The Endomyometrial Thickness Measurement for Abnormal Implantation Evaluation by Pelvic Sonography

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Emergency physicians, obstetrician-gynecologists, and other medical specialists use pelvic sonography when caring for patients presenting with early pregnancy-related symptoms. A thin endomyometrial mantle and eccentric placement of a gestational sac should raise the suspicion for an abnormally implanted pregnancy. In such cases, an interstitial ectopic pregnancy or a cornual pregnancy, two clinically distinct entities, must be considered. This article reviews the literature and guidelines on the sonographic measurement of the endomyometrial mantle as a criterion for determining a pregnancy at risk for an abnormal implantation location. We sought to clarify the history and evolution of this measurement to determine what should be considered an abnormal measurement and to understand its diagnostic utility and management implications for the clinician using sonography.

Key Words—cornual pregnancy; endomyometrial mantle; endomyometrial thickness; ectopic pregnancy; interstitial pregnancy; obstetric ultrasound; pelvic sonography

The ease and accessibility of sonography has made it the imaging modality of choice for emergency physicians, obstetrician-gynecologists, and other medical specialists evaluating patients with early pregnancy-related symptoms. Although 95% to 98% of ectopic pregnancies are tubal in location, 2% to 4% are interstitial ectopic pregnancies, known as interstitial pregnancies. By definition, an interstitial pregnancy occurs when a fertilized embryo implants eccentrically within the intramural portion of the proximal fallopian tube enveloped by myometrium.[1–3] Risk factors are generally similar for both tubal and interstitial pregnancies: ie, previous ectopic pregnancy, previous salpingectomy, in vitro fertilization, and a history of sexually transmitted disease.[1,2]

In the literature, often erroneously, the terms "interstitial pregnancy" and "cornual pregnancy" are used interchangeably. Some authors have used the term "proximal ectopic pregnancy" to encompass both pathologic findings[4]; however, the two remain distinct entities. A cornual pregnancy is intrauterine and specifically refers to the implantation and development of a gestation in one of the upper, lateral portions of the uterus in a patient with a rudimentary horned, septated, or bicornuate uterus. A cornual pregnancy often leads to a complicated but viable pregnancy. An interstitial pregnancy, however, is a category of ectopic pregnancy, which is often associated with high morbidity and mortality rates. Consideration of this diagnosis before rupture has a direct effect on treatment options and patient outcomes. Although an interstitial pregnancy is of prime

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concern to the physician evaluating a pregnant patient in the acute care setting, a cornual pregnancy must be considered, given the management differences.

The incidence of patients with interstitial pregnancies is rising along with overall rising rates of patients with all types of ectopic pregnancies.[2] Patients with interstitial pregnancies can be diagnostically challenging and are at risk of substantial morbidity and mortality, the rates of which are 7 times higher (2%–2.5%) than for those with tubal ectopic pregnancies.[2] The higher mortality rate is due to the potential for painless growth of the fetus surrounded by myometrial tissue, which is a thicker and more highly vascularized environment relative to the tube. Rupture results in severe hemorrhage, which is seen at 7 to 16 weeks' gestation.[2,5,6] Some generally accepted criteria that aid in the early sonographic diagnosis of an interstitial pregnancy include an eccentric gestational sac location and a thin endomyometrial mantle.

Clinical Guidelines

The 2006 American College of Emergency Physicians imaging compendium[7] provides guidelines for evaluation of patients with symptoms in the first trimester of pregnancy. This document recommends evaluation of the uterus in two planes and cautions that a pregnancy that is within 5 to 7 mm from the edge of the myometrium is suspicious for an interstitial pregnancy.

The 2007 joint guidelines from the American College of Radiologists, the American College of Obstetricians and Gynecologists, and the American Institute of Ultrasound in Medicine[8] and the 2009 American College of Obstetricians and Gynecologists bulletin on the performance of obstetric sonography[9] both advise that a first-trimester sonographic examination, performed before 13 weeks 6 days' gestation, should document the location of the gestational sac if seen. There is no recommendation for a lower limit of the endomyometrial thickness measurement in these two documents.

This article seeks to clarify the history and evolution of the endomyometrial mantle measurement, to define an abnormal value range, and to understand its diagnostic utility and management implications for the clinician using sonography.

Search Strategy

A comprehensive literature search for articles, including case reports and clinical guidelines, from 1966 to May 2012 was performed with the MEDLINE, PubMed, and Cochrane Library databases. Search terms used were "endo-myometrium or myometrium," "ultrasound, ultrasonography, sonography," "ectopic pregnancy, cornual pregnancy, or interstitial pregnancy" and "mantle or thickness." Two authors (R.E.L. and T.S.) performed independent reviews of the titles and abstracts of the search results, and only articles specifically describing the endomyometrial mantle measurement or the diagnosis of interstitial or cornual pregnancy were included. There were no disagreements among the authors regarding the search results. Bibliographic references found in these articles were also examined to identify pertinent literature. We identified 14 articles that addressed these topics.

Literature Review

In a 1978 case series, Lawson[10] observed that an ectopic pregnancy most commonly appeared as a complex mass adjacent to an enlarged empty uterus. On retrospective review of the images, the 2 cases of an interstitial pregnancy in his series showed marked eccentric gestational sac locations. In 1979, Graham and Cooperberg[11] published an interstitial pregnancy case series of 4 patients evaluated by transabdominal sonography, and in 1987, Jafri et al[12] published similarly on 11 patients. Both case series concluded that an empty uterine cavity with an eccentrically located gestational sac surrounded by an asymmetric myometrial mantle was the most consistent sonographic finding for an interstitial pregnancy.[11,12]

In 1990, Fleischer et al[13] retrospectively reviewed the transvaginal sonographic findings in 50 patients with surgically confirmed ectopic pregnancies. These authors emphasized the increased diagnostic ability of the transvaginal compared to the transabdominal sonographic technique. Most were tubal pregnancies and showed a tubal ring with 2 to 4 mm of echogenic tissue surrounding a hypoechoic center. These authors categorized cornual pregnancies as ectopic and reported that all 3 of the 50 cornual pregnancies were eccentric in location and had a mantle thickness of less than 5 mm.

Timor-Trisch et al[14] also considered cornual pregnancies as ectopic and used 3 criteria for diagnosis in their 4 patients with a cornual pregnancy: an empty uterine cavity, a chorionic sac separated by at least 1 cm from the lateral edge of the internal uterine cavity, and a thin myometrial layer surrounding the chorionic sac. In 1993, Ackerman et al[15] retrospectively reviewed the sonographic findings in patients with interstitial ectopic pregnancies at surgery. Of 12 interstitial pregnancies, only 4 had a demonstrable gestational sac, and all of these had myometrial thinning of less than 5 mm.

A 2006 case report[16] highlights the difficulty in diagnosing an interstitial pregnancy as well as the problem when the two terms interstitial and cornual are used interchangeably. A young woman received methotrexate for a presumed interstitial pregnancy based on sonographic examinations performed at two points in time. The first report diagnosed an "interstitial/cornual pregnancy," and the second stated that the patient had a "live cornual ectopic pregnancy." Subsequently, 3-dimensional transvaginal sonography confirmed a cornual location, not interstitial as initially presumed. The pregnancy ultimately resulted in fetal demise requiring surgical uterine evacuation. In another case,[17] a patient with mild abdominal tenderness was found to have a gestational sac located in the cornual region of the uterus with an endomyometrial mantle measuring 7 mm. She was given a presumptive diagnosis of an interstitial ectopic pregnancy. The patient chose expectant management despite the recommendation for termination. Ensuing sonographic studies confirmed a centrally located, viable intrauterine pregnancy. In this particular case, an eccentrically located pregnancy, initially interpreted as interstitial, would have resulted in the termination of a desired viable pregnancy.

In a large case series of 32 patients over a 3-year period by Tulandi and Al-Jaroudi,[5] the authors noted that most of the interstitial pregnancies encountered were ruptured at the time of diagnosis. These authors emphasized the difficulty in distinguishing the eccentrically placed gestational sac with a thin myometrial mantle of an interstitial pregnancy from an eccentrically located intrauterine pregnancy.

In a 2007 review article on ectopic pregnancy, Levine[1] acknowledged a 5-mm threshold for the surrounding endomyometrial thickness and simultaneously noted that the specificity of this particular measurement had not been well investigated. Finally, 3 recent case reports emphasize how an interstitial pregnancy diagnosis was made when the clinician measured a thin endomyometrial mantle.[18–20] In all 3 cases, the emergency physician saw a gestational sac eccentrically located outside the uterine cavity, measured an endomyometrial mantle of less than 8 mm, and obtained an emergent obstetrician-gynecologist consultation. An interstitial pregnancy was confirmed at surgery for 2 of the patients, and rupture occurred after consultation, discharge, and presentation to another hospital in the third.

Discussion

We found a paucity of literature focusing on the endomyometrial mantle measurement for abnormal implantation evaluation by pelvic sonography. No prospective studies offer a conclusive measurement for clinicians evaluating patients in early pregnancy. Most of the articles were retrospective reports, pooled data from small case series, and publications of a single case description. A few publications defined less than 5 mm as a cause for concern, whereas others use 8 mm. There appears to be a near-uniform acceptance of less than 5 mm as being highly suspicious for an interstitial pregnancy. Less than 8 mm as a lower limit of normal is used more commonly by emergency physicians and reported in the emergency medicine literature. Presumably, this more conservative measurement increases the sensitivity of the diagnosis, with a resultant higher false-positive rate.

Practitioners evaluating women in their first trimester perform pelvic sonography with the intention of answering a focused clinical question: is the pregnancy intrauterine? The American College of Emergency Physicians guidelines recommend a numerical measurement of the endomyometrial mantle so that the clinician considers an interstitial pregnancy and obtains specialist consultation when warranted.

The diagnostic criterion set forth allows clinicians with a core competency in pelvic sonography to quickly and efficiently target patients who may have an ectopic pregnancy.[21] Although a lower numerical thickness limit will likely include patients with cornual pregnancies, a certain number of false-positive results could be considered acceptable, particularly since these patients are noted to have a higher incidence of high-risk pregnancies and pregnancy-related complications. Ultimately, these patients may also benefit from obstetrician-gynecologist consultation in the emergency department or close specialist follow-up.

Finally, it is imperative to emphasize the importance of differentiating the terms interstitial pregnancy and cornual pregnancy, noting that both can be associated with a thin mantle of tissue surrounding a hypoechoic center. Specialist consultation, additional diagnostic imaging, and a consideration of potential risks can help guide management. This process precludes unnecessary surgical intervention or premature termination of a potentially viable intrauterine pregnancy.

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