Original Contribution

Pelvic ultrasonography and length of stay in the ED: an observational study

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ABSTRACT

Objectives: We compared emergency physician–performed pelvic ultrasonography (EPPU) with radiology department–performed pelvic ultrasonography (RPPU) in emergency department (ED) female patients requiring pelvic ultrasonography and their outcomes in relation to ED length of stay, ED readmission, and alternative diagnosis, within a 14-day follow-up period.

Methods: This was a prospective, observational study of female patients of reproductive age who required either an EPPU or RPPU for their ED evaluation. We hypothesized that patients receiving EPPU would have a length of stay reduction greater than or equal to 60 minutes, as compared with RPPU. Statistical analyses included independent-samples t test and multivariate regression modeling to control for factors associated with ED LOS.

Results: Eighteen resident physicians performed EPPU, with 15 attending physicians supervising. Forty-eight patients received only EPPU, and 84 patients received only RPPU. In univariate analysis, those who received EPPU had an ED LOS 162 minutes less than those who received RPPU (95% confidence interval, 106-209 minutes). In multivariate analysis controlling for gynecologist consultation, disposition, and pregnancy status, patients who received EPPU had an ED LOS reduction of 108 minutes when compared with RPPU (95% confidence interval, 38-166 minutes). Five patients (10%) who had received EPPU and were discharged from the ED returned to the ED within 2 weeks, but none had alternative diagnoses.

Conclusions: Patients with EPPU had statistically and clinically significant reductions in ED LOS, even when controlling for disposition, gynecologist consultation in the ED, and pregnancy status. No patients in the study had an alternative diagnosis within 2 weeks of EPPU.

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1. Introduction

1.1. Background

Emergency department (ED) crowding negatively influences patient care and directly and indirectly leads to increased morbidity and mortality [1]. Emergency department length of stay (LOS) is a well-validated metric used to assess ED throughput as well as the risk for crowding and boarding [2]. The performance of laboratory and imaging studies contributes to increased ED LOS, with an average ultrasound study performed by the radiology department contributing to an increase of 56 minutes to ED LOS [3]. This is particularly important, as recent implementation of the Affordable Care Act has been associated with an increase in patient visits in nearly half of EDs nationwide [4].

Emergency physician–performed pelvic ultrasonography (EPPU) has been shown to be accurate in confirming intrauterine pregnancy (IUP) and lead to ED LOS reductions. Emergency physician–performed pelvic ultrasonography has been shown to be 75% to 90% sensitive and 90% to 99% specific in the identification of IUP, with a reported ED LOS reduction of between 59 and 149 minutes [5–9]. In addition, Mateer et al [10] showed that a protocol involving pregnant patients presenting with vaginal bleeding or lower abdominal pain and EPPU led to a reduction in return ED visits for missed ectopic pregnancy.

The American College of Emergency Physicians has recommended EPPU as first line in the identification of IUP since 2001, in the 2006 Imaging Criteria Compendium, and in the most current guidelines from
1.2. Goals of this investigation

Prior studies support the role of EPPU in confirming IUP and its ability to reduce ED LOS. However, this is the first prospective study to examine the use of EPPU for all adult female patients with ED presentations that require pelvic ultrasonography. Our hypothesis is that an EPPU will shorten ED LOS by at least 60 minutes as compared with radiology department pelvic ultrasonography. The study was conducted from January to August 2011 at an urban, academic ED with 40,000 annual visits. All attending physicians are American Board of Emergency Medicine-certified or eligible, and approximately one-half have performed more than 800 abdominal ultrasounds. There is a well-established ultrasound fellowship, and all of the 18 EM residents receive extensive didactic and hands-on instruction in bedside ultrasound. In addition, the ED bills for most bedside ultrasound studies including focused abdominal sonography in trauma, biliary, deep venous thrombosis, and pelvic ultrasonography. The medical center’s institutional review board approved this study.

2. Methods

2.1. Study design and setting

This was a prospective, observational study of ED patients 13 years or older that had a chief complaint and presentation that required workup with pelvic ultrasonography. The study was conducted from January to August 2011 at an urban, academic ED with 40,000 annual visits. All attending physicians are American Board of Emergency Medicine-certified or eligible, and approximately one-half have performed more than 800 abdominal ultrasounds. There is a well-established ultrasound fellowship, and all of the 18 EM residents receive extensive didactic and hands-on instruction in bedside ultrasound. In addition, the ED bills for most bedside ultrasound studies including focused abdominal sonography in trauma, biliary, deep venous thrombosis, and pelvic ultrasonography. The medical center’s institutional review board approved this study.

2.2. Selection of participants

Undergraduate research associates screened patients for eligibility from 8 AM to midnight 7 days a week, and EM physicians were responsible for obtaining informed consent. Subjects were screened for prospective enrollment if they were females older than 13 years and had a chief complaint of lower abdominal or pelvic pain and/or vaginal bleeding or discharge, and the treating emergency physician determined that they required a pelvic ultrasound as part of their ED evaluation. Patients of reproductive age received standard urine pregnancy testing and, if necessary, serum quantitative beta human chorionic gonadotropin and Rh factor testing. Patients who spoke languages other than English or Spanish were excluded due to lack of language translation services for consent purposes.

2.3. Intervention

The decision to perform an EPPU vs to order an RPPU was left at the discretion of the treating ED attending physician. Neither the attending nor resident physicians were blinded to the study hypothesis or outcomes. Emergency physician–performed pelvic ultrasonography was performed by the treating EM resident physician with supervision from the attending physician on shift. Sonosite M-Turbo (Sonosite, Bothell, WA) ultrasound machines were used with obstetrics examination setting and a curvilinear transducer for transabdominal and intracavitary transducer for transvaginal pelvic ultrasonography. All patients received a transabdominal ultrasound examination, and select patients also received transvaginal ultrasounds when evaluating for adnexal pathology or if deemed necessary by the attending physician. Examinations were performed according to the American College of Emergency Physicians Ultrasound Imaging Criteria Compendium [12]. All attending physicians are credentialed to perform bedside ultrasonography, and EM resident physicians had received at least 4 hours of didactics and 8 hours of hands-on instruction in pelvic ultrasonography as part of their standard residency curriculum. In addition, EM residents take a required month-long rotation in emergency ultrasonography consisting of scan shifts and weekly quality assurance image review. In addition to the core application of identification of IUP, didactic content includes identification of uterine and adnexal pathology via both phantom models and simulators.

2.4. Methods of measurement

After informed consent was obtained, each patient received either an EPPU or RPPU at the discretion of the attending physician. A research associate accessed the electronic medical record (EMR) system to extract data needed for the study onto a data collection sheet. This included demographic data, chief complaint, triage time, location of pelvic ultrasound study (EPPU, RPPU, or both), type of ultrasound performed (transabdominal/endovaginal), disposition time, and discharge diagnosis. This was then imputed to an Excel spreadsheet that was placed on a secured server. Emergency department LOS was calculated as the duration from the initial triage time to the disposition time. Emergency physician–performed pelvic ultrasonography interpretations were extracted from the EMR provider note for the visit, under a specific ultrasound section. All EPPU images were archived and reviewed for image adequacy and accuracy by the ED ultrasound director, who is the senior investigator on this study. Radiology department–performed pelvic ultrasonography interpretations were extracted from the attending radiologist interpretation in the EMR system.

At least 2 weeks after initial ED visit, research associates accessed the EMR to collect data that were not available during the ED visit, such as whether patients received a gynecologist (ObGyn) consult in the ED or pending lab results. Consult and disposition data were apparent at this later time via ObGyn consult notes or discharge notes in the EMR that corresponded to the date of visit in the ED. For patients who were discharged from the ED, researchers also recorded any subsequent ED visits and repeat imaging studies within 2 weeks as well as whether the studies led to an alternative diagnosis than that of the original ED visit.

2.5. Data collection and processing

There were 2 components to data collection: (1) the point-of-care collection of ultrasound interpretation as well as the clinical and
demographic data and (2) the chart review to assess the subjects’ clinical course during and after the index ED visit. This chart review followed strict criteria involving training of 2 research associates as well as data verification by a study investigator in 10% of these chart reviews [16]. Research associates collected data via extraction from the EMR system onto a paper questionnaire. This was then imported into a Microsoft Excel 2011 (Microsoft, Redmond, WA) database that was placed on a secured server. The database was then imported into SPSS version 19 (IBM, Armonk, NY) for data analysis.

2.6. Primary data analysis

Before study enrollment, a power analysis was performed to determine the total number of patients needed to evaluate the study question. Based on prior studies, we estimated the ED LOS of patients who required pelvic ultrasonography to be 300 minutes, with an SD of 100 minutes. To detect a difference of at least 60 minutes, using an α of .05 and a β of .2, and a conservative ratio of RPPU to EPPU of 2, we calculated a sample size of 132 patients.

To perform parametric testing, ED LOS data, reported in minutes, were log transformed to fit a normal distribution for analysis and transformed back for reporting. An independent-samples t test was used to test for difference in mean LOS between EPPU and RPPU. We used linear regression modeling to control for the effects of ObGyn consultation in the ED, pregnancy status, disposition, and location of ultrasound (ED vs radiology) on ED LOS.

In addition, to assess for interactive effects, we performed odds ratio analyses between EPPU vs RPPU and ObGyn consultation, disposition, and pregnancy status. Factors showing significant association with type of ultrasound performed underwent subgroup analysis to assess for true differences between LOS and type of ultrasound in these subgroups. As we only performed 3 tests for interaction in our subgroup analysis, we did not pursue additional statistical measures to decrease the chance of a type I error [17].

3. Results

3.1. Characteristics of study subjects

We screened 203 patients and enrolled 157 (Fig. 1). Of those screened but not enrolled, we were unable to obtain consent from 18 patients. Fourteen patients had inadequate study data (eg, improper medical record number listed), 3 patients did not speak English or Spanish, and 1 patient did not have a pregnancy test result reported. Ten of the patients who had EPPU (12%) had images that were deemed inadequate by the ED ultrasound director and were also excluded. Of the 157 patients included in the study, 48 (30%) received EPPU, 84 (54%) received RPPU, and 25 (16%) received both. Patients who received both EPPU and RPPU were excluded from the analyses, but we did examine the correlation between interpretations to elucidate the possible reasons for obtaining both studies in sensitivity analysis. All 18 resident physicians performed at least 1 EPPU for the study, and 15 attending physicians supervised. For the EPPU studies, there was no discrepancy in interpretation between the treating physicians and the ED ultrasound director.

3.2. Main results

Patients who received an EPPU had an ED LOS of 265 minutes (range, 80–1021 minutes), and patients who received an RPPU had an ED LOS of 427 minutes (range, 145–1411 minutes). Overall, there was a statistically significant reduction in the LOS in the EPPU group compared with the RPPU group of 162 minutes, (95% confidence interval [CI], 106–209 minutes). In linear regression analysis, when controlling for pregnancy status, ObGyn consult in the ED, and admission rate, there was still a statistically significant reduction in LOS for the ED ultrasound group of 108 minutes (95% CI, 38–166 minutes).

3.3. Tests of interaction and subgroup analysis

Overall, 47% of patients were pregnant, with 77% of patients who received EPPU and 24% of patients who received RPPU being pregnant. In tests of association, pregnant patients were 10.8 times more likely to receive an EPPU (odds ratio [OR], 10.8; 95% CI, 4.7–25) (Fig. 2). The ObGyn consult rate in the ED was 25%, with 32% of RPPU patients receiving ObGyn consult, compared with 9% of EPPU patients. Patients who received an ObGyn consult in the ED were 5.2 times more likely to receive an RPPU (OR, 5.2; 95% CI, 1.7–16). Overall admission rate was 15%, with 9% of EPPU patients and 20% of RPPU patients being admitted. Patients who were admitted were 2.8 times more likely to receive RPPU (OR, 2.8; 95% CI, 0.9–8.8).

In subgroup analysis, pregnant patients who received EPPU had a statistically significant reduction in LOS of 140 minutes (95% CI, 59–101 minutes) (Fig. 3). In nonpregnant patients, those who received EPPU had a statistically significant reduction in LOS of 112 minutes (95% CI, 7–193 minutes). However, there were only 11 nonpregnant patients who received EPPU vs 64 who received RPPU. In patients who received an ObGyn consult, those who had EPPU had a nonstatistically significant reduction in LOS of 105 minutes. However, there were only

![Fig. 1. Study screening and enrollment flowchart.](image-url)
4 patients who received EPPU and ObGyn consult. In patients who did not receive an ObGyn consult, those who had EPPU had a statistically significant reduction in LOS of 139 minutes (95% CI, 80-186 minutes). Subgroup analyses were not performed in patients who were admitted or discharged, as there was no statistically significant association between admission status and type of ultrasound performed.

3.4. Diagnoses

Of the EPPU group, 24 patients were diagnosed with IUP (50%); 10 patients, with threatened abortion (21%); and 7 patients, with abdominal or pelvic pain (15%). Of the RPPU group, 21 patients were diagnosed with abdominal or pelvic pain (25%); 13 patients, with vaginal bleeding (15%); 12 patients, with ovarian mass or cyst (14%); 10 patients, with fibroids (12%); and 9 patients, with IUP (11%). There were 2 cases of ovarian torsion by RPPU and 2 cases of ectopic (ectopic and cornual/interstitial) in the group who received both EPPU and RPPU. These and less common diagnoses are listed in Table 1. In addition, 2 weeks after the initial ED visit, there was no change in or alternative diagnoses in the 44 patients who had EPPU and were discharged.

3.5. Sensitivity analysis

Of the 25 patients who received both EPPU and RPPU, 17 (68%) were pregnant, 7 (28%) received an ObGyn consult in the ED, and 3 (12%) were admitted. Of the EPPU interpretations, 21 (84%) agreed with the RPPU interpretation. These included 5 cases of IUP where the presence of subchorionic hemorrhage was added to the RPPU interpretation but not the EPPU interpretation. Of the 5 EPPU interpretations with abnormal IUP, all had RPPU interpretations that indicated a more specific reason for abnormal IUP (eg, "fetal anencephaly"). Of the discordant cases, 1 EPPU interpretation was of IUP, but the RPPU was interstitial pregnancy; 2 had no EPPU pathology listed but showed ovarian cysts; 1 EPPU case documented adnexal mass but had a normal RPPU; and 1 EPPU case documented nondiagnostic IUP (NDIUP), whereas the RPPU interpretation was of IUP (Table 2).

4. Discussion

This is the first prospective study of a general adult female population that demonstrates a clinically and statistically significant reduction in LOS for patients who receive an EPPU as opposed to RPPU. We also found a strong association between type of ultrasound study and pregnancy status as well as ObGyn consult performed in the ED. However, when controlling for these factors in regression analysis as well as in examination of subgroups, the ED LOS reduction associated with EPPU still persisted.

There are key differences between our study and the only other prospective study that evaluates EPPU and ED LOS, by Shih [7] in 1997. Shih [7] enrolled only pregnant patients and assessed the impact of ObGyn consultation on ED LOS, whereas our study enrolled all patients who required pelvic ultrasonography and assessed ObGyn consultation and disposition status on ED LOS. Our study also used a more generalizable group of emergency physicians (18 resident physicians and 15 attending physicians) with a wide range of ultrasonography experience. In contrast, in the previous study, although 14 emergency physicians practiced at the institution, there is no explicit account of the number of emergency physicians that participated in the study. Another key difference is that 13 of 14 physicians in the prior study did not undergo EM residency training, whereas all physicians in our study were or are currently being trained in EM and, therefore, benefit from formal ultrasonography training.

The ED LOS associated with EPPU was consistent with prior retrospective studies that demonstrated a similar reduction of 60 to 140 minutes [5-9]. Interaction, however, was suggested between selection of EPPU vs RPPU and pregnancy status as well as need for ObGyn consult in the ED. This was expected, as many emergency physicians consider EPPU usually in the context of identifying IUP in pregnant patients. In addition to this indication, the EPPUs in our study were able to diagnose patients with

Table 2
Sensitivity analysis of subjects who received both EPPU and RPPU

<table>
<thead>
<tr>
<th>Study no.</th>
<th>Chief complaint</th>
<th>EPPU interpretation</th>
<th>RPPU interpretation</th>
<th>Agreement</th>
<th>Pregnant</th>
<th>ObGyn consult</th>
<th>Admitted</th>
<th>Discharge diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Vaginal bleeding</td>
<td>IUP</td>
<td>IUP with subchorionic hemorrhage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Threatened abortion</td>
</tr>
<tr>
<td>14</td>
<td>Pelvic pain</td>
<td>IUP</td>
<td>IUP with subchorionic hemorrhage</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Threatened abortion</td>
</tr>
<tr>
<td>17</td>
<td>Abdominal pain</td>
<td>No pathology</td>
<td>Ovarian cyst</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Ovarian cyst</td>
</tr>
<tr>
<td>25</td>
<td>Abdominal pain</td>
<td>IUP</td>
<td>Intestinal pregnancy</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Intestinal pregnancy, UTI</td>
</tr>
<tr>
<td>28</td>
<td>Abdominal pain</td>
<td>No pathology</td>
<td>No pathology</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Early pregnancy vs spontaneous abortion</td>
</tr>
<tr>
<td>33</td>
<td>Pregnant with nausea</td>
<td>Abnormal IUP</td>
<td>IUP with anencephaly</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Fetal anencephaly</td>
</tr>
<tr>
<td>34</td>
<td>Abdominal pain</td>
<td>Adnexal mass</td>
<td>Adnexal cyst, no torsion</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Abdominal pain</td>
</tr>
<tr>
<td>38</td>
<td>Pelvic pain</td>
<td>IUP</td>
<td>IUP with subchorionic hemorrhage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Threatened abortion</td>
</tr>
<tr>
<td>60</td>
<td>6-wk EGA with vomiting</td>
<td>NDIUP</td>
<td>NDIUP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Hyperemesis gravidum</td>
</tr>
<tr>
<td>62</td>
<td>Pelvic pain</td>
<td>Abnormal IUP</td>
<td>NDIUP with decreased fetal heartbeat</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>IUP, abdominal pain</td>
</tr>
<tr>
<td>64</td>
<td>Abdominal pain</td>
<td>No IUP</td>
<td>No IUP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Excitop pregnancy</td>
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<tr>
<td>65</td>
<td>Pelvic pain</td>
<td>NDIUP</td>
<td>IUP</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Hypokalemia, diarrhea, IUP</td>
</tr>
<tr>
<td>67</td>
<td>Pelvic pain, LMP 3 mo ago</td>
<td>No IUP</td>
<td>IUP</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Amnorrhea</td>
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<tr>
<td>69</td>
<td>6-wk EGA with vaginal bleeding</td>
<td>IUP</td>
<td>IUP with subchorionic hemorrhage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>IUP, abdominal pain</td>
</tr>
<tr>
<td>71</td>
<td>Vaginal bleeding</td>
<td>IUP</td>
<td>IUP with subchorionic hemorrhage</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Threatened abortion</td>
</tr>
<tr>
<td>75</td>
<td>Pelvic pain</td>
<td>Abnormal IUP</td>
<td>Intestinal pregnancy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Intestinal pregnancy, spontaneous abortion</td>
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<tr>
<td>79</td>
<td>Vaginal bleeding</td>
<td>IUP</td>
<td>IUP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Uterine rupture</td>
</tr>
<tr>
<td>81</td>
<td>Pelvic pain</td>
<td>No pathology</td>
<td>No pathology</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Pelvic pain, ovarian cyst</td>
</tr>
<tr>
<td>109</td>
<td>Fever and vaginal discharge</td>
<td>Free fluid around ovary</td>
<td>Free fluid around ovary</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Sepsis, concern for TOA</td>
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<tr>
<td>112</td>
<td>12-wk EGA with vaginal bleeding</td>
<td>Abnormal IUP</td>
<td>Abnormal IUP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Spontaneous abortion, vaginal bleeding</td>
</tr>
<tr>
<td>126</td>
<td>Pelvic pain</td>
<td>Adnexal cyst</td>
<td>Adnexal cyst, no torsion</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Pelvic pain, ovarian cyst</td>
</tr>
<tr>
<td>128</td>
<td>Abdominal pain</td>
<td>No IUP</td>
<td>No IUP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Spontaneous abortion</td>
</tr>
<tr>
<td>138</td>
<td>Pelvic pain</td>
<td>Abnormal IUP</td>
<td>Fetal demise</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Spontaneous abortion</td>
</tr>
<tr>
<td>147</td>
<td>8-wk EGA with vaginal bleeding</td>
<td>Pelvic free fluid</td>
<td>Complex pelvic fluid collection</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Spontaneous abortion</td>
</tr>
<tr>
<td>148</td>
<td>Pelvic pain</td>
<td>Pelvic free fluid</td>
<td>Ovarian cyst</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Ovarian cyst</td>
</tr>
</tbody>
</table>

Abbreviations: UTI, urinary tract infection; EGA, estimated gestational age; LMP, last menstrual period.

fibroids, ovarian cysts, ectopic pregnancy, and TOA. Although there are no studies that explicitly assess preference, the study authors note that gynecologists and other consultants typically prefer a “formal” radiology study. This may be due to need for documentation purposes, inability of the consultant to interpret bedside ultrasound images, and/or preference for radiologist interpretation.

Although patients who received both EPPU and RPPU were not part of the hypothesis testing, sensitivity analysis was performed on this subgroup resulting in similar pregnancy rate as patients who received an EPPU and yet a similarly high consult rate as those who received an RPPU. Admission rate for this subgroup fell between the EPPU and RPPU group at 12%. It is unclear why a subsequent RPPU was ordered for patients who had IUP on EPPU, in cases where the RPPU interpretation was IUP with subchorionic hemorrhage. Possibly, this surrounding fluid collection is considered diagnostic of interstitial pregnancy [21]. Emergent physician–performed pelvic ultrasonography was also able to identify pathology in 4 of 6 nonpregnant patients who had adnexal pathology on RPPU. Reasons for a subsequent RPPU may include the need to better characterize the abnormality as well as possibly per ObGyn consult request in the 2 cases for admission for TOA.

We attempted to control for selection bias by regression modeling as well as with subgroup analysis. In our regression model, there was still a clinically and statistically significant ED LOS reduction. In the same subgroups that were associated with a particular ultrasound exam (EPPU vs RPPU), there was still an ED LOS reduction for the EPPU group. With the exception of patients who received an ObGyn consult in the ED, all ED LOS reductions were statistically significant.

In addition, there were no missed alternative diagnoses in patients receiving EPPU as assessed by 2-week follow-up through review of return visits to our ED. Emergency physician–performed pelvic ultrasonography interpretation did not differ between treating physicians and ED ultrasound director, suggesting that EPPU can be accurate in the hands of many emergency physicians. However, this study was not designed to explicitly assess diagnostic accuracy of EPPU performed by a large group of physicians with a wide range of ultrasonography experience and skill. Rather, our data suggest that EPPU may be
considered for other indications aside from confirming IUP and that EPPU is associated with a meaningful reduction in ED LOS that maintained clinical and statistical significance even in subgroup analysis.

5. Limitations

The main limitation of this study is the observational design in which provider and consultant decision-making factors were not adequately addressed in the analysis. This leads to selection bias, as implicit factors may influence the type of ultrasound obtained, which may affect the LOS. For example, although pregnant patients were 10 times more likely to receive EPPU, there are likely more factors than pregnancy status that influenced provider selection of EPPU for these patients. This is also likely true for the association between RPPU and those who received ObGyn consultation in the ED. In addition, our physicians were not blinded to the study hypothesis and, therefore, may have expedited patient management in those receiving EPPU via a Hawthorne effect. This study also did not incorporate other clinical data, such as presence of systemic inflammatory response syndrome criteria or presence of prior significant gynecologic or obstetric history.

However, EPPU was able to identify pathology outside the usual indication for IUP, including ovarian cysts and pelvic free fluid as well as abnormal IUPs. This argues against the notion that ED LOS was associated with pregnancy status or relatively low complexity presentations.

Our convenience sampling of hours outside of midnight to 8 AM may also have led to selection bias. However, this would likely have the effect of minimizing the differences in ED LOS, as RPPU would likely take longer during these hours. In patients who were excluded, there was no other indication that the reasons for exclusion may be associated with other selection biases.

We also did not assess physician attitudes or cognitive factors associated with the decision to pursue EPPU vs RPPU. A future study may incorporate a questionnaire that can be administered to physicians in real time that addresses these issues.

Although we used a large group of resident and attending physicians to perform EPPU, this was a single-center study, and our results may not be generalizable to other institutions. This is especially true of institutions where ultrasound education and quality assurance may not be as robust.

In terms of our definition of ED LOS (triage time to disposition time), we incorporated both the waiting room time and the treatment time, but not the boarding time [22]. At our institution, triage time to ED rooming time is mandated to be less than 30 minutes, so any differences in triage time between groups receiving EPPU and RPPU should have minimal influence on overall LOS. In addition, patients with more acute diagnoses requiring ObGyn consult and RPPU are more likely to be given a higher emergency severity index score and roomed earlier. Therefore, the ED LOS differences would be underestimated with this associated bias. We also did not incorporate actual ED boarding time, that is, duration between disposition and actual exit from the ED, as there are many factors associated that are not related to the study question.

In our study, we determined that there were no alternative diagnoses at 2-week follow-up. Because of our method of determining this through EMR review, we cannot say that this is actually reflective of missed diagnoses as patients may have gone to other facilities or ObGyn offices for follow-up care.

Because of limitations associated with our observational study design, we attempted to use both subgroup analysis and linear regression in an effort to reduce biases associated with our findings. However, a study incorporating a randomized control design would best help to mitigate these biases.

6. Conclusion

Our prospective study demonstrates a significant reduction in ED LOS for patients who received an EPPU compared with patients who received an RPPU, even when controlling for factors such as pregnancy status, ObGyn consultation in the ED, and final disposition. This is the first study to assess EPPU in the context of expanded indications for use and not just for first trimester bleeding. A randomized clinical trial is needed to confirm our results and to control for potential selection bias associated with selection of RPPU vs EPPU and ED LOS.

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References