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How to improve the order and completion time of an extended transvaginal ultrasound for endometriosis using the EzExam+™

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Introduction

Endometriosis, a gynecological pathology characterized by the presence of endometrium-like tissue outside the uterus, affects a significant proportion of women of reproductive age. Its prevalence is estimated to vary depending on the studied group; in the general population, it is estimated to be between 5% and 10%[1]. However, the actual incidence is presumed to be even higher due to the existence of asymptomatic cases or those with mild symptoms that do not prompt the search for specialized medical attention. A critical aspect of this disease is the significant diagnostic delay observed globally. Reports such as Hadfield's indicate a delay ranging from 11.73 years in the United States to 7.9 years in the United Kingdom[2], while another report by Nnoaham found a diagnostic delay of 6.7 years[3]. It is important to note that countless factors cause this statistic to differ across various geographical regions and patient groups. This delay leads to significant negative consequences for patients, including decreased productivity, impaired quality of life (even affecting interpersonal relationships), and the resulting economic burden[4].

Factors Contributing to Diagnostic Delay

Various factors contribute to the untimely diagnosis of endometriosis, and in many cases, the diagnosis is incomplete, leading to suboptimal treatments in both conservative management and excisional surgical interventions. Some factors contributing to diagnostic delay include symptom suppression with hormones, presentation in adolescence, misdiagnosis of pelvic inflammatory disease or irritable bowel syndrome, and the normalization of pain by patients, their families, and even healthcare professionals[5].

One of the main obstacles is the normalization of symptoms by the patient, their family environment, and even some primary care health professionals. Symptoms such as severe menstrual pain (dysmenorrhea), pain during sexual intercourse (dyspareunia), and other painful manifestations like dysuria, dyschezia, low back pain, or leg pain are often considered a natural part of the menstrual cycle or common conditions, which delays the search for a specialized evaluation. While the psychological and social factors underlying this normalization are beyond the scope of this analysis, it is crucial to recognize their impact on the diagnostic process.

However, other factors intrinsic to the role of imaging techniques also warrant detailed attention, particularly those related to the specialized training and expertise required to perform extended examinations. The difference between a routine transvaginal ultrasound and an extended transvaginal ultrasound with bowel preparation is considerable. A routine evaluation usually comprises the analysis of the size, shape, and characterization of lesions in the uterus and ovaries, usually sufficient to diagnose fibroids, adenomyosis, endometrial pathology, and ovarian conditions including polycystic ovaries, ovarian simple cysts, and endometriomas. The extended transvaginal sonographic examination with bowel preparation is usually performed only at specialized centers and there's usually no uniformity among centers in regards of the training or expertise of the sonographers performing the examination.

The Current Role of Extended Transvaginal Ultrasound in Endometriosis Diagnosis

Currently, it is recognized that laparoscopy, which historically played a central diagnostic role, currently is reserved for the definitive surgical treatment of endometriosis. Detailed pre-surgical diagnosis is fundamentally based on extended transvaginal ultrasound with bowel preparation and/or magnetic resonance imaging. These imaging techniques allow for a comprehensive evaluation of the extent and location of ovarian and deep infiltrative endometriosis lesions, which is essential for planning and executing effective definitive surgery. In a 2022 article, Leonardi et al. found greater sensitivity and diagnostic accuracy of transvaginal ultrasound when using the transvaginal ultrasound methodology described in the IDEA consensus[6].

IDEA Group Consensus for Endometriosis Ultrasound Examination

In October 2016, a group of international endometriosis experts, known as the IDEA (International Deep Endometriosis Analysis) group, published a consensus on the pelvic structures that should be systematically examined in patients with suspected endometriosis. This consensus precisely defined the anatomical details for describing these structures during ultrasound examination, standardized how findings should be reported, and, even more relevantly, structured the extended transvaginal ultrasound examination into four fundamental steps to ensure a complete evaluation of all areas of interest[7].

The Four Essential Steps for a Complete Pelvic Examination According to the IDEA Consensus:

Step 1 - Routine examination of the uterus and ovaries: The main objective in this step is to identify possible Müllerian malformations, myometrial lesions such as adenomyosis and fibroids, as well as endometrial alterations. Regarding the ovaries, the presence of cystic or solid lesions is evaluated, analyzing their characteristics to determine the possible existence of endometriomas or other pathologies.

Step 2 - Search for superficial endometriosis: This stage of the examination is dynamic and interactive; it is based on applying gentle pressure on the ovaries to detect pain or abnormal tenderness. Additionally, the sliding of the ovaries over the pelvic wall and adjacent structures is evaluated, looking for signs of adhesions to adjacent organs.

Step 3 - Evaluation of the status of the Pouch of Douglas: The primary objective at this point is to determine if there is adhesion between the posterior aspect of the uterine body and the retrocervical region with the anterior aspect of the mid and upper rectum. Possible adhesions between the uterine fundus and the sigmoid colon or the anterior abdominal wall are also investigated, as well as adhesions between the anterior aspect of the uterine body and the bladder dome (vesicouterine recess).

Step 4 - Search for deep infiltrative endometriosis implants: In this phase, the structures of the anterior compartment are explored, especially the bladder and ureters. Recently, the methodology for the exploration of the parametria was also published[8]. In the posterior compartment, the rectovaginal septum, the lower rectum, the vaginal fornices, the mid and upper rectum, as well as the uterosacral ligaments are evaluated.

Challenges of Extended Transvaginal Ultrasound for Endometriosis

While the implementation of the four steps defined in the IDEA consensus has extended the scope of the transvaginal examination and thereby increasing the ability to detect endometriosis lesions outside the uterus and ovaries, performing an extended examination poses certain challenges for both the patient and the examiner.

One of the main difficulties lies in the time required to complete a comprehensive examination that includes the evaluation of all the structures mentioned in the four steps. Depending on the operator's experience and skill, a detailed review of these features can extend to more than 30 minutes. This examination time can be considerably uncomfortable for a patient suffering from chronic pain and who may experience anxiety and discomfort due to the nature of the procedure. In a comparative analysis of examination times for a routine transvaginal ultrasound and a transvaginal ultrasound for endometriosis, Deslandes et al. found in a retrospective study that the examination time can be extended up to 65% when performing a transvaginal study for endometriosis[9].

The exhaustive review of the pelvis represents a considerable challenge for the sonographer. Not only does it require a meticulous and delicate exploration to ensure patient comfort and safety, avoiding any discomfort or harm, but it also involves the detailed evaluation of a multitude of anatomical structures. Each compartment of the pelvis must be examined with sufficient precision and detail to ensure that no essential step of the examination protocol is omitted. This is fundamental for obtaining a complete and accurate diagnosis, especially in the context of endometriosis, where the identification of small or atypical lesions is crucial.

Optimization of the Process with Samsung's "EzExam+™" Tool

The "EzExam+™" tool, integrated into Samsung ultrasound equipment, offers a promising solution for optimizing the time and order of examination in extended transvaginal ultrasound for endometriosis. This tool allows the examiner to establish a specific and predefined examination protocol. In each step of the protocol, the type of transducer to use, the optimized image preset for the structure to be evaluated, the number of images to acquire, the standard measurements to perform, and the corresponding label for documenting each finding can be specified (Figure 1, 2).

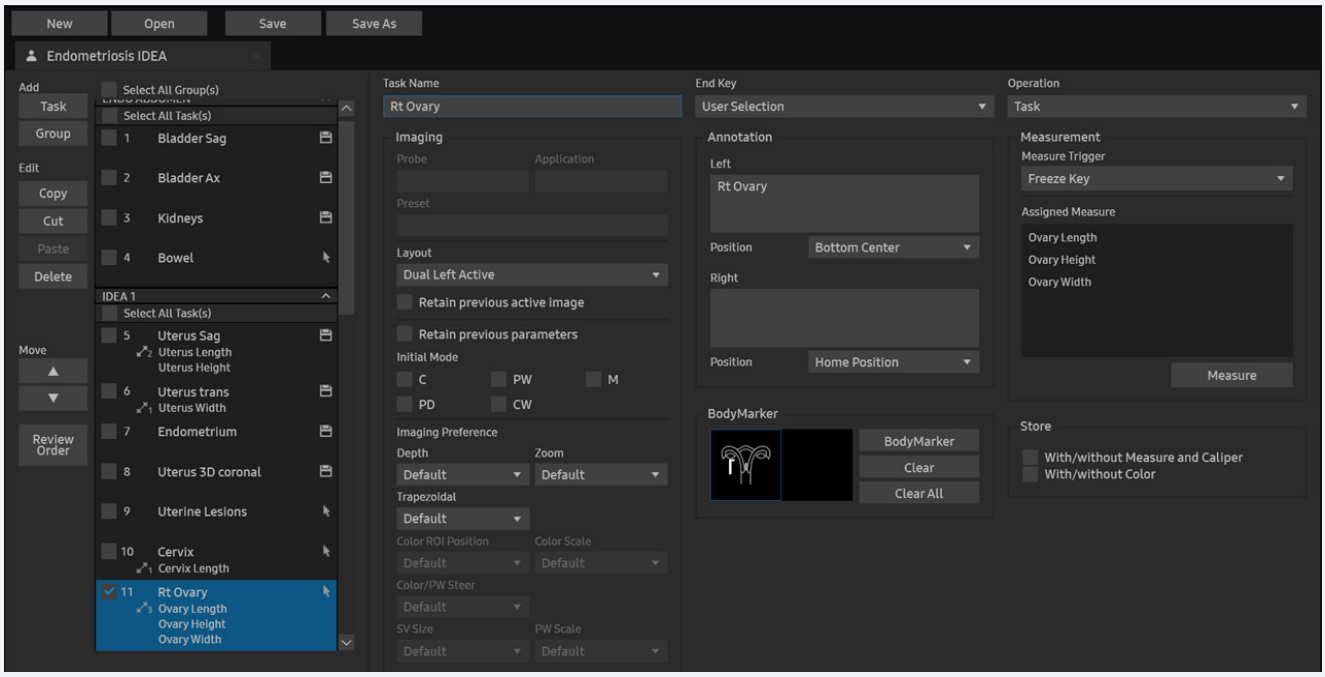

Figure 1. EzExam+™ customization screen: The protocol can be integrated by separate groups as shown on the left. Tasks can be customized to start with a defined transducer, preset, ultrasound mode. Labels and measurements can be set as well to launch automatically.

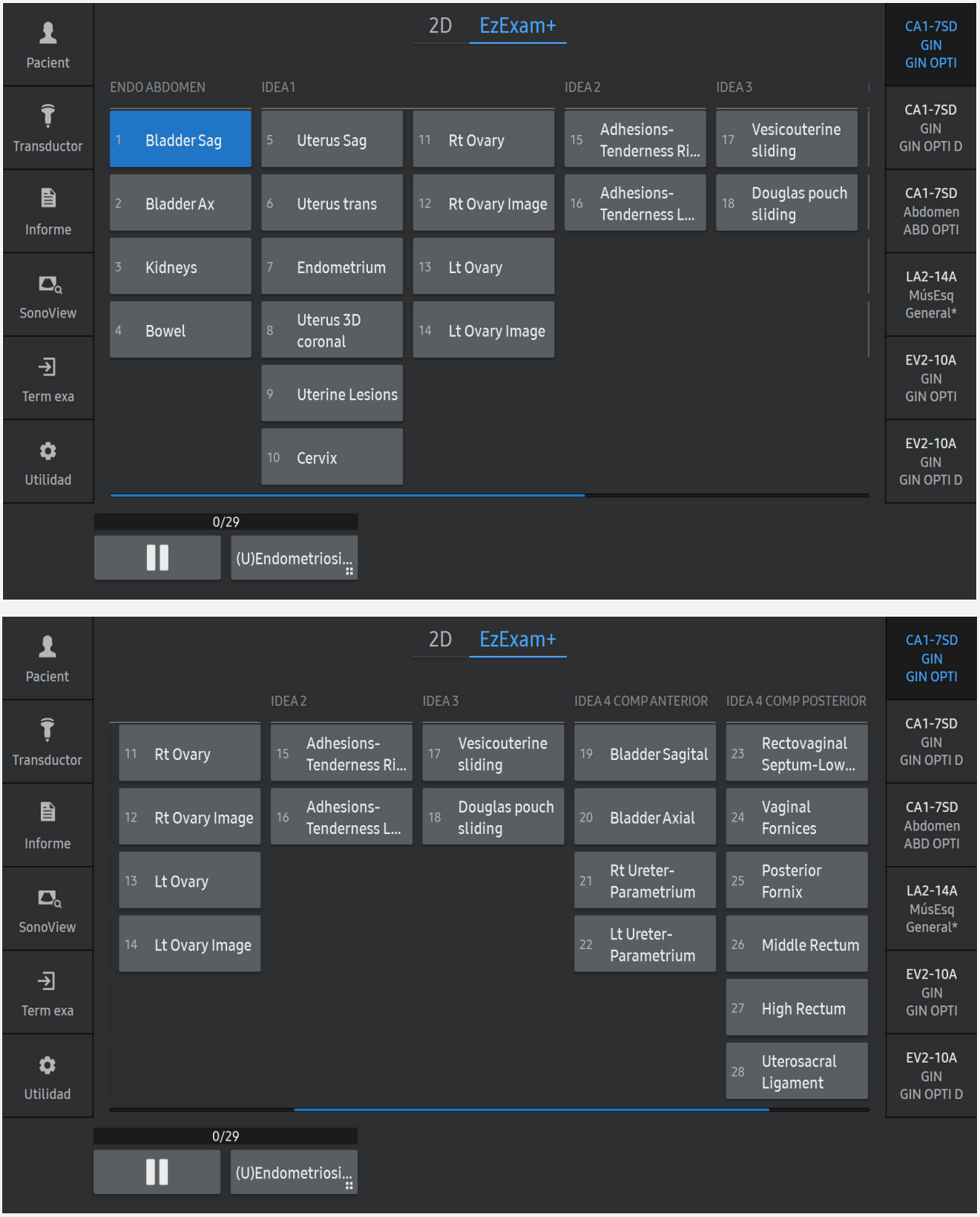

Figure 2. Touch screen shows the steps of the protocol. During the examination the sonographer can navigate forward or backward in the protocol depending on the needs and the color of button changes once this task has been completed.

The implementation of the “EzExam+™” tool in an examination of these characteristics presents several significant advantages. First, it optimizes examination time by eliminating the need to spend valuable seconds on manual labeling and manual changing of presets between the evaluations of different structures. Secondly, it helps maintain a sequential and logical order during the examination, which is particularly important when numerous pelvic structures and compartments need to be evaluated.

Performing a thorough pelvic examination, specifically aimed at diagnosing endometriosis, is a task that involves acquiring a considerable volume of images, ranging from 35 to 50, with the fundamental purpose of exhaustively documenting both the presence or absence of any pathological condition. The complexity of the examination is accentuated by the need to identify abnormalities that, at times, may not be directly related to endometriosis but require attention and documentation.

It is not uncommon for the sonographer to perform this type of extended transvaginal ultrasound to feel overwhelmed. This feeling can arise from various factors: the detection of multiple lesions, which demand detailed analysis; the possibility of distraction during the examination, either due to the patient’s discomfort or pain, which can influence the professional’s concentration; and other environmental or intrinsic factors of the procedure that can make it difficult to maintain a constant focus to avoid omitting any of the examination steps.

The pressure to identify and characterize each finding, coupled with the need to maintain patient comfort and adhere to a standardized imaging protocol, can create an environment of stress and fatigue for the sonographer. Therefore, process optimization and the implementation of tools that facilitate order and efficiency are crucial to ensure the quality of the diagnosis and accuracy in documentation, minimizing the possibility of omissions or errors due to information overload or distractions inherent in the procedure.

Study Objective

The main objective of this study is to measure the examination time required to perform an extended transvaginal ultrasound with bowel preparation, strictly following the four steps defined by the IDEA consensus.

Additionally, it aims to compare the examination time between two groups of patients: those with mild findings during the examination (such as soft markers of superficial endometriosis and lesions in the myometrium and endometrium) and those with more complex lesions, such as endometriomas and deep infiltrative endometriosis lesions in the anterior and posterior compartments of the pelvis.

Methodology

A prospective study was conducted, including 120 patients with clinical suspicion of endometriosis referred to an extended transvaginal ultrasound with bowel preparation. The examinations were performed by a single expert operator in the technique, using an endovaginal transducer EV2-10A in a Samsung V7 ultrasound machine with the "EzExam+™" tool (Samsung Medison Co., Ltd., Seoul, Korea) customized to follow the four-step protocol of the IDEA consensus.

The complete extended transvaginal ultrasound with bowel preparation protocol used is outlined in detail below:

Abdominal examination:

1. Sagittal image of the bladder.
2. Axial image of the bladder.
3. Sagittal image of each kidney to rule out hydronephrosis.
4. Review of cecum, appendix, left colon, sigmoid, ileocecal valve, and distal ileum in search of deep infiltrative endometriosis lesions.
5. Search for implants in the abdominal wall, especially in patients with symptoms in scars from previous surgeries or in inguinal regions.

Vaginal examination:

1. Sagittal and transverse images of the uterus, sagittal image of the endometrium, 3D image in the coronal plane of the uterus, and uterine measurements taken in 3 orthogonal planes.
2. Characterization of lesions such as fibroids, adenomyosis, ACUM, irregularities of the transition zone, and endometrial lesions.
3. Double image in orthogonal planes of both ovaries, volume measurement, characterization of ovarian lesions, identification of soft markers of superficial endometriosis through mobilization maneuvers, and identification of abnormal tenderness.
4. Review of the bladder in sagittal and axial planes.
5. Review of the ureters from the meatus to the highest possible portion, usually 3 to 5 cm above the crossing of the uterine vessels.
6. Maneuver to confirm sliding of the vesicouterine pouch and rule out adhesions of the uterine fundus to the abdominal wall.
7. Sagittal image of the rectovaginal septum and lower rectum.
8. Double image of both vaginal fornices, right and left.
9. Sagittal image of the posterior vaginal fornix in the midline.
10. Sufficient images to demonstrate mid-rectal lesions (Figure 3).
11. Image of high rectum and sigmoid (when possible).
12. Image demonstrating sliding of the Pouch of Douglas.
13. Image demonstrating the status of the uterosacral ligaments.

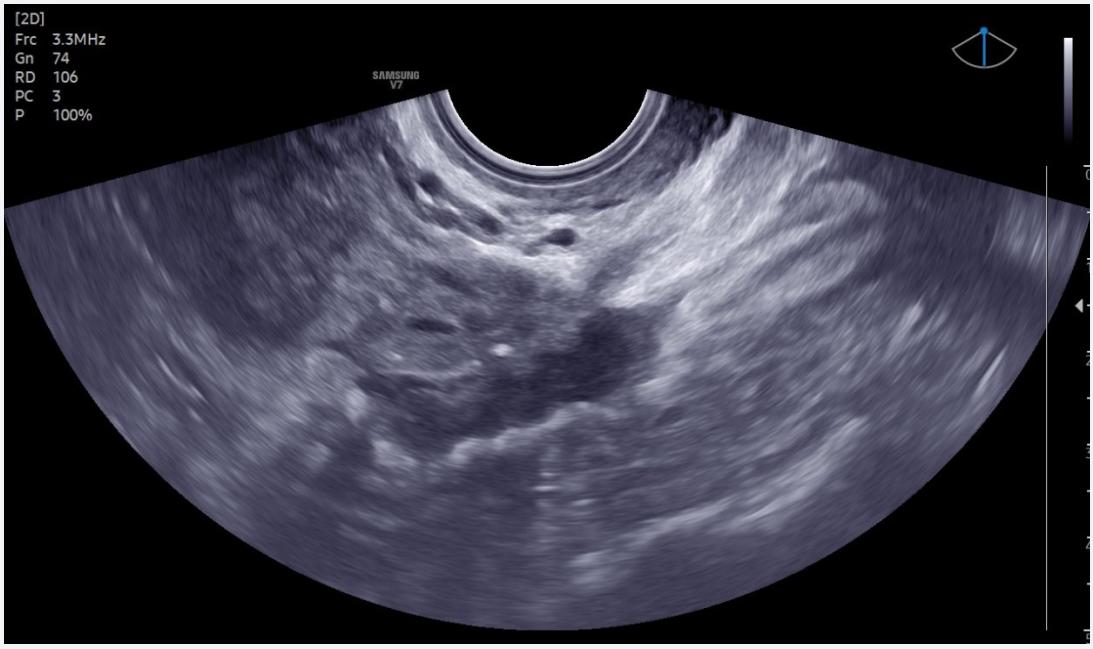

Figure 3. Deep endometriosis nodule at the anterior surface of the mid-rectum, these lesions are usually missed when there are no dedicated maneuvers to explore rectum.

Only the vaginal examination was considered for inclusion, as it is perceived as the most uncomfortable part for the patient and is the most extensive part requiring better structuring and speed for its execution.

All patients, prior to their study, were provided with written information about endometriosis and the extended transvaginal ultrasound with bowel preparation, including instructions for bowel preparation. Briefly, for bowel preparation the ingestion of a mild laxative 24 hours previous to the examination and an enema or micro-enema one hour before the examination was indicated.

One hundred and twenty consecutively examined patients were included during June and July 2025. Only examinations of patients with uterus and both ovaries, where it was possible to review all structures referred to in the protocol, were considered. Patients without uterus or one ovary, or those for whom a vaginography with gel was performed due to their history or requirements, were excluded from the study. In all cases, the study was video recorded to measure the examination time from when the transducer touched the vaginal introitus until it was removed from the vagina.

Patients were separated into two groups. Group 1 included patients with normal examinations or uterine findings such as fibroids and adenomyosis, and any type of endometrial lesions. Patients in this group were considered to have mild disease for the purpose of this study. Patients with hemorrhagic cysts in the ovaries, soft markers of superficial endometriosis (pain and adhesions on examination), superficial endometriosis lesions, and tubal lesions such as hydrosalpinx were also included in Group 1.

The remaining patients were included in Group 2. This group commonly had findings similar to Group 1, in addition to endometriomas, ovarian tumor lesions, and infiltrative endometriosis implants in the rectum, bladder, and uterosacral ligaments.

Results

A total of 120 patients were included and separated into two groups.

The first group comprised 68 patients, and the average examination time was 11:42 minutes. The second group comprised 52 patients, and the average examination time was 14:41 minutes. The difference in examination time between patients in Group 1, considered to have a mild to moderate degree of abnormalities, and patients with more abnormalities detected by ultrasound, especially with deep infiltrative rectal endometriosis implants and endometriomas, was 3 minutes. Proportionally, the examination time for patients in Group 2 was 25% longer, as expected when it is necessary to characterize and document a greater number of lesions and more complex lesions. In general practice, changing transducer presets, introducing labels, defining measurements and executing them can consume valuable time and effort from the operator. These operations can cause the examination to be longer, hence prolonging the discomfort for the patient and cause distraction for the operator. An average transvaginal examination requires two changes in transducer presets, typing at least 18 labels and taking at least 8 measurements. So having a tool to automate routine labels, measurements and transducer presets can reduce the examination time.

In all studies performed, all structures of the extended transvaginal ultrasound examination protocol were reviewed and characterized according to the IDEA consensus. Having a tool that place labels automatically helps maintain the examination order and is expected to reduce the omission to examine a structure despite distractions.

Conclusion

The use of the EzExam+™ tool in extended transvaginal ultrasound with bowel preparation according to the IDEA consensus, can improve the order and expedite the diagnostic process for endometriosis. The results suggest that EzExam+™ not only significantly reduces examination time but also helps maintain a systematic order in the procedure. This might help to perform a complete examination and prevent the omission of key structures, which is fundamental for a comprehensive and accurate diagnosis.

This study has the limitation that the examination time without the use of EzExam+™could not be obtained. As a prospective study performed by a single operator, it has an observation bias that could not be avoided. When reviewing examinations performed before the implementation of EzExam+™ it was difficult to identify examinations performed in the exact same fashion as the ones performed currently. During the implementation of EzExam+™ some new items of examination were added such as the 3D analysis of the uterus and the dedicated examination of the ureter above the uterine vessels.

The risk that could pose using a tool as EzExam+™ mainly relies on not reviewing a structure that was not considered in the customization of the protocol. Also, having abnormalities in organs not considered in the protocol could cause a limited or incomplete assessment of such findings.

The EzExam+™ tool help optimize the process and duration of extended transvaginal ultrasound. The ability to create a fully customizable study protocol can improve examination times and help perform complex examinations in other areas of ultrasound diagnosis, such as Doppler evaluations of limb arteries or veins, the pre-surgical protocol for arteriovenous fistulas for hemodialysis, and Doppler for liver and kidney transplants, to cite a few examples.

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