Resident Ultrasonography In Symptomatic First-Trimester Pregnancy And Department Length Of Stay

T Jang, C Aubin

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Abstract

This was a retrospective chart review in an urban academic ED to assess the impact of resident performed US on LOS for patients presenting with symptomatic first-trimester pregnancy. 108 such patient were evaluated with ultrasonography in the ED. Compared to the OB only and EP+OB group, the average LOS for the EP-only group differed by 149 minutes ($p < 0.05$) and 168 minutes ($p < 0.04$) respectively. Excluding patients with hyperemesis, the differences were 156 minutes ($p < 0.04$) and 181 minutes ($p < 0.04$) respectively. By phone follow-up, no ectopic pregnancies were missed. Focused US by EPs reduces average LOS for patients presenting with symptomatic first-trimester pregnancies and allow for more appropriate obstetric consultation.

INTRODUCTION

Women with first-trimester pregnancies frequently present to the ED complaining of abdominal or pelvic pain, cramps, vaginal bleeding, or all of the above. 50-60% of these pregnancies will develop normally, 10% will turn out to be ectopic pregnancies, and up to 40% will go on to miscarry ([1]). Clinical exam, however, is not sensitive nor specific for differentiating between normal intrauterine pregnancy, abnormal intrauterine pregnancy, and ectopic pregnancy ([2,3]). Thus, up to 50% of patients with ectopic pregnancies are mis-diagnosed during their initial evaluation ([4]).

Since ectopic pregnancy is the leading cause of maternal death in the first trimester ([3]), ultrasound evaluation of women with symptomatic first-trimester pregnancy has become standard of care ([5,6]). The clear identification of a normal intrauterine pregnancy by ultrasonography is vital as these pregnancies have a good prognosis ([7]) and make an ectopic pregnancy much less likely, on the order of less than 1:10,000 ([4]).

The purpose of this study was to assess the impact of resident-performed focused, bedside US for IUP on LOS in the ED for patients presenting with symptomatic first-trimester pregnancy. The detection of ectopic pregnancies was assessed secondarily.

MATERIALS AND METHODS

This was a retrospective chart review of female patients presenting to an urban, academic medical center ED with a positive urine hCG test and abdominal/pelvic pain/cramps and/or bleeding. The ED has approximately 95,000 yearly patient visits with a PGY1-4 emergency medicine residency. Patients triaged by nursing staff to a walk-in urgent care were not included in this study. Patients presenting with hemodynamic instability or as either trauma or medical resuscitations were also excluded from this study.

Patient charts were categorized as having (1) only EM resident performed US exams, (2) only an obstetrics and gynecology resident performed US exam, or (3) an EM resident performed US exam and subsequent obstetrics and gynecology resident evaluation. US examinations performed by EM residents were performed using an Aloka SSD-1400 with either a 3.5 MHz or 5.0 MHz curved linear array probe. Images were printed with a Sony video graphic printer and placed in the patient's file. Length of stay was defined by the time of registration to the time discharge instructions were signed by the patient.

Analysis of variance was used to assess differences in the groups with respect to final diagnosis, prenatal status, gravidum-para status, or STD history. Phone follow-up was performed on patients in whom no clear IUP was seen on US or who did not have OB-performed US in the ED.

All residents were eligible for participation regardless of their level of training or ultrasound experience, but had at least a 2-hour introduction to the operation of the Aloka SSD-1400. While EM-resident performed US was limited to

transabdominal US exam, obstetrics and gynecology resident evaluation was allowed to include endovaginal US exam, depending on the particular consultant. This study was approved by IRB at our institution.

RESULTS

From April 2001 through June 2001, 108 patients with symptomatic first-trimester pregnancy were evaluated using ultrasonography. 59 patients were diagnosed as having viable IUP's, 19 were diagnosed with threatened miscarriages, 11 were diagnosed with incomplete miscarriages, and 116 were diagnosed with other diagnoses including urinary tract infection, hyperemesis gravidarum, and 3 ectopic pregnancies (table 1). There was no statistically significant difference between the groups with regards to the distribution of final diagnoses, prenatal care status, gravidum-para status, or STD history.

Figure 1

Table 1: # of patients per diagnosis in each group (IUP intrauterine pregnancy, TAB threatened miscarriage, IAB incomplete miscarriage, other includes UTI, IUP with hyperemesis, etc.)

Diagnosis	*EP only*	*OB only*	*EP+OB*
IUP	39	10	6
TAB	10	4	2
IAB	4	2	3
Other	6	7	3

The average LOS for those in the EP-only group was 280 minutes (95% CI (217,343)) compared to the OB-only group with an average LOS of 429 minutes (95% CI (317,541)) and the EP+OB group with an average LOS of 448 minutes (95% CI (329,567)), corresponding to differences of 149 minutes ($p<0.05$) and 168 minutes ($p<0.04$) respectively (table 2). Excluding the patients with hyperemesis gravidarum, who often required prolonged IV hydration and observation, the differences where 156 minutes ($p<0.04$) and 181 minutes ($p<0.04$) respectively.

Figure 2

Table 2: department length of stay (95% CI) by group, * compared to the EP-only group

	EP only	OB only	EP+OB
Length of stay in minutes	280 (217, 343)	429 (341, 517)	448 (330, 567)
Difference*		149 (p<0.05)	168 (p<0.04)
Difference (excluding hperemesis gravidarum)*		156 (p<0.04)	181 (p<0.04)

Stratifying the data by diagnosis, for patients with an IUP and excluding those with hyperemesis gravidarum, those in the OB-only and EP+OB groups had longer department LOS compared to the EP only group by 195 minutes ($p=0.02$) and 279 minutes ($p=0.06$) respectively (table 3). For patients with threatened miscarriages, the differences were 155 minutes ($p<0.05$) and 147 minutes ($p=0.02$) respectively. No statistical differences in department LOS were noted in patients with incomplete miscarriage or ectopic pregnancy.

Figure 3

Table 3: LOS differences (minutes) by diagnosis compared to the EP only group, excluding patients with hyperemesis gravidarum

Diagnosis	*OB only*	*EP+OB*
IUP	195 (p=0.02)	279 (p=0.06)
TAB	155 (p<0.05)	147 (p=0.02)

By phone follow-up, no ectopic pregnancies were missed. Likewise, all patients identified by resident-performed US with IUPs had subsequent obstetric follow-up confirming pregnancy status.

DISCUSSION

This study found that resident-performed bedside US exam was associated with decreased department LOS for patients with symptomatic first-trimester pregnancy. This difference was most notable among those patients diagnosed with IUPs or threatened miscarriages and was not evident among those with incomplete miscarriages and ectopic pregnancies. It may be that obstetric consultants found suspicious US findings by EM residents to be an impetus for more urgent consultation. Furthermore, it may be that EM-resident performed US allows for better overall utilization of obstetrical consultants in the academic ED.

Three studies in the emergency medicine literature have focused on the use of bedside, focused ultrasonography for patients with symptomatic first-trimester pregnancy. In one study, 314 patients were evaluated prospectively using a protocol for suspected ectopic pregnancy that included bedside ultrasonography by EP's ($_{8}$). Compared to a historical control group with 12 ruptured ectopic pregnancies, there was only 1 ruptured ectopic pregnancy in the prospective group ($p<0.05$). The eight participating EP's received 10-12 hours of training and performed 10-12 proctored exams before involvement with the study. In another study, eight EP's with extensive ultrasound skills underwent 24 hours of pelvic ultrasound training and performed 20 proctored exams with an average of 1-1/2 years of ED ultrasound experience prior to participation in

their study ([9]). 125 patients were evaluated and 121 had findings confirmed by subsequent radiology department evaluations, for an overall sensitivity and specificity for ectopic pregnancy of 90% and 88% respectively. However, in their study, finding and diagnosing an intrauterine pregnancy (IUP) had a negative predictive value for ectopic pregnancy of 100%. In a third study, attending physicians at a community teaching hospital performed bedside US after undergoing 24 hours of ultrasound training and performing 10 proctored exams each in pelvic, aortic, and gallbladder imaging ([10]). Among 115 patients, those who had EP performed bedside US had a shorter average length of stay (LOS) by almost 120 minutes ($p<0.001$) and no ectopic pregnancies were missed.

At our institution, the practice had been for formal obstetrical consultation on all patients with symptomatic first-trimester pregnancy. Over the last three years, this has changed, allowing for undocumented EP-performed US exams and, more recently, for the documentation but not billing of EP-performed US exams.

This study is unique in several respects. First of all, it is the only study in the emergency medicine literature looking solely at resident-performed first-trimester ultrasonography. Compared to the prior work on LOS by Shih ([10]), this study involved resident-performed US as opposed to trained attendings and had no enrollment or selection bias. Furthermore, every resident rotating in the ED during the study period performed US exams in the study sample as opposed to the limited number of "expert" operators in the studies mentioned above. Secondly, while other studies have looked at endovaginal ultrasound in the ED ([8],[9],[10]), this study was limited to transabdominal obstetric US exams. Third, our study determined LOS based on time of registration and time discharge instructions were signed, rather than by physician documentation, thus eliminating this possible bias. Finally, our patients had an overall longer LOS, compared to those in Dr. Shih's study, where patients had an average LOS of 45 minutes in the EP group.

One concern that has been raised is that EM residents might miss evidence of an ectopic pregnancy or falsely diagnose an IUP. In our study population, there were no false positives for IUP. In addition, although our population had a lower ectopic pregnancy rate (3 of 108) compared to the 10% published elsewhere ([1],[4]), by phone follow up, no ectopic pregnancies were missed. Furthermore, every "false negative" for IUP by EM-resident performed US in the EP+OB group (ie, those in whom no definite IUP was seen by EM resident performed transabdominal US exam) required endovaginal US by obstetric consultants for final diagnosis and disposition.

Another concern that has been raised is that "false positives" would lead to "over treating" patients, unnecessary obstetrician follow up, and potential limitations of treatment (eg, medication choices). As stated earlier, in our study population, there were no false positives for IUP. By phone follow up, all patients identified by residents as having IUPs were subsequently confirmed to have IUPs by obstetricians.

LIMITATIONS AND FUTURE QUESTIONS

There were several limiting factors in this study. First of all, the sample size was chosen to compare LOS and not to look at sensitivity data. In particular, the number of ectopic pregnancies was small and makes it difficult to state what the exact sensitivity may be for resident-performed US. Second, the determination of whether or not a patient required a formal obstetrical consultation varied by attending, although every resident-performed US that did not definitely identify an IUP was followed by a formal obstetrical consult. This was due to the evolving policy of our division mentioned above. Consequently, some attendings preferred to simply have obstetrical consultation following a physical exam that included a pelvic exam rather than making the decision based on resident-performed US findings. Finally, the level of US "competence" varied among residents. When the residency program was started, residents did not rotate on the obstetric service until their third year. Three years ago, however, the obstetrics rotation was moved to the first year, thus giving residents an earlier exposure to transabdominal obstetric US.

Some might consider the retrospective design of this study to be a weakness. It is unlikely that this situation would recur given our new policy allowing for the use of resident-performed US in pregnant patients. However, it allowed for elimination of both enrollment and selection biases, while also removing possible biases that would occur from personnel working faster or slower because a study was being done. Furthermore, given the changes in our department's US policy, it would be difficult to compare the three scenarios (EP-only, OB-only, or EP+OB) today.

This study was meant to evaluate department LOS comparing EM resident-performed US to obstetric consultation. The findings here may not apply to those institutions where obstetric ultrasound is done by the

department of radiology and available 24 hours/day. Future studies could focus on the effect of an US elective on EM-resident performance of obstetrical US, an assessment of the number of exams required to obtain diagnostic competence, and what impact EP performed obstetrical US would have in hospitals where obstetrical US exams are done by the department of radiology and difficult to obtain "afterhours."

CONCLUSION

Our data demonstrate that resident-performed transabdominal obstetric ultrasound is associated with decreased department LOS for patients with symptomatic first-trimester pregnancies. In addition, our data suggest that resident-performed US exams might lead to better utilization of obstetrical consultants.

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Author Information

Timothy B. Jang, MD
Emergency Medicine Residency, Division of Emergency Medicine, Barnes-Jewish Hospital

Chandra D. Aubin, MD
Assistant Residency Director, Division of Emergency Medicine, Washington University School of Medicine