

Three-dimensional Ultrasound for Assessing Uterine Pathology

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Abstract: Two-dimensional ultrasound is commonly used for assessing uterine pathology. Three-dimensional ultrasound is a new imaging modality, which is being introduced into clinical practice. The aim of this paper is addressing the current status of three-dimensional ultrasound in the assessment of uterine pathology.

Keywords: Three-dimensional ultrasound, uterus.

INTRODUCTION

Two-dimensional ultrasound (2DUS) is commonly used for assessing uterine and endometrial pathology. This technique is widely used as a first line imaging technique in women with suspected uterine pathology and its role for diagnosing different uterine and endometrial anomalies has been well-established. It has been shown that this technique is useful in the diagnosis of some kinds of uterine congenital malformations, fibroids, adenomyosis and endometrial polyps.¹⁻³

Endometrial thickness measurement is an easy, simple and reproducible technique that is useful for distinguishing those patients with and without endometrial pathology.⁴ This technique has shown a high sensitivity for detecting endometrial lesions^{5,6} but it is not specific.⁷

The use of pulsed and color Doppler ultrasound is controversial.^{8,9} Some authors have advocated the use of power Doppler blood flow mapping of the endometrium in order to increase the specificity of ultrasound.¹⁰ However, this latter technique has been shown to be reproducible only when performed by experienced examiners.¹¹

Three-dimensional ultrasound (3DUS) has become recently available for clinical practice.¹² This technique allows unique ways for assessing the uterus and the endometrium as reported in another article of this journal issue. On the other hand, several studies have demonstrated that 3DUS is highly reproducible for measuring endometrial volume and vascularity.¹³⁻¹⁶

In the present article, I shall review current evidence about the role of 3DUS for assessing uterine and endometrial pathology.

CONGENITAL UTERINE MALFORMATIONS

Although conventional 2DUS has shown the capacity to discriminate among different types of uterine anomalies¹⁷ it is highly dependent on the expertise of the examiner¹⁸ and limited in its ability to obtain the coronal plane of the uterus in most cases.

Several studies have demonstrated the advantages of 3DUS.

Jurkovic and colleagues compared 2DUS, 3DUS and hysterosalpingography (HSG) for diagnosing congenital uterine malformations. They used HSG as gold standard and found that 3DUS was more accurate than 2DUS for diagnosing arcuate uterus and had a higher positive predictive value for diagnosing major anomalies, especially for differentiating subseptated and bicornuate uteri.¹⁹

Raga and coworkers evaluated the diagnostic accuracy of 3DUS for diagnosing congenital uterine anomalies using laparoscopy and HSG as gold standard. They found that 3DUS correctly classified 92% of all anomalies.²⁰ Wu and colleagues performed a similar study, but using laparoscopy and hysteroscopy as gold standard. They were able to detect septated uterus in 92% and 100% for bicornuate uteri.²¹

In our experience, 3DUS is more accurate than 2DUS for diagnosing arcuate, subseptated, septated and bicornuate uteri, but not for didelphys (Figs 1 to 3). We also found that 3DUS is very useful to determine the dimensions of uterine septum, which may provides very useful information to surgeons during hysteroscopy.

Furthermore, Salim and coworkers have recently demonstrated that 3DUS is a reproducible method for diagnosing and discriminating congenital uterine anomalies.²²

The potential clinical value of using 3DUS for diagnosing congenital uterine anomalies has been shown in two studies, which found that screening uterine malformations by means of 3DUS may improve reproductive outcomes.^{23,24}

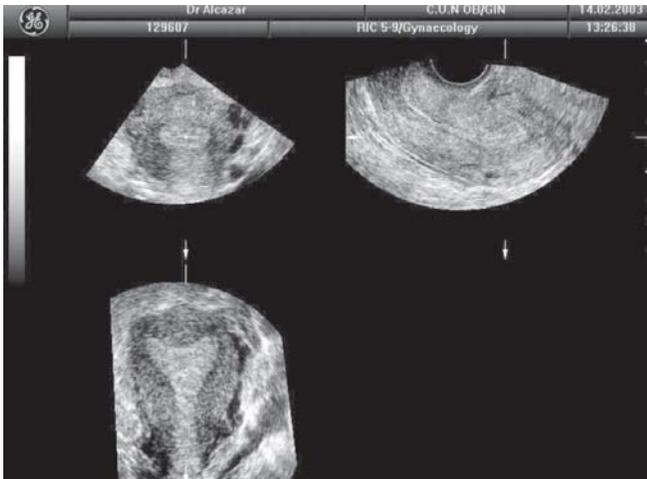


Fig. 1: Three-dimensional ultrasound of an arcuate uterus



Fig. 2: Three-dimensional ultrasound of a subseptated uterus

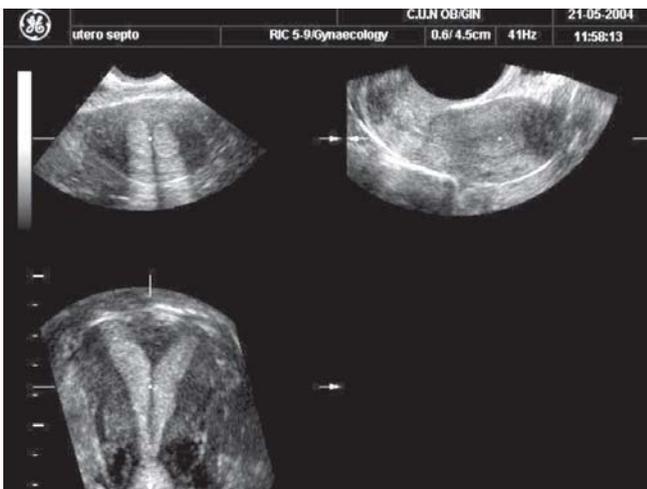


Fig. 3: Three-dimensional ultrasound of a septated uterus

UTERINE CAVITY AND SONOHYSTEROGRAPHY

Saline infusion sonohysterography (SIS) has been demonstrated to be a very useful tool for diagnosing intrauterine abnormalities.^{25,26} However, the possibility to assess the uterine cavity by three-dimensional ultrasound has raised a lot of interest among clinicians.

Several authors have tried to answer the question whether 3DSIS would add useful information to 2DSIS (Fig. 4).

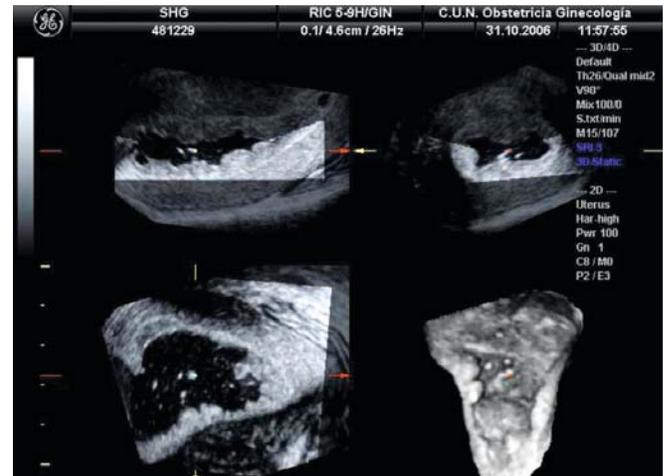


Fig. 4: Three-dimensional sonohysterography depicting a case of endometrial polyps

Lev-Toaff and colleagues found that 3DSIS added valuable information to 2DSIS in 69% of their cases and in 92% of the cases when compared to HSG.²⁷ However, their sample size was small. The advantages were found in confirming suggestive findings on 2DSIS or HSG and in establishing the location, number and attachments of endometrial polyps, submucous fibroids and adhesions.

Sylvestre et al evaluated the diagnostic accuracy of 3DSIS for diagnosing intrauterine lesions in 209 infertile women. They found that, when compared to hysteroscopy, 3DSIS had a sensitivity of 100% and a positive predictive value of 92%. However, these figures were not different from those for 2DSIS (98% and 95%, respectively).²⁸

De Kroon and coworkers compared 3DSIS versus 2DSIS in 49 patients suspected of having intrauterine abnormalities. They concluded that, overall, 2DSIS and 3DSIS had similar performance, but 3DSIS added “relevant clinical” information in 7% of their patients.²⁹

Recently Ghate and co-workers have found similar results.³⁰

However, three-dimensional ultrasound has been shown to be very useful for assessing submucous myomas. Salim and colleagues compared 3DSIS with hysteroscopy for classifying

submucous fibroids. They found that agreement between both techniques was high (kappa value: 0.80).³¹ Furthermore, the same group of investigators has reported that 3DSIS is reproducible for determining the degree of protrusion of submucous myomas into the uterine cavity.³²

Leone and colleagues reported similar findings.³³

Muniz and co-workers reported that 3D power Doppler ultrasound accurately depicts fibroid vascularity and in some cases reveals collateral flow not depicted by angiography. They also found that this technique could be useful for predicting results of uterine artery embolization as treatment of uterine fibroids.³⁴

ENDOMETRIAL PATHOLOGY IN POSTMENOPAUSAL BLEEDING

Gruboeck et al reported that the assessment of endometrial volume in women with postmenopausal bleeding was more accurate than endometrial thickness measurement for detecting endometrial pathology.³⁵

Bonilla-Musoles and coworkers reported that 3DUS improved the diagnostic accuracy of ultrasound to determine myometrial and cervical invasion in endometrial carcinoma.³⁶ Similar findings have been showed by Su et al.³⁷

Kurjak et al reported that the use of 3DUS provided higher sensitivity than conventional ultrasound for detecting endometrial cancer (89% compared to 67%, respectively).³⁸

More recently, Mansour et al compared endometrial volume and thickness in a series of 170 women with postmenopausal bleeding. These authors reported that the best cut-off for endometrial volume was 1.35 mL with a sensitivity of 100% and a false-positive rate of 29%.³⁹ Odeh et al reported that the best cut-off for endometrial volume was 3.56 mL with a sensitivity of 93% and a specificity of 36%.⁴⁰

A recent retrospective study from our group in a series of endometrial hyperplasia and endometrial cancer has shown that endometrial volume in endometrial cancer trends to be higher than in endometrial hyperplasia.⁴¹

Regarding the assessment of endometrial vascularization by 3D-PDA, Odeh et al⁴⁰ and Mercé et al⁴¹ observed that 3D vascular indexes are higher in endometrial cancer as compared with endometrial hyperplasia.

3D-PDA has been reported to be useful for detecting abnormal vascularization in a case of uterine carcinosarcoma.⁴²

CONCLUSIONS

Three-dimensional sonography is a new diagnostic imaging technique for assessing uterine and endometrial pathology. It offers unique ways for assessing this pathology. It is reproducible and preliminary data are encouraging, but further research is needed.

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