The Width of the Uterine Cavity is Narrower in Patients With an Embedded Intrauterine Device (IUD) Compared to a Normally Positioned IUD

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Objective. The purpose of this study was to determine whether women with intrauterine devices (IUDs) embedded in the myometrium or cervix have a narrower fundal transverse endometrial diameter as seen on 3-dimensional (3D) sonography compared to women whose IUDs are in a normal location. ***Methods.*** A sonographer blinded to the study hypothesis retrospectively evaluated the 3D images and reconstructed coronal views of the uterine cavity in 172 consecutive women who had an IUD in the uterus. The width of the endometrial cavity at the fundus of the uterus was measured transversely on the rendered coronal sonogram using the calipers on a picture archiving and communications system. The measurements obtained from women who had nonembedded IUDs were compared to those with embedded IUDs. ***Results.*** Measurement of the width of the endometrial cavity at the fundus was successfully performed in 132 patients with nonembedded IUDs and 29 with embedded IUDs. The mean ± SD values of the fundal uterine cavity for the nonembedded and embedded IUDs were 3.2 ± 1.0 and 2.5 ± 0.8 mm, respectively ($P = .0003$). ***Conclusions.*** Patients with embedded IUDs have a smaller fundal endometrial cavity diameter compared to those with normally placed IUDs as documented using 3D rendering of the uterus. Whether preprocedural 3D sonography for women who are IUD candidates would be useful deserves further study. ***Key words:*** intrauterine device; 3-dimensional sonography; uterus.

Abbreviations
IUD, intrauterine device; 3D, 3-dimensional; 2D, 2-dimensional

Received December 24, 2009, from the Departments of Radiology and Obstetrics and Gynecology, Brigham and Women's Hospital (T.D.S., B.B., B.R.B.), and Departments of Radiology (B.R.B.) and Obstetrics and Gynecology (T.D.S., B.B., B.R.B.), Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts USA; and Diagnostic Ultrasound Associates, PC, Boston, Massachusetts USA (T.D.S., B.B., B.R.B.). Revision requested January 20, 2010. Revised manuscript accepted for publication February 9, 2010.

Guest Editor: Alfred Z. Abuhamad, MD.

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The use of intrauterine devices (IUDs) is undergoing resurgence within the United States. These devices are used not only for contraception but also for the treatment of menorrhagia.[1,2] Despite the benefits, IUDs are not without their side effects. Pain and bleeding are some of the most common adverse effects associated with the use of IUDs.[3]

Although IUDs are identified during 2-dimensional (2D) pelvic sonography by the location of the shaft, the use of 3-dimensional (3D) sonography is crucial to determine the location of the arms of the IUD with respect to the uterine cavity.[3] Three-dimensional sonography has been used to show that abnormalities of the position of the IUD within the uterine cavity can be associated with pelvic pain and abnormal bleeding.[3]

Given the ability of 3D sonography to identify the location of the side arms of the IUD, the question arises of whether some women may have a variation in the size or shape of the endometrial cavity, which could result in malpositioning of the IUD. Those with uterine anomalies are likely to have difficulty with normal placement of an IUD. In addition, uterine cavities that are small may also be at risk for a malpositioned IUD. Hence, in this study, we used the 3D coronal view of the uterus to compare the transverse diameter of the uterine cavity of patients with malpositioned IUDs to those whose IUDs were in a normal location.

Materials and Methods

Institutional Review Board approval was obtained for this study, which was limited to the retrospective review of medical records and evaluation of 3D rendered coronal images of the uterine cavity.

In our laboratory, we routinely perform 3D sonographic evaluation of the uterus during gynecologic sonography in addition to standard 2D imaging. During the 3D evaluation, we evaluate the coronal view of the uterus, which is typically not obtainable during 2D imaging, even with use of a transvaginal ultrasound probe.[4] After the 3D volume sweep of the uterus is obtained, reconstruction of the volume is used to obtain the coronal view of the uterus. This is normally presented as a rendered image. These images are saved as part of the patient's medical record. It is on these rendered coronal images that this study was performed.

This study included consecutive patients who were scanned during a 1-year period from June 1, 2007, to May 31, 2008, with no submucous fibroids or other confounding uterine abnormalities distorting the endometrial cavity. We previously evaluated most of this patient cohort in a prior study that focused on symptoms (pelvic pain and bleeding) related to the location of the IUDs.[3] In this study, we evaluated the width of the uterine cavity of these patients to determine whether differences in uterine size may be related to IUD malpositioning.

The 3D volume acquisitions were obtained during transvaginal sonography with a Voluson ultrasound system (GE Healthcare, Milwaukee, WI) using a 5- to 9-MHz transducer. The 3D volume acquisition was obtained using a longitudinal view of the uterus in the method described by Abuhamad et al[5] and further illustrated in our prior article.[3]

A single sonographer, blinded to the study hypothesis and with approximately 5 years of 3D sonographic experience, retrospectively reloaded the 3D volumes and reconstructed coronal views of the uterine cavity in 172 consecutive women who had undergone gynecologic imaging and had an IUD in the uterus. The width of the endometrial cavity was measured transversely at the fundus of the uterus on the rendered coronal sonogram using the electronic calipers on a picture archiving and communications system (ViewPoint; GE Healthcare).

The measurements obtained from women who had a normally placed IUD were compared to those with an embedded IUD. This designation was based on the reading physician's interpretation at the time the gynecologic sonographic examination was performed. The IUD was deemed normally placed if it was entirely within the confines of the endometrial cavity. The IUD was termed embedded if any part of it extended into the myometrium or cervix.

Statistical analysis was performed using the Student *t* test for continuous variables and the Fisher exact test for categorical variables. $P < .05$ was considered statistically significant.

Results

Overall, 172 consecutive women with IUDs underwent gynecologic sonography during the study period. Of these, 162 (94.2%) had reconstructed rendered images of sufficient quality so that transverse measurements of the uterine fundal endometrial cavity could be obtained. On the images of 10 patients, the endometrium could not be clearly demarcated, and the extent of the endometrial cavity could not be confidently ascertained. One patient had a circular IUD placed in China and was excluded from the study. This left 161 patients with adequate rendered coronal views of the endometrial cavity and T-shaped IUDs. Of these, 132 patients were noted to have a normally placed IUD, and 29 had an embedded IUD (Figure 1).

Fundal endometrial cavity measurement was successfully performed in 132 patients with nonembedded IUDs and 29 with embedded IUDs. The mean ± SD values for the patients with nonembedded and embedded IUDs were 3.2 ± 1.0 and 2.5 ± 0.8 mm, respectively ($P = .0003$).

Because the transverse diameter of both of the currently available T-shaped IUDs in the United States (Mirena [Bayer HealthCare Pharmaceuticals, Inc, Montville, NJ] and ParaGard [Duramed Pharmaceuticals, Inc, Cincinnati, OH]) is 32 mm, we evaluated the proportion of patients who had transverse uterine cavity diameters at the fundus of greater than 32 mm (Figure 2). Four patients (13.8%) with abnormally positioned IUDs had a uterine cavity width of greater than 32 mm compared to 43 (32.6%) with normally placed IUDs ($P = .046$).

Discussion

We previously reported that 16% of consecutive patients with IUDs presenting for sonographic examinations had abnormally positioned IUDs. These patients with malpositioned IUDs were more likely to have pain or bleeding than patients with normally positioned devices.[3] We undertook this study to determine whether the width of the uterine cavity in the coronal plane could be related to the ultimate positioning of the IUD.

Our results show that patients with embedded IUDs have a smaller fundal endometrial cavity diameter compared to those with normally placed IUDs. This difference could possibly contribute to the abnormal positioning of the IUDs in those with smaller uteri because only 4 of 29 patients who had embedded IUDs had a uterus wider than the actual width of the standard commercially available IUDs.

Several limitations must be mentioned. First, we did not have any information regarding many demographic variables such as gravidity, parity, timing of delivery or abortion, prior uterine surgery, and timing of IUD insertion for our patients because this was a retrospective study from our database. Additional study is required to determine whether any of these factors have an impact on the size of the uterine cavity. We are currently conducting a study to better illuminate the importance of some of these variables. Second, we did not have information regarding the stage of the menstrual cycle, and the measured size of the cavity may vary with the stage of

Figure 1. Three-dimensional rendered image of the coronal view of the uterus. The IUD is shown with one arm embedded within the uterine wall. The transverse width of the endometrial cavity at the fundus of the uterus measures 20.7 mm.

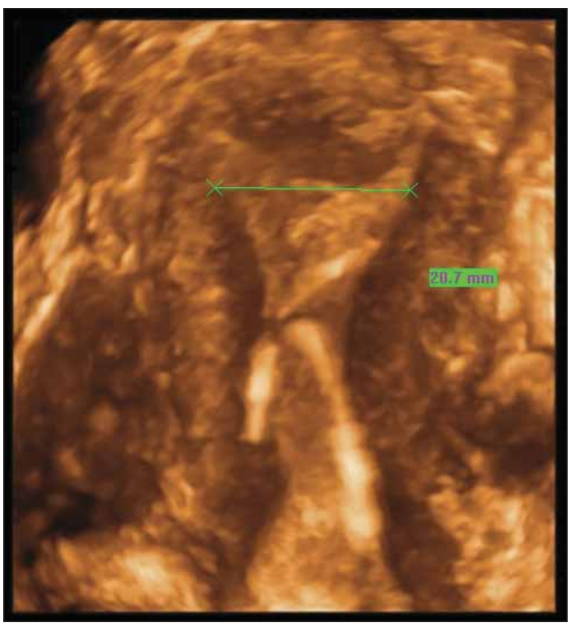
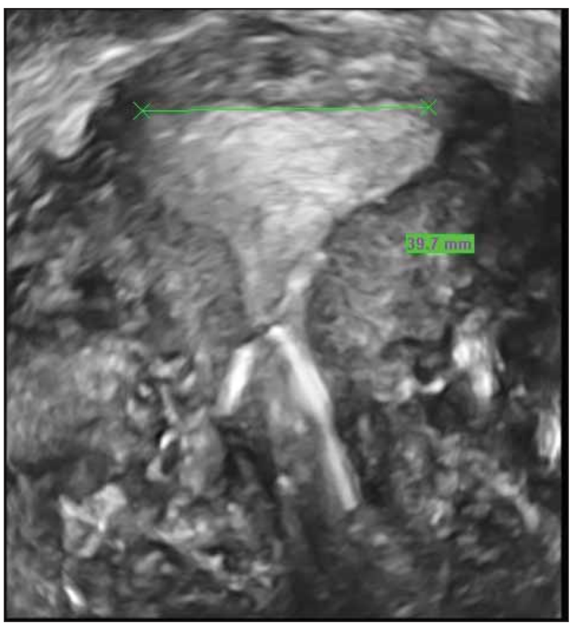


Figure 2. Three-dimensional reconstructed image of the coronal view of the uterus. The IUD is shown with one arm embedded within the uterine wall. The transverse width of the endometrial cavity at the fundus of the uterus measures 39.7 mm.



the cycle. This factor demands further study. Third, our evaluation was performed predominantly on the cohort of patients previously reported.[3] However, the aim of this study was completely different from the previous report, and the sonographer who performed the measurements of the uterine cavity width was blinded to the study hypothesis to avoid the potential for bias. Last, it is remotely possible that a normally located IUD can prop up the sides of the uterine cavity, thus contributing to its width. Therefore, the IUD may make the fundal endometrial measurement larger simply by virtue of its presence. Although this is unlikely, we are currently conducting a study to determine the width of the uterine cavity in consecutive patients who do not have IUDs.

Sonography plays an important role in evaluating patients with suspected IUD migration.[6–8] Recent case reports have also documented the benefits of sonography in patients with IUDs and müllerian anomalies.[9,10] Our study suggests that preprocedural 3D sonography for uterine cavity biometric measurements might be useful for women who are candidates for IUD placement because it seems that patients with embedded IUDs have a substantially smaller endometrial cavity width compared to those with normally positioned IUDs.

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