Diagnostic Value of Ultrasound-Guided Fine-Needle Aspiration for Pelvic Space-Occupying Lesions Via Rectal Endoscopic Ultrasound

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ABSTRACT

Background/Aims: The present study seeks to appraise the therapeutic outcomes of cystic lesion management and the diagnostic performance of endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) in characterizing pelvic space-occupying lesions.

Materials and Methods: EUS-FNA was performed transrectally on 83 patients with pelvic space-occupying lesions identified using ultrasonography, computed tomography, or magnetic resonance imaging (MRI) from January 2016 to December 2024. Tissue was obtained for pathological analysis and smear cytology using a 19 G or 22 G puncture needle. Cytological samples are collected, and drainage is executed for pelvic cystic lesions. In the presence of an abscess, metronidazole solution was routinely provided for irrigation. Postoperatively, additional clinical monitoring was performed on patients to assess their prognosis, including the evaluation of clinical symptoms and laboratory indicators during follow-up.

Results: After pathological and/or cytological evaluation of 83 patients, 67 instances of solid masses were identified, comprising 41 adenocarcinomas, 6 malignant mesenchymal tumors, 7 inflammatory masses, 3 lymphomas, 2 dermoid cysts, and 8 other cases. Sixteen instances of cystic masses were recorded, comprising 3 plasma cystadenomas, alongside 13 occurrences of perirectal abscesses, of which 11 patients with perirectal abscess were drained of pus and treated with metronidazole injection. The comparison of 19G and 22G puncture needles revealed no statistically significant variation in the percentage of punctures amenable to immunohistochemistry ($P > .05$). Thirteen patients with perirectal abscesses exhibited differing degrees of pain during EUS-FNA. Except for 1 patient who exhibited hematochezia attributable to a pelvic lesion in the prostate, none of the other patients encountered postoperative complications, including fever or hematochezia.

Conclusion: The EUS-FNA is a direct, secure, and minimally invasive method with therapeutic promise for clarifying the characteristics of pelvic space-occupying lesions.

Keywords: Biopsy, endoscopic ultrasound-guided fine-needle aspiration, pelvic tumor, EUS

INTRODUCTION

Clinical observations indicate that pelvic masses may vary from benign entities, such as cysts or abscesses to malignant tumors, with their etiology being intricate. Due to its superior soft tissue contrast and resolution, computed tomography (CT) is the most commonly employed diagnostic technology in clinical settings. Notable advantages encompass the capacity to thoroughly delineate the extent of the occupied lesion and its relationship with adjacent tissues and organs, in addition to the capability of obtaining multidirectional images without necessitating patient repositioning. Describing the lesion is more arduous, despite the accessibility of imaging tests such as CT scans. Distinguishing between recurrent tumors

and scar tissue is particularly problematic in patients who have received local surgery or radiation therapy. This complicates the accurate evaluation of the disease's prognosis and, consequently, the formulation of a suitable treatment plan. The execution of accurate and effective treatment depends on obtaining a lesion sample for pathological diagnosis. Unnecessary surgeries resulting from misdiagnosis can also be averted.

Ultrasound-guided fine-needle aspiration (EUS-FNA) provides a more distinct ultrasound image of the lesion by meticulously assessing the gastrointestinal tract wall and surrounding organs. Cytological and histological specimens can be obtained using ultrasound-guided aspiration

to secure a conclusive pathological diagnosis of the lesion. Nevertheless, the effectiveness of EUS-FNA in detecting pelvic mass lesions is still disputed owing to the intricacies of pelvic anatomy. Presently, there are only a few pertinent single-center studies and individual case reports. Transrectal EUS-FNA data from 83 cases were gathered and analyzed to examine the diagnostic and therapeutic utility of endoscopic ultrasonography for pelvic masses.

MATERIALS AND METHODS
General Information
To determine the nature of the mass, a retrospective analysis of 83 cases of pelvic masses discovered by ultrasound, CT, magnetic resonance imaging (MRI), etc. at Xiangyang Central Hospital between January 2016 and May 2024 was conducted using transrectal EUS-FNA. Of these patients, 27 were male and 56 were female, with an age range of 29–86 years and a mean age of 58 years; the maximum diameter of the lesions ranged from 1.9 to 11.8 cm, with a mean of 6.3 cm (Table 1). The primary sites of pelvic masses in 83 patients mainly included the rectum, uterus, ovaries, prostate, colon, and peritoneal metastases (Table 2). Ethical committee approval was received from the Ethics Committee of Xiangyang Central Hospital (Approval number: 22024-062, Date: May 16, 2024). Informed consent was obtained.

Inclusion and Exclusion Criteria
Patients aged 18 years or older who consented to or requested an EUS-FNA evaluation and provided written informed consent were eligible for study participation. Documentation of a pelvic mass on routine imaging constituted an additional inclusion criterion. Patients with serious heart or lung conditions, those who couldn't handle EUS-FNA/B, those who had a clear risk of bleeding, and those with mental illnesses who couldn't comply with EUS-FNA were all excluded.

Main Points

- *This retrospective study included 83 patients with pelvic masses who underwent transrectal EUS-FNA. It achieved high diagnostic efficacy for malignant tumors, with 94.4% sensitivity and 100.0% specificity.*
- *Transrectal EUS-FNA is safe in which only 1 patient had hematochezia (successfully managed). No statistical difference in immunohistochemical eligibility existed between 19G and 22G needles (P > .05).*
- *Beyond diagnosis, EUS-FNA treated 11 perirectal abscesses via aspiration and metronidazole irrigation, achieving complete healing without recurrence during 2-month follow-up.*

Table 1. Baseline Characteristics of the Patients

Baseline Characteristics	Digital
Number of patients, n	83
Age, years, average (range), n	58 (29-86)
Gender, male/female, n	27/56
Size of lesions, cm average (range)	6.3 (1.9-11.8)

Statistical Analysis
The data were analyzed using SPSS 26.0 (IBM SPSS Corp.; Armonk, NY, USA) statistical software. Fisher's exact probability method was used to assess the count data, which were reported as percentages. A difference was considered statistically significant if it was less than 0.05.

Operational Equipment and Puncture Needle Selection
The Pentax 3500 endoscopy mainframe, the Hitachi 5500 ultrasound mainframe, and the Japan Pentax EG-3630UT (probe frequency 5-10 MHz, electronic line array fan scanning) are used for ultrasound endoscopy. Selection of 19G puncture needles includes COOK Echotip-19 and 22G puncture needles: COOK Echotip-1-2 and Olympus NA-10J-1. The 22G puncture needle was chosen from Olympus NA-10J-1 and COOK Echotip-1-2, while the 19G puncture needle was chosen from COOK Echotip-19.

EUS-FNA Procedure
The bowel was regularly cleaned prior to the procedure, and the patient or designated representative completed the appropriate informed consent form. In order to assess the size, shape, location, and echo intensity of the pelvic space-occupying lesion, the patient was in 1 of 3 positions during the examination: supine position, left lateral recumbent, or right lateral recumbent. The probe was positioned in the rectum to scan the pelvis, with the entry lens positioned 2-20 cm from the anus. The patient was then instructed to choose the best puncture position based on the endoscopic ultrasound image. The color

Table 2. Primary Organs of Pelvic Masses Among 83 Patients

Primary Organs	Number
Rectum, n	11
Uterus, n	6
Ovary, n	41
Fallopian tube, n	2
Prostate, n	14
Pelvic unorgan, n	9

Doppler function was used to examine the blood vessels along the puncture path, paying particular attention to avoiding the large blood vessels. In order to match the puncture needle with the center of the mass, the clamp was raised during the puncture to change the direction. After confirming the needle tip had penetrated the target lesion, the stylet was withdrawn and a negative-pressure syringe was attached.

Cystic solid masses were punctured and aspirated with a 22G puncture needle, puncturing and extracting the cystic fluid 1-2 times and puncturing the solid part of the body 2-3 times, with negative pressure of 0-10 mL, and lifting and inserting back and forth in the lesion 10-30 times. Abscesses or cystic fluid masses were punctured and aspirated 1-3 times with a 19G puncture needle, maintaining negative pressure of 5-10 mL. For the first time, abscesses or cystic fluid masses were punctured and aspirated 1–3 times with a 19G puncture needle, maintaining negative pressure of 5–10 mL, with a negative pressure of 0–10 mL applied and repeated to-and-fro manipulation performed within the lesion for 10–30 passes. If the initial aspiration yields a large volume of hemorrhagic fluid with minimal linear tissue, repeated negative-pressure manipulation is omitted. Once an adequate specimen is obtained, negative pressure is released and the needle is withdrawn.

Smear cytology, carcinoembryonic antigen, and bacterial culture were performed on puncture aspirates as needed. Using a needle, the extracts were pushed out onto a slide or into a liquid-based cytology preservation solution. If tissue strips developed, they were then fixed in a 10% formalin solution. Smear cytology, carcinoembryonic antigen, and bacterial culture were performed on puncture aspirates as needed. Repeat aspiration was performed 2–3 times if necessary. Postoperative follow-up was conducted for the pathological and cytological results.

Postoperative Treatment

Patients were monitored for fever, blood in the stool, stomach pain, and other side effects following EUS-FNA. Inpatients received intravenous metronidazole or tinidazole for 2 days postoperatively for prophylactic anti-infection therapy; outpatients were administered oral norfloxacin capsules for the same duration. Patients who were inpatients were monitored for any adverse events every day for 3 days following surgery; patients who were outpatients were monitored in the ultrasonography endoscopy room when they visited the hospital to acquire the results of their pathology tests. They visited the hospital at any time if there were any adverse events, such as fever and stomach trouble. For patients with an inconclusive diagnosis who required subsequent surgical intervention, surgical pathological examination was performed after the puncture procedure, with clinical follow-up extended for more than 2 months.

RESULTS

Tissue strips were taken from 79 cases that were sent for pathology and cytology, with the exception of 13 cases of perirectal abscess and 1 case of dermatoid cyst, which were only subjected to smear cytology. Eighty-three patients who were screened based on the nadir criteria underwent fine-needle aspiration biopsy. According to the pathological examination results, there were 67 cases of solid masses in the pelvis, 42 of which were adenocarcinomas (Figures 1 and 2), 6 of which were malignant mesenchymal stromal tumors, 7 were inflammatory masses, 3 were lymphomas, 1 was a dermoid cyst, and 8 were identified as other indeterminate cases. Of these, 8 cases were combined with laparoscopic or surgical exploration, and 3 of them turned out to be adenocarcinomas. Cytological examination of 67 patients with pelvic solid space-occupying lesions yielded a diagnostic sensitivity of 94.4%, specificity of 100.0%, positive predictive

Figure 1. (a) A pelvic hypoechoic mass, approximately 9 cm in diameter, was discovered by ultrasound endoscopy. (b) A fine-needle aspiration biopsy was conducted on the pelvic mass under the guidance of endoscopic ultrasonography. (c) The solid pelvic mass's pathologic results revealed cancer.
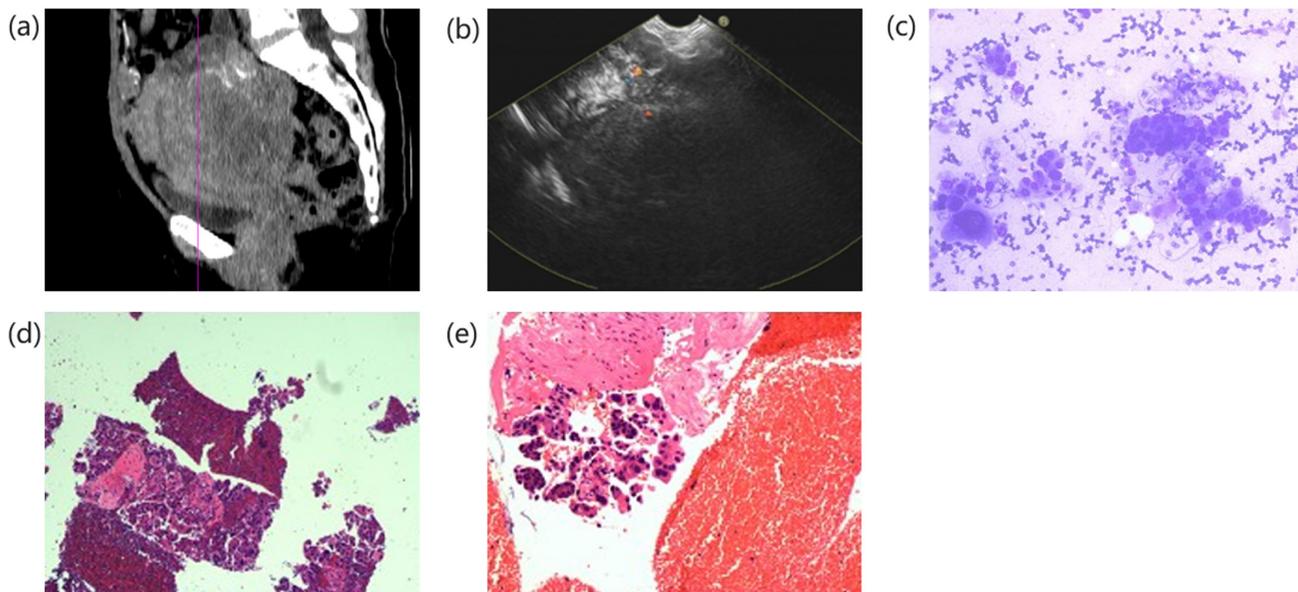
Figure 2. Metastatic adenocarcinoma of the pelvis, (a) A large soft-tissue mass measuring about 8.5 × 8.1 cm is seen in one pelvis on a sagittal CT scan. It has irregular morphology, unclear borders, and multiple patches of calcified foci inside. It also has heterogeneous density of enhancement within the uterus, inhomogeneous enhancement on enhancement, and unclear demarcation from the anterior-posterior uterine border. (b) According to EUS, there is a large hypoechoic pelvic lesion with patchy hyperechoic shadows scattered throughout. Its morphology is irregular, its borders are unclear, and its anechoic signals are localized (colored dots symbolize flow signals from color Doppler; red dots indicate blood flow toward us; blue dots represent blood flow away from us). (c) Adenocarcinoma was identified by combining microscopic pictures with hematoxylin-eosin staining. (d) (e) Pelvic adenocarcinoma accompanied by immunohistochemistry and morphology typical of high-grade plasma carcinoma. Vimentin (individually +), CA-125 (+), P16 (partially +), PR (spot foci weak +), ER (foci +), HNF-1 (-), Napsin-A (-), Villin (-), Ki-67 (Li: ~70%), CK7 (+), CK20 (-), CK18 (+), Pax-8 (+), WT-1 (+), and P53 (diffuse strong +, suggestive of mutant phenotype) were all detected by immunohistochemistry.

value of 100.0%, and negative predictive value of 81.2% for identifying pelvic malignancy. Transrectal EUS-FNA results of cases with substantial pelvic mass are shown in Table 3. Thirteen cases of perirectal abscesses and 16 cases of cystic or cystic-solid lesions, including 3 plasma cystic adenomas, were reported. Two of the cases had only a small amount of pus removed because the pus was so viscous, while the other 11 cases had metronidazole injections and repeated irrigations. The 11 cases were reexamined 2 months later, and the abscesses had vanished.

Eight cases employed 19G puncture needles, and all punctures were sufficient to do immunohistochemical

staining (100%). Of the 67 solid lesions, 59 were sampled with a 22G needle, with a successful sampling rate of 96.6% (57/59). There was no statistically significant difference in the percentage of punctures that could perform immunohistochemistry between the 19G and 22G puncture needles ($P > .05$) (Table 4).

Thirteen patients with perirectal abscesses experienced noticeable pain during the puncture procedure. The discomfort was quickly reduced following the puncture process, and none of them received any extra care. With the exception of one patient with metastatic adenocarcinoma whose pelvic lesion was in the prostate gland and

Table 3. Transrectal EUS-FNA Results of Cases with Substantial Pelvic Mass (n = 67)

	Type of Disease (Final Diagnosis) n = 67	
EUS-FNA Diagnosis	Malignant Tumor	Non-Malignant Tumor
Malignant tumor	51	0
Non-malignant tumor	3	13

Table 4. Immunohistochemical Results Available for Pelvic Parenchymal Masses (n = 67)

	Type of Disease (Final Diagnosis) n = 67	
Puncture Needle Type	Immunohistochemistry Available	No Immunohistochemistry
22G	57	2
19G	8	0

who had blood in the stool, 83 cases were observed following the puncture procedure. The remaining patients did not exhibit any overt symptoms of abdominal pain, fever, blood in their stool, or other negative reactions.

DISCUSSION

The urinary bladder, urethra, rectum, and reproductive organs are the main organs of the pelvis. Lesions that occupy these organs are common clinical conditions caused by a variety of factors, such as abnormal body fluid accumulation, abnormal proliferation of pelvic tissues, and pelvic adhesions.[1] The 2 types of pelvic lesions are benign and malignant. Although benign lesions frequently do not exhibit certain clinical symptoms and characteristics, they can cause internal swelling in the patient's pelvis. In certain cases, these lesions are accompanied by several symptoms, which can have a significant impact on the patient's life and work.[2] Patients' lives may be jeopardized if pelvic mass illness is not treated promptly since it raises the chance of malignancy. The prognosis of individuals with pelvic masses can be effectively improved by early diagnosis.[3]

While EUS-FNA allows transrectal puncture biopsy of pelvic masses and the acquisition of tissue samples for pathological and cytological analysis, conventional imaging modalities including ultrasound, CT, and MRI fail to provide a conclusive diagnosis.[4] Originally used primarily to diagnose pancreatic tumors, EUS-FNA has recently been used more frequently to diagnose masses outside of the pancreas,[5] including perigastric intestinal wall bulge,[6] mediastinum,[7] retroperitoneum,[8] pelvic masses,[9] and others. It possesses the ability to precisely diagnose a patient prior to surgery, pinpoint the nature of the tumor, differentiate primary from metastatic cancers, and detect potentially beneficial genetic changes to tailor the appropriate treatment plan.

In addition to being expensive, using CT-guided percutaneous puncture biopsy to determine the type of pelvic lesions is both challenging and time-consuming. Lesions that are larger in scope and closer to the abdominal wall are more significant for the traditional ultrasound-guided percutaneous puncture biopsy.[4] Transabdominal wall ultrasound is frequently inadequate for masses that are inaccessible to the abdominal wall and are often covered by intestinal loops which increases the risk of penetrating the bowel loops. Additionally, transabdominal ultrasound-guided percutaneous biopsies are not appropriate for patients with smaller pelvic masses that are challenging to accurately puncture through the abdominal wall. In

addition to guiding the puncture needle to pierce the mass at the closest distance and providing real-time monitoring of the puncture process, a linear-array endoscopic ultrasound can clearly visualize pelvic lesions. At the same time, color Doppler imaging can identify vital adjacent organs and major blood vessels along the puncture path to reduce the risk of bleeding and other complications.[10] In addition to diagnosing pelvic diseases, EUS-FNA/B can perform therapeutic procedures such as lavage and the puncture and drainage of perirectal abscesses, having a therapeutic function.

The process of acquiring tissue under the guidance of transendoscopic ultrasonography is safe. According to reports, its total complication rate ranges from 0.3% to 2.2%.[11] Tumor cell implantation is the most concerning consequence. Nonetheless, there are currently few instances of EUS-FNA needle tract implantation.[12] Clinicians may initiate symptomatic management based on the patient's clinical status if the most common complications—hemorrhage, infection, and perforation—occur.[13] Prophylactic antibiotics should be considered for transendoscopic ultrasound-guided fine-needle aspiration biopsies of cystic lesions to prevent infection. According to the American Society for Gastrointestinal Endoscopy (ASGE) guidelines, prophylactic antibiotics are not advised while doing EUS-FNA on solid lesions because there is a low risk of bacteremia associated with this procedure.[14] Because of the presence of microorganisms in the intestinal lumen, the performance of EUS-FNA may still be complicated by a local infection, even with a small penetration needle. As a result, postoperative antibiotic prophylaxis for infection should be administered for 2 days, and preoperative bowel cleansing should be done regularly. No fever or infectious complications were identified in any of the 83 patients during postoperative follow-up. In this study, to prevent infection, inpatients received intravenous metronidazole or tinidazole for 2 days postprocedure, while outpatients were prescribed oral norfloxacin capsules for the same 2-day postoperative course; none of these 83 patients developed fever or infection during a 2-month postoperative follow-up period.

Changes in the cystic fluid's echogenicity indicate the existence of intracapsular bleeding, which seldom develops to a serious degree. Although bleeding normally stops on its own, several drugs that interfere with coagulation can make things worse. Coagulation parameters should be regularly evaluated before EUS-FNA to prevent bleeding. Clopidogrel should be stopped 7 days

before the procedure, with low-molecular-weight heparin held for 12–24 hours and unfractionated heparin held for 6 hours prior to the procedure; aspirin does not need to be stopped. To prevent thrombotic events, high-risk patients should stop taking warfarin 5 days before surgery and start heparin bridging therapy.[15] Of the 83 patients who underwent EUS-FNA in this study, only 1 patient—diagnosed with metastatic adenocarcinoma with a pelvic lesion located in the prostate—developed hematuria. The patient was transferred to the urology department for specialized management, after which the hematuria was promptly controlled. During the 2-month postoperative follow-up, the patient had no complications such as fever, infection, or bleeding.

Only a small number of studies have reported EUS-FNA for pelvic lesions using the lower gastrointestinal tract approach, where the target lesion was limited to the rectum or perirectal area.[16] The EUS-FNA is widely used as a standard technique for obtaining pathological specimens through the upper gastrointestinal tract and thus diagnosing peripheral lesions. In 2021, a single-center retrospective study conducted at Gifu University Hospital in Japan used database analysis to identify 49 patients who had undergone EUS-FNA/B for pelvic lesions between January 2008 and December 2018. Of these, 28 underwent the procedure via the upper gastrointestinal tract approach, and 21 underwent it via the lower gastrointestinal tract approach. We treated pelvic lesions below the level of the internal and external iliac bifurcations with the lower GI approach, while we treated those at the level of the major iliac and internal and external iliac bifurcations with the upper GI method. With an overall success rate of 95.2% (20/21) for the lower gastrointestinal tract approach and 91.8% (45/49) to 89.3% (25/28) for the upper gastrointestinal tract method, the study had a comparatively high success rate.[17] While there were no adverse effects in the trial, the ultrasound endoscope had to be pushed downward toward the duodenum throughout the procedure, and it is still necessary to further evaluate the safety of the upper gastrointestinal tract approach to pelvic lesions using EUS-FNA. To view pelvic lesions during the surgery, the endoscope must be moved downward toward the duodenum or gastric wall, significantly raising the risk of bleeding or perforation.

From September 2014 to December 2021, 35 patients with pelvic masses who were hospitalized at Soochow University's Second Affiliated Hospital for EUS-FNA via the lower gastrointestinal tract route had their clinical data gathered for a 2022 study that was published in Translational Cancer Research. The pathological features of the surgical specimen were used to make a definitive diagnosis for 10 individuals who had surgery. The final diagnosis for the 25 patients who did not have surgery was determined by clinical follow-up or the malignant pathological findings of EUS-FNA. In identifying malignant pelvic masses, EUS-FNA's sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were, 91.3% (21/23), 100.0% (12/23), 100.0% (12/23), 100.0% (12/23), 100.0% (12/23), 100.0% (12/23), 100.0% (12/23), and 100.0% (12/23), respectively. The corresponding sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were 91.3% (21/23), 100.0% (12/12), 100.0% (21/21), 85.7% (12/14), and 94.3% (33/35). All individuals experienced no problems from the biopsy puncture.[4]

Ultrasound endoscopy is becoming more and more useful for treating conditions like choledocholithiasis,[18] perirectal abscess drainage,[19] tissue glue injection of varices in the stomach fundus,[20] EUS-guided blockade of the abdominal plexus for intractable abdominal pain in inoperable patients with advanced pancreatic cancer,[21] and more. Thirty-seven patients had EUS-guided drainage of perirectal and sigmoid abscesses (31 postoperatively and 6 because of illnesses like CD) using plastic or luminal-adjacent metallic stents in a 2-center case series research.[22] On follow-up CT at 4 weeks, all patients had complete regression of the abscesses and a marked improvement in their symptoms. At 3 and 12 months, 3 patients experienced recurrences that necessitated surgical drainage. In the current investigation, for 11 patients with perirectal abscesses, after pus aspiration via puncture, metronidazole injection was administered for irrigation. During the 2-month follow-up, the abscess cavities were completely healed, and no complications such as fever, infection, or bleeding occurred. In addition to alleviating patient discomfort, it is clear that ultrasonic endoscopic drainage of pelvic abscesses is safe, has a good long-term prognosis, and can be taken into consideration as an alternative to percutaneous and surgical drainage.

The qualitative diagnosis of pelvic space-occupying lesions can be made with high accuracy with EUS-FNA, and the risk of associated consequences is quite low. It is a qualitative diagnostic method that has demonstrated safety, effectiveness, and feasibility for lesions that occupy pelvic space. It has a high clinical value and produces positive outcomes when used to treat pelvic abscesses. However, more proof is still required through multi-center research with higher sample sizes.

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