Cost Effectiveness of Pelvic Sonogram in the Emergency Room: Endovaginal vs. Transabdominal Examination

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Endovaginal (EV) sonography has revolutionized pelvic imaging with its excellent tissue characterization, rapid performance, and good patient acceptance without the discomfort of a full bladder (1). At many emergency rooms, however, both transabdominal (TA) and EV sonography for pelvic pathology are performed, with TA imaging as the initial modality. This practice has yielded a high degree of accuracy but at the expense of patient discomfort from a full bladder, additional cost of a Foley catheter with the risk of infection (2), and the frequent necessity of requiring EV imaging to clarify the clinical picture. The aim of this randomized and prospective study was to determine whether initial imaging by endovaginal sonography is a cost-effective measure in the emergency room. Transabdominal pelvic imaging nevertheless can play a crucial role as the initial modality in a subset of patients who present with a large pelvic or lower abdominal mass. Also, it must be emphasized that EV and TA pelvic scanning are complementary methods and should be used in conjunction to clarify any anatomic or clinical question.

MATERIALS AND METHODS

A randomized and prospective trial of 120 female emergency room patients was performed using both endovaginal and transabdominal sonographic evaluation of the pelvis. EV examination was performed in 64 patients as the initial study, whereas 56 patients were examined first by TA pelvic sonography. The age range of the patients was 14–61 years, with a mean of 28 years. Only three patients were postmenopausal, and 68 patients presented with a positive beta-human chorionic gonadotropin level. Three patients were excluded from this study: one patient refused EV examination, and two others were in the second trimester of pregnancy (16 weeks). Foley catheters were placed in all patients before the transabdominal portion of the study to facilitate bladder filling. At the time of the study, this procedure was the standard of care in our emergency room.

Patients were randomly assigned to either EV or TA imaging as the initial modality, and the other imaging technique was performed subsequently. Scans were obtained using either a Toshiba 140 (TA probe, curved array C4-2; or EV probe, curved array C9-5) or the ATL HDI 3000 (TA probe, 3.75 MHz sector; or EV probe, 6 MHz). Three experienced radiologists participated in this study, with collaboration from three technologists. Length of time of the respective
examination, time between examinations (lag time), reason for the lag time (probe preparation, filling or emptying bladder), and total time of the examinations were recorded.

Findings with each modality were then reviewed to determine the necessity of the other examination and whether this second modality changed the diagnosis and/or patient management. Criteria used in deciding the need for additional sonographic interrogation included incomplete visualization of ovaries and uterus (especially with suspicious pathology), and whether the clinical question had been answered (ectopic pregnancy or ovarian torsion excluded, fetal death in utero, adnexal mass, etc.). Finally, the data were tabulated, and potential savings were compared depending on which imaging method was performed first.

RESULTS

The time of each examination was meticulously recorded as shown in Figure 1. The total time of the examination was slightly prolonged to 1.2 minutes if the TA pelvic sonogram was undertaken initially, but this was without statistical difference. In 73.2% of the examinations in which TA was the initial modality, 16.4 minutes were added to each examination. When EV imaging was done first, however, 12.3 minutes were added to the examination in only 9.4%. Lag time (time between examinations) was very consistent, with filling and emptying of the bladder and probe preparation accounting for most of the additional time.

Figure 2 demonstrates whether the second modality was deemed necessary and whether management was changed. When EV was done first, only six patients needed additional imaging, and, in all cases, this was secondary to nonvisualization of an ovary or ovaries. In only one patient (Fig. 3) did the management change; this patient had a 5-cm complex ovarian mass, seen only by TA imaging, and she was subsequently lost to follow-up. Although the mass was not seen by EV imaging, this patient would have had TA evaluation automatically, as the ovary was not seen on the EV examination.

When TA scanning was done first, nearly three-fourths of patients required EV imaging. The most common reason was to define the ovaries (N = 17). Other reasons included documentation of cardiac activity or its absence (N = 4), ectopic pregnancy (N = 3), better definition of ovaries/adnexal mass (N = 11), visualization of gestational sac (N = 3), and better evaluation of an uterine mass (N = 3). More importantly, management was changed in 25 patients: three with ectopic pregnancies (Fig. 4), four with fetal deaths in utero (Fig. 5), five with exclusion of ovarian torsion, seven with an ovarian or adnexal mass too suspicious to follow, and six with examinations that were interpreted as normal, with pelvic pathology very unlikely.

DISCUSSION

Early studies demonstrated the superiority of endovaginal sonography for prompt diagnosis in first trimester pregnancies (3). Our data confirmed the advantages of the EV scan: excellent tissue characterization; the close proximity of the transducer, permitting earlier diagnosis and management; no discomfort of a full bladder; and generally good patient acceptance (4, 5). The reported disadvantages of TA scanning were also seen in our study: the need for a full bladder to create a good acoustic window, which often necessitates insertion of a Foley catheter; compromised images secondary to bowel gas or obesity; retroverted uterus; and inadequate visualization of pelvic anatomy (3–8). Although EV examination can miss large pelvic masses, as in our case of a complex 5-cm ovarian mass, these patients will not have a normal EV examination and will continue to TA imaging. From a medicolegal perspective, it is imperative that the imager be confident of identifying and defining pelvic anatomy (uterus, ovaries, adnexa, and cul-de-sac) by EV examination. If EV scanning does not adequately define the pelvic anatomy or an abdominal mass is suspected, TA imaging is warranted.

There was no statistical difference in the total time of the examination, regardless of whether EV or TA sonography was performed first. The fact that sonography is an operator-dependent examination is not overlooked. Nevertheless, our staff—with varying degrees of expertise in sonography—took comparable amounts of time for evaluation by EV or TA technique. Our results show that the potential time saved is related to the decreased need for additional imaging when the EV examination is performed first.

Our study demonstrated that EV examinations provided unique information in nearly three-fourths of patients and changed management in 44.6%. This is comparable to findings in other studies (9), but our higher percentage of changing patient management (24% with other research) may be related to more aggressive treatment in emergency room patients.

The average cost of pelvic sonography performed in the Tampa Bay area was determined, with the reading fee included. If endovaginal sonography was performed initially, the average amount billed was $235. Transabdominal imaging costs were slightly higher, at $240. Most imaging centers gave a reduced rate when both EV and TA examinations were used, with an average cost of $380. It is important to realize that the amount billed often is vastly different than the amount collected, and the latter varies greatly with the patient population.

When TA imaging is performed initially, the estimated cost savings is only $14 per patient. By using EV pelvic sonography first, a potential savings of $102 is possible for each patient. The savings in each scenario was determined