Case report

Use of three-dimensional ultrasound in evaluating the intrauterine position of a levonorgestrel-releasing intrauterine system

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Abstract

This paper reports the first case of three-dimensional (3-D) transvaginal ultrasonography (TVS) imaging of malpositioned levonorgestrel-releasing intrauterine system (LNG-IUS). In patients carrying LNG-IUS, the application of 3-D TVS with the adjunctive volume contrast imaging in the coronal plane (VCI-C) and inversion rendering modes clearly display the correct spatial position of the LNG-IUS in relation to the uterine cavity much better than two-dimensional ultrasound.

Keywords: *3-D TVS, imaging, IUD, levonorgestrel-releasing intrauterine system*

Introduction

The intrauterine position of an intrauterine contraceptive device (IUD) is thought to be closely related to its contraceptive power (Anteby *et al*., 1993). Two-dimensional (2-D) transvaginal ultrasonography (TVS) is the primary method for confirming the intrauterine location of a copper IUD (Bonilla-Musoles *et al*., 1996), with high accuracy in monitoring the location of any type of IUD (Aleem *et al*., 1992; Petta *et al*., 1996; Palo, 1997). When this method fails, a plain radiograph of the pelvis, computed tomography or magnetic resonance imaging should be considered (Botash, 1997; Hall *et al*., 2000).

In contrast to a copper IUD, imaging of the levonorgestrel-releasing intrauterine system (LNG-IUS) needs higher operator's skills and is less accurate. The LNG-IUS has a 32 mm T-shaped plastic frame with a reservoiron the vertical stem of the intrauterine system. Its typical unique sonographic appearance includes both proximal and distal ends of the vertical arm of the device, which extend into the internal cervical os and fundal region respectively, and an acoustic shadowing between both ends which defines the location of the device (Palo, 1997; Zalel *et al*., 1999).

Case report

A 45-year-old woman, gravida 5, para 3, was referred to the department because of acute pelvic pain. The patient was fitted with LNG-IUS 6 months prior to her admission. The insertion was unremarkable with an uneventful post-insertion course followed by regular menstrual blood flow. Her gynaecological examination was unremarkable except for mild adnexal tenderness and her pregnancy test was negative. 2-D TVS was performed and revealed a vague picture in accordance to the aforementioned typical ultrasonographic appearance (**Figure 1**). Thereafter, three-dimensional (3-D) TVS (Voluson 730 Expert, vaginal probe RIC 5–9 H; GE Medical Systems, Haifa, Israel) with volume contrast imaging in the coronal plane (VCI-C) mode with slice of 2 mm was applied. This mode improves the contrast resolution by reducing the width of the slice scanned in the coronal plane to a minimum of 2 mm and provides an image with highly improved tissue contrast. By this method, the acoustic shadow of the IUD and its position in the uterine cavity were clearly visualized (**Figure 2**). The shadowing of the IUD vertical arm was directed to the left cornua, while the horizontal arms were demonstrated parallel to the longitudinal

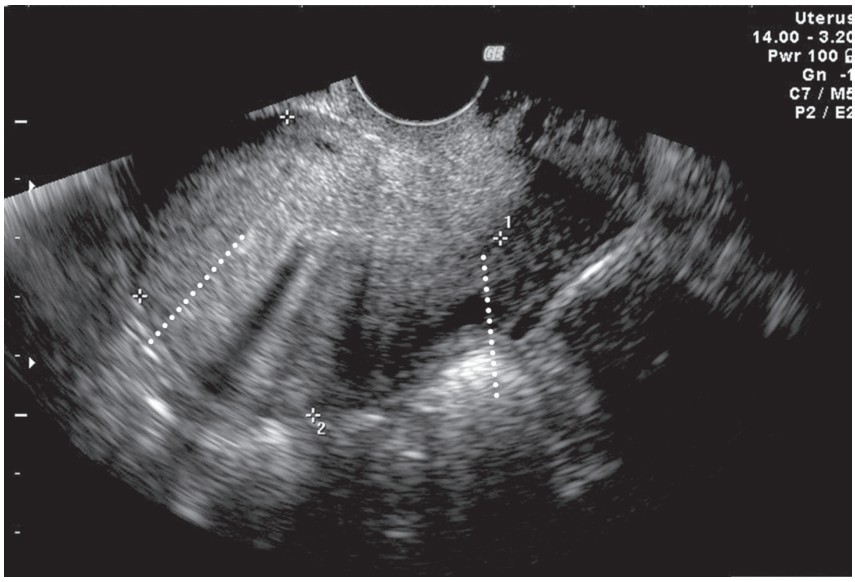

Figure 1. Two-dimensional transvaginal ultrasonographic visualization of the levonorgestrel-releasing intrauterine system. The dashed lines delineate the acoustic shadowing of the device.

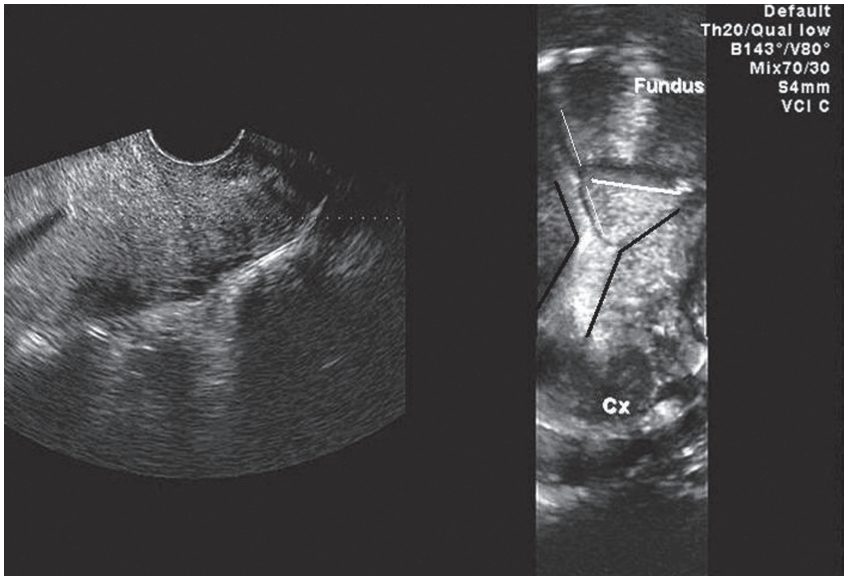

Figure 2. The acoustic shadow of the levonorgestrel-releasing intrauterine system, as demonstrated by three-dimensional transvaginal ultrasonography with volume contrast imaging in the coronal plane mode. The shadowing of the IUD vertical arm was directed to the left cornua (marked by the wide white line), while the horizontal arms were demonstrated parallel to the longitudinal axis of the uterine cavity (marked by the thin white lines). The black lines delineate the endometrial cavity.

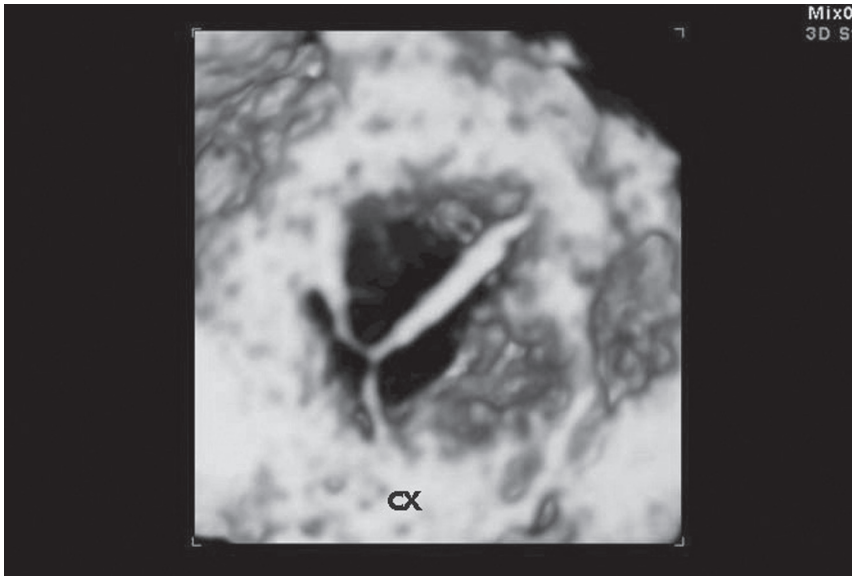

Figure 3. Visualization of the levonorgestrel-releasing intrauterine system by three-dimensional transvaginal ultrasonography with the inversion-rendering mode. CX = cervix.

axis of the uterine cavity. At this point, in order to evaluate the precise spatial position of the IUD in relation to the uterine body, the contrast between the IUD and the scanty endometrium was accentuated with the inversion-rendering mode, which inverts the anechoic shadows of the plastic collar filled with polydimethylsiloxane into echogenic voxels (**Figure 3**).

The patient was hospitalized for observation. The LNG-IUS was not removed. During hospitalization, symptoms spontaneously resolved and the patient was dismissed.

Discussion

The recent advent of computerized 3-D TVS systems has led to improvement in the quality and precision of ultrasonographic examination (Timor-Tritsch *et al*., 2005). Several studies found that 3-D ultrasound provides useful information on the location of a copper IUD following insertion and enables imaging of the entire IUD (i.e. the shaft and the arms simultaneously) and the relationship between IUD and uterine cavity (Lee *et al*., 1997; Zhang *et al*., 2002). Moreover, 3-D ultrasound evaluation with an adjunctive VCI-C were recently shown to visualize the acoustic shadow of the IUD and provide a useful modality in cases of difficult visualization of an IUD (Valsky *et al*., 2006).

The levonorgestrel-releasing intrauterine system (LNG-IUS) is a hormonally medicated IUD. In addition to the better contraceptive effect, the advantage of its introduction includes a reduction of menstrual blood loss and the number of days of bleeding per cycle (Andersson and Rybo, 1990; Luukkainen and Toivonen, 1995). The LNG-IUS is a T-shape device with a plastic collar attached to its vertical arm, containing the active progestin as levonorgestrel dispersed in polydimethylsiloxane. This mixture, together with the absence of copper, lead to the lower image quality of the LNG-IUS by the 2-D TVS visualization. However, the use of 3-D TVS with the adjunctive VCI-C and inversion-rendering modes, which visualises the collar, clearly display the entire LNG-IUS and its relation to the uterine cavity.

It is therefore recommended, in symptomatic patients carrying LNG-IUS, the use of 3-D TVS with the adjunctive VCI-C and inversion rendering modes, in order to clearly visualize the correct spatial position of the LNG-IUS in relation to the uterine cavity.

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