Gynecologic Teleultrasound and COVID-19
Is There a Connection?

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Gynecologic Teleultrasound During the COVID-19 Pandemic

Relating to the experience and following the constantly changing and adapting circumstances related to patient care forced upon the health care system in general and upon patients in need of gynecologic diseases in particular the goal was to try to maintain the best possible patient care. Out of sheer necessity, starting in March 2020, “in-person” US evaluation of gynecologic patients was effectively shut down. However, also due to necessity, care of pregnancies, or strictly pregnancy-related diseases, did not cease during the above period. “In-person” ultrasound (US) scanning of pregnant patients to evaluate fetal anatomy and pregnancy parameters continued despite severe restrictions of provider and patient contact. Preventative and cautionary measures were set in motion to curtail, or at least to minimize spread of disease, while providing necessary obstetrical and maternal and fetal high-risk care.

The situation regarding the gynecologic patients was totally different. To comply with infection control issues practically all diagnostic and therapeutic services of gynecologic disease were curtailed coming practically to a standstill. Emergency cases were exceptions. Office gynecology including gynecologic US were first to close leading to minimal use of operating facilities. This also included and extended affecting even the evaluation, imaging, and treatment of oncologic patients. Various solutions to maintain patient care were introduced. Among them were telephone and video patient consultations that lasted throughout much of 2020 and still selectively going on. While before we were interacting directly with patients undergoing US evaluation, remote US image reading was added to avoid direct patient provider contact. Sonographers were in the forefront of obtaining the necessary transmitted images, thus the quality of the information was dependent on their expertise and experience. Thus, confirming, evaluating, “fine-tuning” or ruling out findings based upon “frozen” US images and verbal reports by sonographers was difficult and at times incomplete. Streaming

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recorded continuous swipes or “clips” were useful; however, the obvious and most relevant drawback was the lack of opportunity of the doctors to rescan and personally interact with patients. Often “reading” of cases was performed after the patient had already left the office. While remotely evaluating the scans in real time while the patient was still on the examination table and instructing sonographers to obtain additional views was feasible, however, this not only prolonged the examination but also raised patients’ doubts about the perceived quality of their care. The solution was to reschedule the patient for a later “in-person” scan by the physician. Rescheduling added burden to the already scarce appointment slots but also generated pointed questions of patients about the reason of an additional scan not to mention the rightful complaint of insurance about performing 2 scans for the same indication. It should also be clear that not every patient is usually re-examined by the physician even when personally present and that we do rely on the experience of sonographers; however, the presence of the reading physician at the scanning site is a much needed added “quality assurance” in the interest of patients.

After the introduction of vaccination and applying the necessary safeguards, and after the staggered return of the sonographers and physicians to their full or part time presence, remote reading of US considered to be temporary, slowly established itself as more or less permanent. The new reality set in telemedicine, telephone consultations, and teleultrasound became part of our practice. While toward the second part of the year 2020, our practice as well as operative gynecology slowly returned to almost normal, remote reading of gynecologic US persisted despite its drawbacks. Anecdotally, the above occurred in a similar fashion in other US sites in our community.

While we believe that reading gynecologic US remotely during the pandemic was the right solution, its indefinite continuation needs to be reexamined.

Introduction and Historic Perspective

Ultrasonography is a noninvasive, relatively inexpensive, extremely useful diagnostic imaging tool; however, producing clinically useful information by, acquiring and meaningfully interpret US images is operator-dependent requiring trained operators, adequate transmission capabilities.

As early as 1990, the authors advocated that office use of US should be part of workup of the gynecologic patient.\(^1\,^2\) It is almost impossible to ascertain if this concept was adopted and if so: how widely.

Over the years, we continued to link the clinical, office-based gynecologic examination with the concomitant use of transvaginal US.\(^3\,^5\)

Although recorded and mail delivered “cassette recordings” for remote reading by imaging specialists (in or case obstetricians and gynecologists) was practiced several decades ago, they were rightfully abandoned since they created delayed reporting and concerns of legal issues. With the advent of electronic technology transmission of images in medicine found its real use.

The use of teleultrasound is not new,\(^6\) and as a special subset of telemedicine is still utilized, mainly to provide services to remote areas in a real-time (synchronous) or a delayed (asynchronous) mode since US equipment and a technician (ultrasonographer) may be locally available, whereas a specialist reading the scan may not. Reportedly, the percentage of accuracy in image transmission is greater than 90%,\(^7\) since electronic picture transmission it is now close to perfect, the above issues are virtually resolved. Besides transmitting good-quality US images, the speed and the volume of the electronic transmission is also important. Even if transmission is using cost cutting, low speed, low-band width connections teleultrasonography performs adequately, is an affordable, safe, and low-cost modality ideal for the use of transmitting US scans.\(^8\,^9\)

The duration of an US scan to comply with remote reading may be longer than that required for an in-person examination; however, it may provide diagnostic information that is not available at the point of care.\(^10\)

Most of teleultrasound-related information is published in non-medical literature concentrating on technical and connection issues but only marginally related to clinical, diagnostic aspects. There is a special journal dedicated to tele-medicine: (Journal of Telemedicine and Telecare) catering to articles in this category.

Teleultrasound in Gynecology

Teleultrasound was mainly used to transmit imaging of fetal anatomy but most importantly those
regarding fetal anomalies were and are still the subject of most such publications.\textsuperscript{11–13}

It is striking that searching for teleultrasound in gynecology resulted in only one article.\textsuperscript{14}

A “deep dive” to find causes of lack of publication of teleultrasound use in gynecology may lead to the conclusion that US is an extremely operator-dependent imaging modality, where creating an US picture is not identical with “examining” the gynecologic patient with US. There is more to a good gynecologic US scan than just snapping still pictures or even transmitting a video clip, a feature that is available on most US equipment. Here is where bandwidth may play a role. Another reason is that only few use tools that give opportunities for an in-depth sonographic evaluation of the pelvis and transmit still images.

Current Approach to Gynecologic US

The typical imaging suite employs a systematic and pragmatic approach to pelvic US scanning. Most scans in the United States are performed by technicians (preferred term: sonographers). In Europe, gynecologic US is performed by the same MDs involved in the patient’s management, and also, often surgery as well, leading to more comprehensive patient care. The dissociation between the scanning person (sonographer) and the interpreting physician is a common trend in the United States. Increasingly, this involves a remote encounter with images sometimes read out of context by someone who did not speak to or examine the patient, and possessed only scant case-specific clinical information shared on a prescription sized requisition form. Interpreting images in this fashion, in isolation from the patient, limits the effectiveness of US. Quite often, this practice leads to including a larger than necessary list of differential diagnoses and sometimes unnecessary additional imaging such as Magnetic Resonance Imaging (MRI) and/or Computerized Tomography (CT) scans, when an in-person US examination using “dynamic” US methods and conversation with patients would often be sufficient for a clinically useful diagnosis. Thus, all too often, additional imaging such as CT and MRI, which may be less operator dependent and utilizes standardized scanning protocols, are then employed. Some practicing imagers do not do 3D US, do not necessarily go into the room when sonographers scan, do not perform saline infusion sonohysterographies, and may only selectively turn on Doppler. The trend to read US remotely appears to limit the proper and potentially much larger and diverse use of the imaging modality.

It is also an unfortunate practice of a number of gynecologic, but mainly emergency room practitioners, to refer patients to CT and MRI before a simple US scan. This may be the result of the fact that at times, the above caregivers may not have the necessary training in, or understanding of, US.

US “Scanning” by Referral, or “Examining” Gynecologic Patients With US?

Remotely read US evaluations of patients scanned by sonographers saving US pictures in computerized archiving applications are slowly penetrating imaging laboratories of obstetrics and gynecology departments. Regardless of being personally present or “reading” remotely, the imaging of gynecologic patients is and always was dependent upon the skill, the theoretical knowledge, technical ability, and ingenuity of sonographers as well as their verbal or written transmission of US findings to the MD who reviewed and when needed rescanned the patient before finally reporting the findings and providing the diagnosis along with suggestions for clinical management. However, well-trained and experienced the sonographers are, they may not be versed in the understanding of gynecologic diseases, their characteristic morphology. Nor do they have operating room experience. It is therefore that the diagnostic “database” upon which the characterization and appearance of pelvic organ disorders and masses are based, will necessarily require personal sonographic evaluation of patients.

Another aspect of remote reading, where images are captured and transmitted, is the reader’s reliance on the sonographer. This can be extremely variable. It works better if the reading imager is familiar with and trusts the knowledge and skills of the sonographer they are relying on. However, a less experienced sonographer can easily lead to misdiagnosis or overcalling a normal finding. Capturing videoclips of sweeping through organs or areas in the pelvis may help some, however a recall of patients for an in-person scan will
often be needed to establish the proper diagnostic differential. Our opinion is that remote reading of gynecologic US should be used only if the actual scanning is performed by a sonographer well known to, and trusted by, the interpreting physician.

In-person attention and examining a gynecologic patient using vaginal US transducers is totally different from scanning and reporting of US findings of a referred patient. In 1990, Goldstein wrote, “There is a difference between an ultrasound examination by referral… and examining one’s patients with ultrasound” and “The ultrasound enhanced bimanual exam should become a routine part of the gynecologic exam” and that such an “US enhanced gynecologic exam has to have an objective component which is to describe the sonographic finding which can be replaced by an image and a subjective component reflecting pain, mobility, motion of structure in pelvic fluid etc., depending on the experience of the sonologist.”

With all said above, certain conditions may lend themselves to teleultrasound, especially, if the sonographer is well trained. For example, follow up of fibroids for growth, Intrauterine Contraceptive Device (IUD) position, follow up of a benign appearing ovarian tumor which has already been evaluated and is being managed conservatively with watchful follow-up.

Components of the “Dynamic,” Interactive US Scan

Among the most important advantages of an “in-person” US evaluation of a gynecologic patient is that it allows us to combine imaging with physical exam. The ability to examine and image patients simultaneously offers considerable value, and is unique to US as a cross-sectional imaging technique. We are able to connect directly to the patient expanding on her perceived indication of the scan. Listed below are some of the components of this “dynamic” US evaluation of the patient:

- **Unmediated communication with the patient.** Talking to the patient to get direct feedback and identifying the organ or the site of the pain in question. When touching it with the probe. Such “tenderness-guided” US is an effective way of detecting location and extent of painful implants in infiltrating deep penetrating endometriosis.

- **Evaluating the high BMI gynecologic patient** especially searching for pelvic pain US-guided pelvic examination is superior to bimanual pelvic digital exam. The authors conclude: “The Sonographic Bimanual Examination provides improved confidence in overall and key aspects of the pelvic examination across BMI classes compared to the Digital Bimanual Exam.”

- **Detecting moving structures in real time.** “Streaming” effect of particulate matter in fluid, floating, “ondulating” thin “threadlike” strands and loculated, shifting fluid in pelvic postoperative or infectious adhesive disease.

- **Using the “sliding organs” sign.** It is probably the most important “dynamic” US sign (online supplemental Video). This sign is helpful in guiding and planning for complex gynecologic and oncologic surgery estimating the degree of adhesive disease starting with safe trocar placement for laparoscopic surgery and also completing the desired goal of the surgery. Testing the concordant or differential directional sliding movement of normal structures (eg, ovaries, paraovarian cysts) or pathological lesions (eg, pedunculated fibroids) using the “sliding organs sign” first published in 1988, reinforced by other later publications as a “must test” to be performed while scanning since is essential to make correct diagnosis.

- **Saline infusion sonohysterography** is a simple and effective and by all means underutilized addition to transvaginal US examination of the uterus providing information about general uterine shape and the content of its cavity. It is endorsed by the American College of Obstetricians and Gynecologists as a useful diagnostic and “…when properly performed, saline infusion sonohysterography can provide information about the uterus and endometrium.”

- **Active, interactive “manipulation” of 3D US volumes.** Acquiring 3D US volume of the female pelvis is one of the most important recent advances in diagnostic imaging. Extracting the desired plane by “manipulating” the volume provides a large number of desired images of the pelvic organs. There are now ample indications for imaging of the pelvis which would previously have only been possible.
with MRI, but are now part of 3D US capabilities. The coronal plane of the uterus is only visible when reconstructed from a volume and is key to imaging the uterus for indications such as uterine anomalies, IUD positioning, locations of fibroids and polyps. Three-dimensional ultrasonography has huge potential for evaluating infertile patients, performing difficult procedures under guidance, and studying patients with abnormal uterine bleeding, hydrosalpinges, and cancer. Also, pelvic US should be a real-time exam to reap the benefit of scanning the patients with the vaginal probe using 2D and potentially also 3D Doppler evaluation to be added when needed. While capturing and recording and electronically transmitting 3D volumes for remote evaluation by manipulating their content is possible, it seems less ideal demanding technologic know-how.

- Scanning the patient with endometriosis. Another extremely important example of transvaginal US is the examination of patients with endometriosis. One of the pathologies typical of endometriosis is pelvic adhesions. Applying the “sliding organs sign” is elementary for their detection. An advanced clinical feature of endometriosis is its deep infiltrating nature. Various references attest to describing this typical findings of this disease, but only a few describe the systematic scrutiny of following the turns and twists of the large bowel (“running the bowel,” a term borrowed from general surgeons) focusing on deep infiltrating lesions of the bowel and other organs by endometriosis. Preoperative transvaginal US examination by expert users can accurately determine the extent and depth of rectosigmoidal infiltration thereby contribute to optimal planning of surgical treatment options in women with such lesions. Such a lesion-directed evaluation of the possible DIE becomes even more relevant after publication of enhancing its effectiveness with a pre-imaging “bowel preparation” eliminating the shadowing effect of large bowel content obscuring and preventing evaluation of the “far” bowel wall.

Summary and Conclusion

Remote teleultrasound of gynecologic patients during the COVID-19 pandemic was an important ingredient of serving the gynecologic patients while maintaining their safety.

US techniques have progressed to improve its performance in gynecology, but only if they are applied by the imaging practitioner and/or the gynecologist him/herself. The imager should have direct patient access to be able to personally examine their gynecologic patients taking advantage and using the many applications of “dynamic” pelvic US.

Teleultrasound in gynecology minimizes and often eliminates interactive, dynamic examination of the patient using the full range of transvaginal US techniques.

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