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Case Study

The Efficacy of Three-Dimensional Ultrasound Imaging In Identifying Intrauterine Contraceptive Device Malposition

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Abstract

Conventional two-dimensional (2D) endovaginal sonography is a well-established method of confirming the appropriate placement of an intrauterine contraceptive device (IUCD), however, it has limitations. Three-dimensional (3D) sonographic imaging methods overcome these limitations and improve efficacy and accuracy in identifying IUCD position in the uterine cavity, which is especially useful in cases of device malposition.

Background

The use of IUCDs by women in the United States is rising. Recent data estimates that between 2008 and 2014, the percentage of patients choosing long-acting, reversible IUCD methods increased from 6% to 14% [1,2]. This translates into approximately four and a half million women who currently use IUCDs as their primary method of preventing pregnancy. The typical protocol for insertion of an IUCD requires at least two physician office visits; the first for initial consultation and selection of the appropriate device, the second for the actual insertion procedure. Many practitioners also recommend a third visit distant to insertion to confirm appropriate positioning of the device. Follow-up imaging is also indicated in patients with signs and symptoms associated with IUCDs. Ultrasound is an established, cost-effective, and well-tolerated method of verifying correct positioning of an IUCD within the uterine cavity – an integral requirement for effective long-acting contraception. While traditional 2D, endovaginal ultrasound can be effective in acquiring the desired confirmatory results, it carries limitations. This case study demonstrates how the addition of 3D ultrasound imaging in localizing an IUCD increases diagnostic confidence, especially when malpositioning is present.

Case Report

A 21-year-old woman who had a levonorgestrel-releasing intrauterine device (Mirena®, Bayer HealthCare Pharmaceuticals, Inc.) placed three years prior by her healthcare professional was participating in a company-based marketing activity (*Resona 7, Mindray North America*). The goal of this exercise was to optimize imaging presets and acquire ultrasound images for use in future downstream marketing activities. Appropriate consent was obtained, established clinical and safety protocols were observed, and the procedure was performed by a credentialed sonographer. The participant did not have any clinical signs or symptoms related to possible side effects associated with the in situ device.

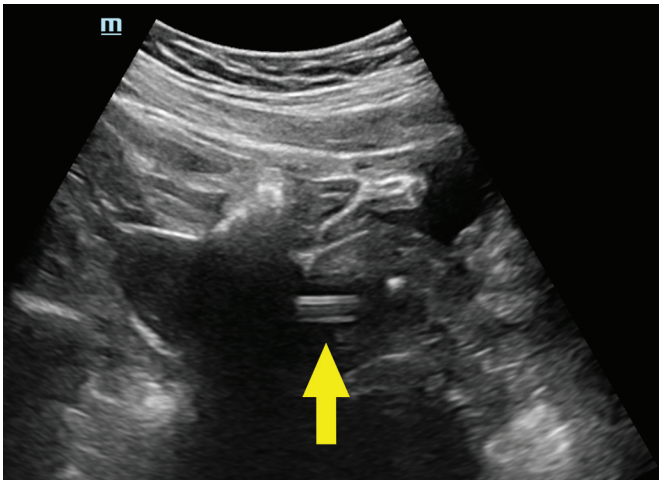
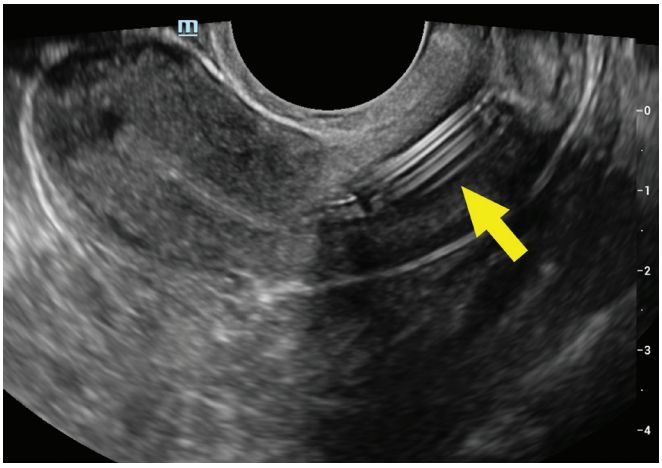


Figure 1 - Transabdominal longitudinal image through an empty urinary bladder demonstrating multiple parallel echogenic reflectors consistent with the presence of an IUCD in the lower uterine segment (arrow).



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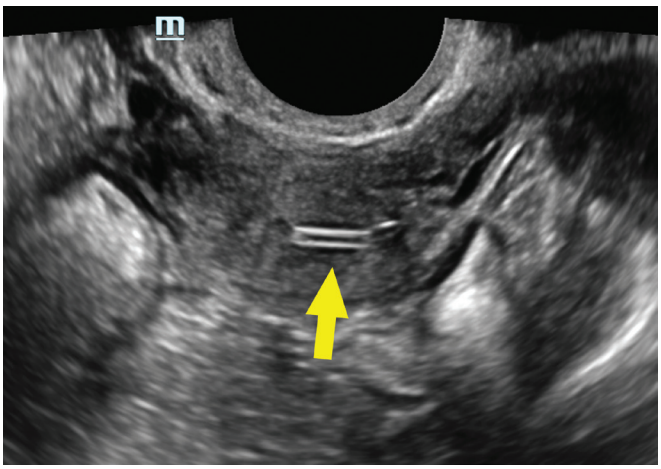


b.

Figure 2 - Longitudinal (a) and axial (b) endovaginal ultrasound images clearly demonstrating an empty endometrial cavity and the presence of an IUCD shaft in the lower uterine segment (arrows).

Two-dimensional transabdominal imaging through an empty urinary bladder was initially performed and demonstrated several parallel linear echogenic reflectors within the area of the lower uterine segment and cervix (Figure 1). This unexpected appearance strongly suggested malpositioning of the IUCD. Two-dimensional endovaginal imaging was then performed and clearly demonstrated an empty endometrial cavity and the presence of the IUCD shaft within the lower uterine segment (Figure 2).

The 2D endovaginal probe was removed, and a 3D endovaginal probe was inserted to obtain volumetric 3D data sets of the uterus. Multiplanar images obtained through the fundus of the uterus demonstrated normal endometrial anatomy without the presence of an IUCD (Figure 3). Imaging through the lower uterine segment revealed the presence of a multilinear echogenic structure which was assumed to be the shaft of the IUCD. The device is clearly identified in sagittal, axial, true coronal, and 3D reconstructed images (Figure 4). The findings obtained during this imaging session were incidental and unexpected, and the participant was advised to see her healthcare professional for a follow-up visit and appropriate management. During that visit, the shaft of the Mirena IUCD was noted to be malpositioned in the lower uterine segment with the side arms penetrating the myometrial tissue.
This could explain why the side arms were not visualized sonographically on either 2D or 3D imaging. The patient was scheduled for appropriate clinical management.

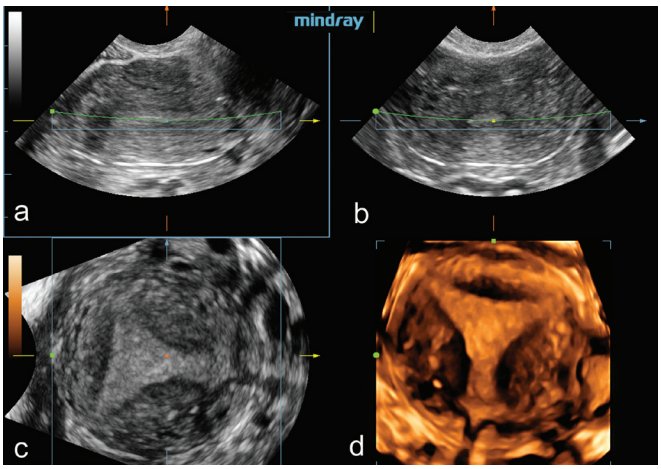


Figure 3 - 3D empty uterine cavity. Sagittal (a), axial (b), and true coronal (c) views demonstrate an empty endometrial cavity, which is optimally visualized in the 3D reconstructed coronal view (d).

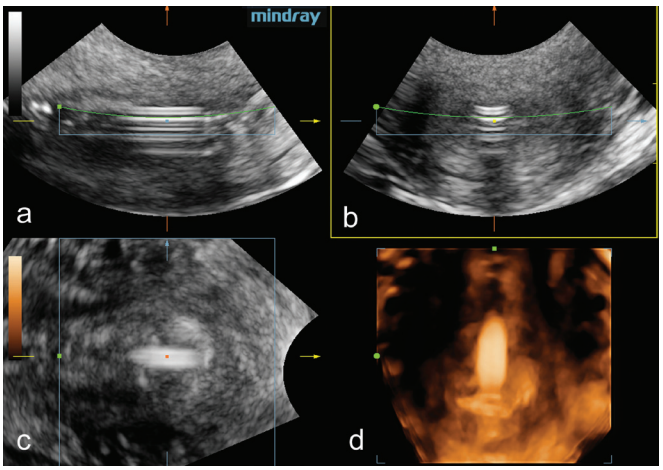
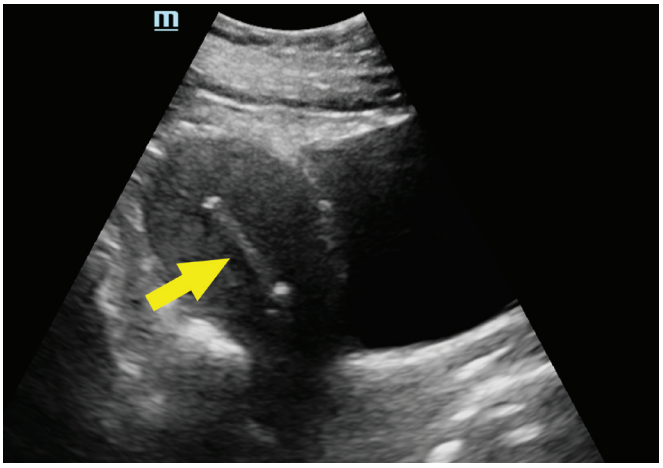


Figure 4 - Malpositioned IUCD. Sagittal (a), axial (b), true coronal (c), and 3D reconstructed coronal (d) images demonstrate the presence of a multilinear echogenic structure within the lower uterine segment consistent with the shaft of a misplaced IUCD. Side arms are not visualized.



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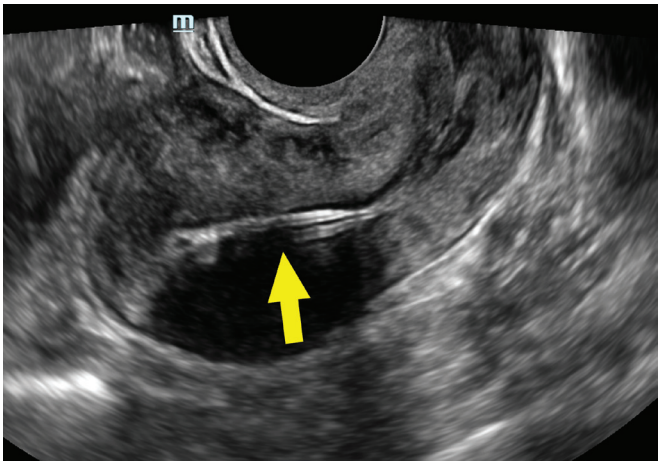

b.

Figure 5 - Sagittal transabdominal (a) and endovaginal (b) imaging demonstrates normal IUCD placement with the shaft of the device centrally located within the endometrial cavity (arrows).

Discussion

Proper placement and positioning of an intrauterine contraceptive device is requisite for ongoing, effective prevention of pregnancy. In addition to the potential for unwanted pregnancy, malpositioned IUCDs may also cause pelvic pain, vaginal bleeding, and, in some cases, penetration of the myometrium and uterine perforation. Ultrasound is an established method for the evaluation of IUCD placement relative to the uterine cavity. While traditional 2D endovaginal ultrasound has become the initial method of choice in the evaluation of these patients, there are known limitations associated with using this approach. Typically, while 2D imaging demonstrates the shaft of the IUCD with reasonable precision, it is often unable to adequately visualize the location of the side arms that are found on most devices currently in use. It is also less effective in identifying other positioning complications such as malrotation [3 4].

On ultrasound examination, a normally placed IUCD should be visualized as centrally located within the endometrial cavity, with the side arms (when present) seated in the uterine fundus and extending into both cornu [5]. Transabdominal and 2D endovaginal imaging are useful in localizing the shaft of the device within the uterine cavity (Figure 5); however, localization of appropriate placement of the side arms within the uterine cornu is only possible in a coronal plane of section obtained using 3D imaging methods (Figures 6 and 7) [6]. In addition to improving conspicuity of IUCDs, including non-metallic devices currently in use, multiplanar 3D ultrasound imaging provides enhanced assessment of uterine anatomic anomalies, better definition of the endometrium, more accurate delineation and location of endometrial polyps, location of leiomyomas, and visualization of cystic areas within the myometrium [7]. This added information is particularly useful in patients presenting with symptoms associated with suspected IUCD malpositioning [8].

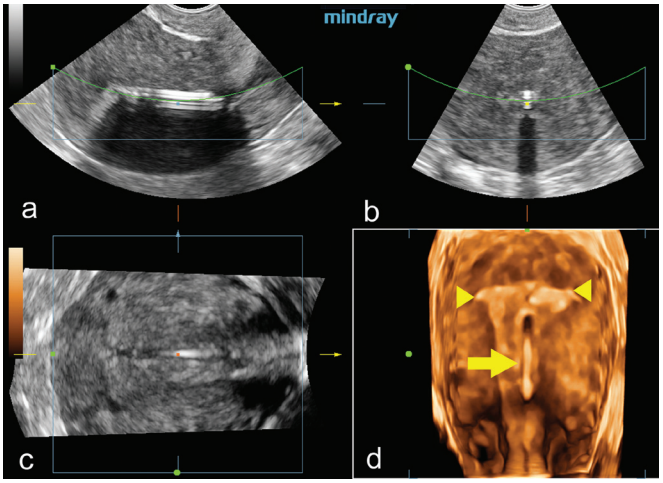

Figure 6 - 3D multiplanar imaging demonstrates appropriate positioning of an IUCD in the uterine cavity. The shaft is clearly seen on sagittal (a), axial (b), and coronal images (c). Shaft (arrow) and side arms (arrowheads) are demonstrated in the uterine cornu on 3D reconstructed coronal view (d).

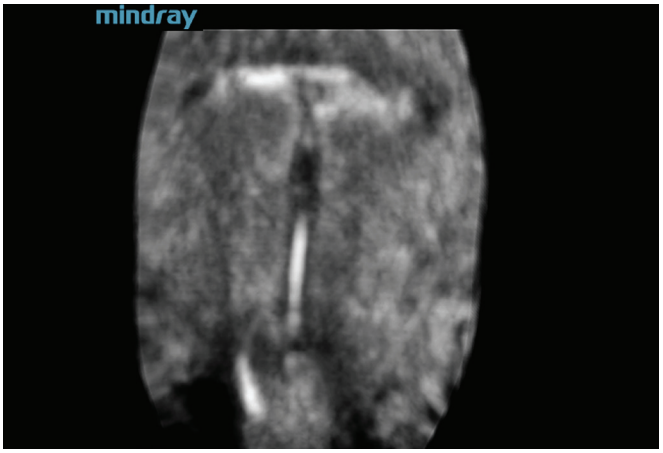

Figure 7 - 3D reconstructed image demonstrating IUCD in normal location within the uterine cavity.

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