Abstract:
Ectopic pregnancy is the leading cause of first trimester maternal death. It occurs between one half and one third of the rate in adolescents as it does in older women; yet, adolescents have the highest reported death rates from ectopic pregnancy among all age groups. For the past 2 decades, pelvic ultrasonography (transvaginal and transabdominal) has become a core application of emergency department ultrasound. The literature shows that point-of-care pelvic ultrasound is time-saving, should be incorporated into the overall physical examination of the pelvis, and reduces risks of complications by early diagnosis when ectopic pregnancy is suspected. This article will review the evidence base for point-of-care pelvic ultrasound.

Keywords:
Point-of-care technology; ultrasound; pediatrics; emergencies; ectopic pregnancy

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Point-of-Care First Trimester Pelvic Ultrasonography for the Pediatric Emergency Physician

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Ectopic pregnancy is the leading cause of first trimester maternal death. It occurs between one half and one third the rate in adolescents as it does in older women; yet, adolescents have the highest reported death rates from ectopic pregnancy among all age groups.[1] It is estimated in 0.64% of all reported pregnancies in the United States and in 0.3% of pregnancies in adolescents aged 15 to 19 years,[1] making ectopic pregnancy another rare but potentially lethal condition encountered in the practice of pediatric emergency medicine. These rates have remained stable for the past decade.[2,3] However, rates of ectopic pregnancy in patients in a pediatric emergency department (ED) may range from 2.6% to 7.5%.[4,5] For the past 2 decades, pelvic ultrasonography (transvaginal and transabdominal) has become a standard application of ED ultrasound.[6] This article will review the evidence base for pediatric emergency physicians who are interested in learning and incorporating this diagnostic skill into their practice. For those wishing to learn the basics of performing

point-of-care pelvic sonography, we refer readers to www.sonoguide.com/obgyn.html and elsewhere.[7]

Pregnant women presenting to the ED with abdominal or pelvic pain, vaginal bleeding, syncope, or presyncope should be considered to have ectopic pregnancy until proven otherwise. Adolescents with ectopic pregnancy are significantly more likely to present with pain compared to older women, but both groups are equally likely to present with vaginal bleeding.[1] However, girls or adolescents may also present a diagnostic challenge on history taking when they are not forthcoming about sexual activity. Thus, availability of rapid point-of-care β–human chorionic gonadotropin (hCG) testing is crucial and mandatory in evaluating this population of patients.

Ectopic pregnancy cannot be ruled out based on risk factors, history, and physical examination alone. Before the widespread implementation of point-of-care pelvic ultrasound in EDs in the 1990s, more than 40% of women with ectopic pregnancy would be misdiagnosed and discharged from the ED,[8-10] and 50% or more of these patients with delayed or misdiagnoses would subsequently go on to rupture.[8,9] A 2010 systematic review and meta-analysis on accuracy of emergency physician–performed pelvic ultrasound to rule out ectopic pregnancy (by confirming intrauterine gestation) estimated pooled sensitivity at 99.3% and a negative likelihood ratio (LR–) at 0.08.[5] Thus, identification of an intrauterine pregnancy (IUP) in a patient without risk factors for heterotopic pregnancy by point-of-care ultrasound essentially rules out ectopic pregnancy. Because ultrasound technology has become more portable and affordable, it has become routinely used by clinicians at the point-of-care.[11] Diffusion and adoption of point-of-care ultrasound has been slower in pediatric EDs,[12] particularly in those that transfer pregnant girls or adolescents to adult EDs or other facilities for evaluation.

EPIDEMIOLOGY OF ED PELVIC ULTRASOUND FINDINGS

Emergency physician–performed point-of-care ultrasound will identify an intrauterine gestation in more than two thirds of symptomatic first trimester pregnancies. [4,13,14] Tayal et al[4] documented intrauterine gestations (Figures 1 and 2) in 70% of 1490 first trimester ED pelvic ultrasounds performed; 20% of studies were indeterminate (Figure 3), 8% documented fetal demise (Figure 4), and 2% documented a definite ectopic pregnancy (Figures 5 and 6). Similarly, Durham et al,[13] in a smaller (n = 125) earlier study, found that IUP was confirmed in 70% of first trimester ED ultrasounds; 22% of studies were indeterminate, 2% documented fetal demise, and 6.5% demonstrated ectopic pregnancy.

When the findings on ultrasound are indeterminate, also termed *pregnancy of unknown location*, it may represent an early intrauterine gestation, fetal demise, or ectopic pregnancy. Tayal et al[4] found that among the 300 patients with indeterminate initial ED ultrasound findings, 53% were ultimately found to have fetal demise; 29%, IUP; and 15%, ectopic pregnancy. A prospective study by Dart

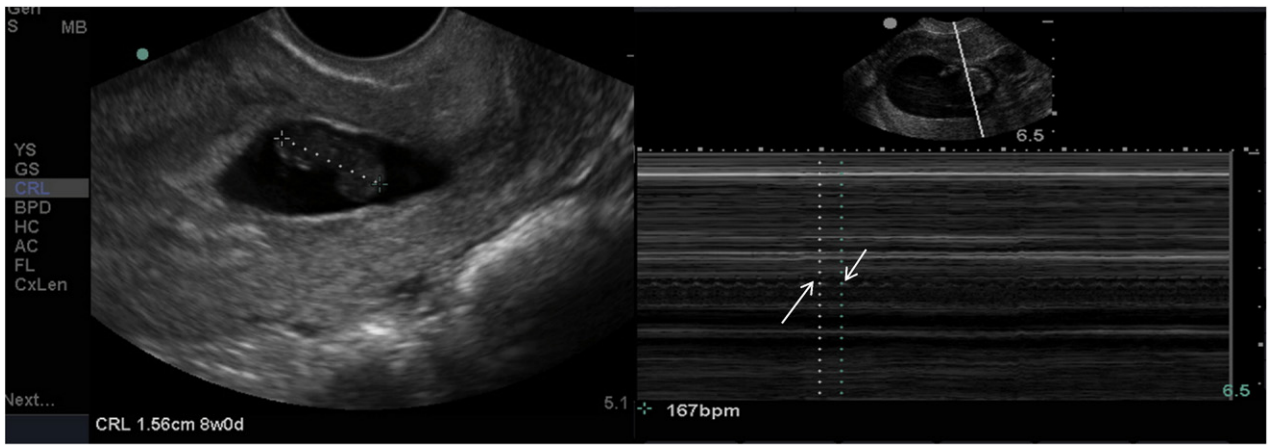

Figure 1. Intrauterine gestation with normal fetal heart rate in a 15-year-old G2P1 by transvaginal sonography. Left panel shows fetal pole with crown-rump length measurement. It is most accurate in the first trimester with an error range of 3 to 4 days in each direction. Right panel shows M-mode tracing to determine fetal heart rate. M mode should be the only method to determine fetal heart rate because it does not have the theoretical risk of energy absorption and potential teratogenic heating of the developing fetus that may occur with color or pulse-wave Doppler. Color or pulse-wave Doppler should be avoided as methods to determine fetal heart rate.