# Practical Applications of 3D Sonography in Gynecologic Imaging

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**KEYWORDS**

• 3D pelvic sonography • Uterine shape anomalies • IUD malposition

**KEY POINTS**

- Three-dimensional (3D) sonography of the pelvis provides clinically useful information, especially if any abnormalities associated with the endometrium are suspected.
- 3D sonography is the modality of choice in assessment of uterine congenital anomalies.
- The coronal view of the uterus locates malpositioned intrauterine devices (IUDs) by visualizing the entire IUD and is now considered to be the optimal method of evaluating IUDs.
- The 3D technique can often be used to identify a hydrosalpinx when multiple adjacent cystic structures are demonstrated.

## INTRODUCTION

Three-dimensional (3D) sonography has become a popular imaging technique in gynecology answering important questions that could not be previously addressed with traditional 2D imaging due to the constraints of the transvaginal as well as the transabdominal probe. The technique provides rapid acquisition of a volume of data that can be stored, reviewed, and manipulated retrospectively producing images in any desired plane potentially reducing operator dependency. However, reconstructions may be inadequate when accessibility to optimal scan planes for image acquisition is limited.

The most useful clinical 3D applications have evolved from the ability to reconstruct and obtain the coronal plane of the uterus. Applications that have now become a routine part of the standard pelvic imaging protocol in many institutions include the evaluation of uterine shape anomalies and intrauterine device (IUD) location. Problems that arise in the evaluation of masses and adhesions associated with the endometrial cavity may also be solved using this technique. This article concentrates on a variety of indications primarily associated with the uterus and endometrial cavity that have been shown to enhance the diagnostic ability of ultrasound examination of the female pelvis.

## EVIDENCE FOR ROUTINE USE OF THE CORONAL PLANE

Reports have suggested that 3D imaging with reconstructions in the coronal plane is better able to characterize some uterine abnormalities and may occasionally detect unsuspected abnormalities. It has also been observed that when 2D imaging is normal, 3D is less likely to be

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contributory.[1,2] The coronal plane has additionally been found to be more useful when the endometrial thickness is greater than 5 mm because this will provide contrast with the myometrium that is usually more hypoechoic.[2]

Andreotti and colleagues[1] looked at 90 consecutive patients using transvaginal sonography with coronal reconstructions of the uterus. Additional findings using 3D reconstructions in the coronal plane were found in 26 (53%) of 49 patients with abnormalities noted on 2D imaging but only in 2 (5%) of 51 patients with normal 2D imaging. In one of these cases, an IUD location was confirmed, and in the other case, an arcuate uterus was identified. Benacerraf and colleagues[2] demonstrated added value of 3D coronal views compared to traditional 2D imaging in 16 (24%) of 66 consecutive pelvic sonograms. Additional information was identified on the coronal view in 3 (12%) of 25 patients with normal findings on 2D sonography. The 3 patients for whom the coronal view of the uterus was helpful all had arcuate uteri.

The arcuate uterus was a common additional finding in the study by Andreotti and colleagues[1] and the most common additional finding in the report by Benacerraf and colleagues.[2] Because an arcuate uterus is widely considered a variation of normal, whether this adds anything clinically significant remains debatable. However, a report by Woelfer and colleagues[3] has shown that women with an arcuate uterus had a significantly greater risk of second-trimester loss and preterm labor than those with a normal uterine configuration. The diagnosis of a unicornuate uterus, more often associated with pregnancy loss, is also an abnormality that is easily seen with 3D imaging when 2D sonography is interpreted as normal. This information may then be important in the management of the patient with infertility and would support the use of the additional view following even normal 2D imaging in women being evaluated for infertility.

## TECHNICAL CONSIDERATIONS

Acquisition of the uterine volume can be obtained via a transabdominal or transvaginal approach. However, the transvaginal approach is the more useful due to the higher frequency of the probe and its closer proximity to the organ being scanned that enhance the resolution of the image. A manual or automated sweep is performed to obtain a volume through the acquisition plane. The images are electronically stored. Three-dimensional images are then processed and displayed on the monitor as a multiplanar format or display showing 3 orthogonal planes with or without a surface rendered image (**Fig. 1**). The surface rendered image is a thicker slice through volume with depth perception improved by different

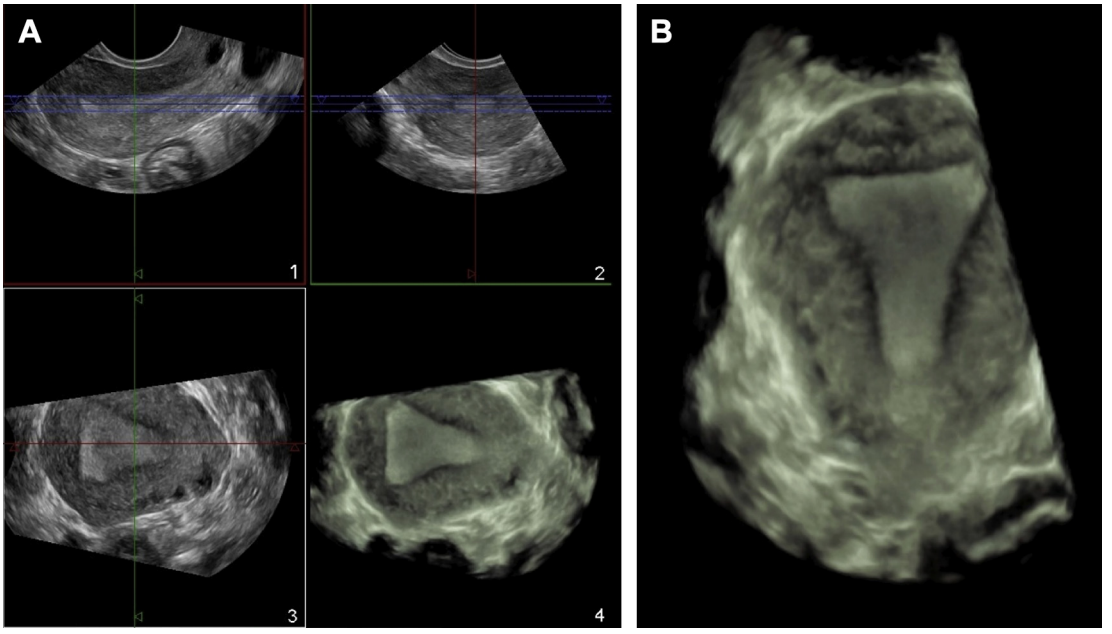


**Fig. 1.** (*A*) Multiplanar display following 3D sweep through a normal uterus in the sagittal plane including a surface rendered image. Quadrants demonstrating sagittal plane (1), transverse plane (2), coronal plane (3), and coronal surface rendered image (4). (*B*) Enlarged surface rendered image of the uterus in the coronal plane that has been rotated so that the fundus is seen as it is routinely viewed, at the top of the image.