, no gestational sac in the uterine cavity, and observation of the adnexal area revealed the presence of a cystic-solid mass with no clear boundary. Observation of the posterior pelvic fornix area and pelvic area showed the presence of a free anechoic zone.
- (5) Endometriosis: Ultrasound examination of the appendage area showed cystic and anechoic characteristics. Observation of the cyst wall showed rough thickening. Observation of the interior of the cyst cavity revealed the presence of small punctate echoes, and the uterus was uniformly enlarged. The cavity line was deviated anteriorly.

4. Discussion

Acute abdomen in O&G has a rapid onset, and the typical symptom is severe abdominal pain. Patients' lives and health can be endangered if the acute abdomen is not diagnosed and treated in time. Ectopic pregnancy,

acute pelvic inflammatory disease, intrauterine miscarriage, ovarian cyst rupture, and endometriosis are common acute abdomen in O&G with many causes. Therefore, in addition to common abdominal pain, patients have diverse clinical symptoms and manifestations, which directly affect disease diagnosis and treatment ^[4,5]. In addition, the acute abdomen in O&G progresses rapidly, and doctors need to assess the patient's condition and provide treatment promptly, otherwise, the life and health of O&G patients may be endangered ^[6]. Surgical pathology is the gold standard for qualitative evaluation of acute abdomen in O&G. However, the speed of pathological diagnosis is slow, which may delay the best time for treatment. Therefore, exploring accurate and high-speed diagnostic solutions is crucial to ensuring the life and health of patients with acute abdomen in O&G and has significant value ^[7].

At present, ultrasound technology has been widely used in treating patients with acute abdomen in O&G, including abdominal B-scan ultrasound, vaginal B-scan ultrasound, and other forms. The two technologies have different diagnostic efficiencies. Abdominal B-scan ultrasound has a wide range of scans and can obtain information such as organ shape, volume, and location. It can also assist doctors in assessing fluid accumulation in adjacent areas of organs and can initially assess the relationship between gynecological diseases and adjacent organs. However, due to the low frequency of the abdominal B-scan ultrasound probe, it cannot display tiny lesions of gynecological diseases, and it is difficult to detect atypical lesions in sonograms. There is a chance of missed diagnosis and misdiagnosis when diagnosing acute abdomen in O&G ^[8]. Moreover, those who cannot hold urine for a long time or those with abdominal obesity should not undergo abdominal B-scan ultrasound examination. Otherwise, the quality of B-scan ultrasound imaging will be reduced due to bladder fullness and abdominal fat, making it more challenging to diagnose the disease qualitatively. Before vaginal B-scan ultrasound examination, patients with acute abdomen in O&G do not need to fill their bladders, as this high-frequency probe examination has a higher diagnostic resolution, can directly contact adjacent organs, obtain clear imaging images, and can also detect abnormalities missed by abdominal B-scan ultrasound including micromass ^[9]. Furthermore, vaginal B-scan ultrasound can also evaluate the patient's pelvic adhesions, which is helpful for doctors to analyze obstetric and gynecological diseases qualitatively. However, vaginal B-scan ultrasound has a small field of view and cannot comprehensively scan adjacent organs. Therefore, vaginal B-scan ultrasound alone also carries a risk of missed diagnosis and misdiagnosis.

Based on the data analysis in this study, 68 cases of obstetric and gynecological acute abdomen were diagnosed by pathology, 53 cases of obstetric and gynecological acute abdomen were confirmed by abdominal B-scan ultrasound, 60 cases of obstetric and gynecological acute abdomen were confirmed by vaginal B-scan ultrasound, and 67 cases of obstetric and gynecological acute abdomen were confirmed by combined diagnosis; The diagnostic efficiency of the combined abdominal and vaginal B-scan ultrasound was higher than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$). It is suggested that the abdominal B-scan ultrasound can clarify the location of emergency abdominal lesions and evaluate the nature of emergency abdominal lesions. However, poor bladder filling, thick abdominal wall fat, and intestinal gas reflection may affect ultrasound imaging and reduce diagnostic efficiency. Other the other hand, vaginal B-scan ultrasound is a high-frequency probe that can obtain high-definition images, and the probe goes deep into the vagina and directly contacts the pelvic organs. The imaging is not affected by fat and obesity and can detect tiny masses without filling the bladder before the examination. Hence, vaginal B-scan ultrasound shortens the diagnosis time leading to prompt treatment of acute abdomen in O&G, and is helpful to improve diagnostic accuracy, but the scope of examination is small. Therefore, combining abdominal and vaginal B-scan ultrasound is necessary to improve diagnostic efficiency and reduce missed diagnoses and misdiagnosis of acute abdomen in O&G ^[10-12].

Another set of data showed that the accuracy of the combined abdominal and vaginal B-scan ultrasound in diagnosing the type of acute abdomen in O&G was higher than that of abdominal B-scan ultrasound alone and vaginal B-scan ultrasound alone ($P < 0.05$). This indicated that combined diagnosis can assist doctors in classifying acute abdomen in O&G, and the diagnostic accuracy is high. The abdominal B-scan ultrasound can expand the scanning field of view and assist doctors in clarifying the relationship between the gynecological acute abdomen and adjacent organs. It has a high diagnostic value, especially in examining anterior abdominal wall lesions, despite the low resolution of the abdominal B-scan ultrasound probe leading to cases of misdiagnosis. Vaginal B-scan ultrasound uses a high-frequency probe to complete the examination, which can obtain clear sonograms, and the probe is close to the vaginal vault and cervical area, which can shorten the distance between the probe and the lesion tissue, which is helpful for doctors to diagnose obstetric and gynecological acute abdomen qualitatively^[13]. Combining abdominal and vaginal B-scan ultrasound can obtain clearer images, play a complementary role, and are not affected by age, body position, and scanning range. It is helpful for doctors to observe the structure of subtle lesions, thereby increasing diagnostic accuracy^[12].

In summary, patients with acute abdomen in O&G received combined abdominal and vaginal B-scan ultrasound for diagnosis, and the results were consistent with pathology and can be promoted in clinical practice.

Disclosure statement

The author declares no conflict of interest.

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