

## BENEFITS OF 3D ULTRASOUND IN THE DIAGNOSIS OF INTRAUTERINE DEVICE MALPOSITION

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### Abstract

*Objective.* The aim of this study is to present the benefits of three-dimensional (3D) ultrasonographic imaging for a better visualization of intrauterine device (IUD) and the diagnosis of its malposition in symptomatic patients with abnormal bleeding and/or chronic pelvic pain.

*Methods.* During one-year period (May 2015-May 2016), we evaluated the position of IUD in 29 symptomatic women, using two dimensional (2D) ultrasound imaging of the uterine cavity and 3D reconstructions of the coronal plane, using Voluson E8 (General Electric Healthcare) machine with a high frequency 2-9 MHz volumetric transvaginal probe.

*Results.* 3D ultrasound was associated with a significant higher satisfactory visualization rate of the IUD than 2D ultrasonography (96.5% versus 79.3%). The detection rates for the incorrect position of the IUD were significantly lower in 2D (76.9%), than in 3D assessment (96.1%). 3D ultrasound technique proved more accurate because the additional reconstructed coronal plane, that offers a better view of the entire device with the position of the arms within the uterine cavity. A uterine deviation (retroversion, lateral deviation, rotation or associations) was noted in 83.3% of cases where IUDs was improperly seen using 2D scan. In all these cases, IUDs was malpositioned. Contrary, in 91.6% of uterine deviations, IUDs was properly seen using 3D technique.

*Conclusion.* We found that the use of 3D ultrasound modality added a rapid, operator-accessible alternative approach to IUD visualization. This technique should be considered especially when malposition of DIU is suspected and whenever technical difficulties impair the classic 2D assessment.

### Rezumat: Beneficiile ultrasonografiei tri-dimensionale în diagnosticul dispozitivului intrauterin incorect plasat

*Obiective:* Scopul acestui studiu este de a prezenta beneficiile utilizării ecografiei tri-dimensionale (3D) în evaluarea și detecția poziției incorecte a dispozitivului intrauterin (DIU) la pacientele prezentate în departamentul nostru pentru sângerări vaginale anormale și/sau dureri pelvine cronice.

*Material și metodă:* 29 de paciente simptomatice cu DIU au fost evaluate utilizând examinări de rutină 2D, precum și reconstrucții 3D ale cavității uterine în plan coronal, într-o perioadă de un an (mai 2015 - mai 2016). Achiziția de imagini ecografice a fost realizată folosind un sistem Voluson E8 (General Electric Healthcare) cu sonda transvaginală volumetrică cu o frecvență de 2-9 MHz.

*Rezultate:* Rata de vizualizare satisfăcătoare a structurii și poziției DIU prin tehnica 3D a fost semnificativ superioară (96.5%) față de folosirea tehnicii 2D (79.3%) în aprecierea poziției DIU în special a poziției brațelor; datorită posibilității de reconstrucție a planului coronal. În consecință, rata diagnosticului malpoziției DIU a fost semnificativ inferioară în evaluarea clasică, 2D (76.9%) comparativ cu folosirea tehnicii 3D (96.1%). Deviații ale corpului uterin de la poziția normală (retroversie, laterodeviație, rotație sau asocieri) au fost constatate în 83.3% din pacientele cu DIU nesatisfăcător vizualizate în 2D. În toate aceste cazuri, DIU a fost incorect plasat. În schimb, în 91.6% din cazurile cu deviații uterine, DIU a fost corect evaluat cu ajutorul tehnicii 3D.

*Concluzii:* Studiul nostru a demonstrat utilitatea modalității 3D ca o alternativă superioară și rapidă pentru mai bună vizualizare a DIU, mai ales în situațiile clinice tehnic dificile pentru evaluarea clasică, în modul 2D, precum deviațiile corpului uterin de la axul normal. Imposibilitatea de a vizualiza DIU prin tehnica 2D sau de reconstrucție coronală a cavității uterine implică un grad înalt de suspiciune cu privire la poziția corectă a DIU.

**Cuvinte cheie:** dispozitiv intrauterin, ecografie, 2D, 3D.

## **Introduction**

Intrauterine devices (IUDs) provide a reversible and long-term method of contraception as a convenient, efficient, relatively safe and low-cost method [1]. First described in 1909, the IUD is nowadays the second most common contraceptive method (14%), with over 168 millions users worldwide, following surgical sterilization (21%) [2]. Ultrasonography of the pelvis and especially the transvaginal route, plays an essential role in evaluating the IUD position [3] and it's potential complications, thus is considered the gold standard for this gynaecological condition [4]. Investigation of the symptomatic patient and even routine follow-up of asymptomatic women with IUDs include transvaginal ultrasonography to rule out IUD malposition and other complications such as perforation, expulsion and pregnancy [5,6]. Two-dimensional (2D) ultrasound was considered until recently the method of choice in assessing the intrauterine position of the IUD, but still it has shown a less accurate evaluation when compared to the three-dimensional (3D) ultrasound [7]. Using 3D ultrasound, the reconstructed coronal plane can visualize a correct positioned IUD is in the center of the endometrial cavity, with both arms spread towards the uterine horns and the inferior part of the vertical body of the IUD just above the isthmic portion of the uterus. The component elements of the IUD should not extend in the myometrium.

The aim of our study was to investigate the advantages of 3D ultrasound in the evaluation of IUDs location and the detection of the malpositioned IUDs in the symptomatic patients that attended our department.

## **Methods**

The present study is a prospective analysis over a period of 1 year, May 2015- May 2016, in our department, the 1<sup>st</sup> Clinic of Obstetrics and Gynaecology of the Emergency County Hospital of Craiova.

In all symptomatic (abnormal vaginal bleeding and/or chronic pelvic pain) women having an IUD, a transvaginal pelvic ultrasound evaluation was

performed in the first stage of the study. We aimed to obtain and store the 2D aspects of the IUD location in the longitudinal and transverse uterine planes. The type and correct location of the IUD were noted. Then, 3D acquisitions of the uterus were performed and stored.

In the second stage we analysed the images and volumes from the database. The best 3D volumes of the patients were selected and analysed in terms of type and IUD position within the uterine cavity, following coronal reconstruction using Gyneco and/or VCI techniques.

All scans were performed using a E8 Voluson system (General Electric Healthcare) with a high-frequency of 2-9MHz volumetric transvaginal probe.

The data was used to calculate the rates of a satisfactory visualization of the IUD position in the uterine cavity, and the rates of incorrect IUD position diagnosis in 2D and 3D assessment.

## **Results**

During the study period, 29 patients were included in the analysis. 28 of them (96.55%) were more than 30 years old, 27 patients (93.1%) had a history of one or two deliveries, 16 (55.17%) had previously one or two caesarean sections and 6.9% of all patients were multiparous (more than 3 deliveries). 21 patients (72.41%) had a copper IUD and 8 (27.5%) patients had a levonorgestrel-releasing IUD.

All 29 IUD cases included in our study accused abnormal uterine bleeding and/or chronic pelvic pain. Using the 2D mode, we obtained a satisfying visualization of the uterine cavity and the IUD in 23 female patients (79.3%). When 3D mode was used, a satisfactory visualization of the IUD and uterine cavity was higher as 96.6% (28 patients).

We visualized the IUD satisfactory using 2D technique 62.5% of the levonorgestrel-releasing IUDs (5 cases) and 85% of the copper IUDs (18 cases). Overall, the malposition of the IUD was diagnosed using 2D in 16 out of a total of 23 cases (69.5%). 1 copper IUD was recorded in a correct position using 2D assessment, but proved to be malpositioned in 3D (Figure 1.). Uterine deviations

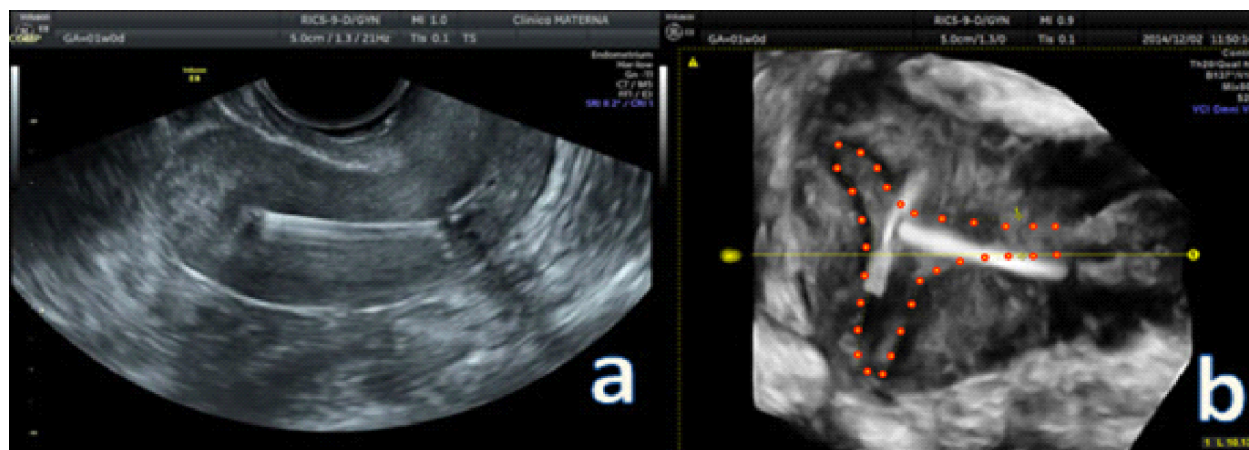
were present in the group of malpositioned IUDs diagnosed with 2D, in 7 cases (35%).

Using 3D mode, we diagnosed 87.5% of the misslocated levonorgestrel-releasing IUDs (7 of the 8 cases) and all the misslocated cooper IUDs. A malposition of the IUD was noted in 6 cases of levonorgestrel-releasing IUDs (85.7%) and in 19 cooper IUDs (90.47%) . Uterine deviation was noted in 12 cases of IUD, all of these proved to be malpositioned.

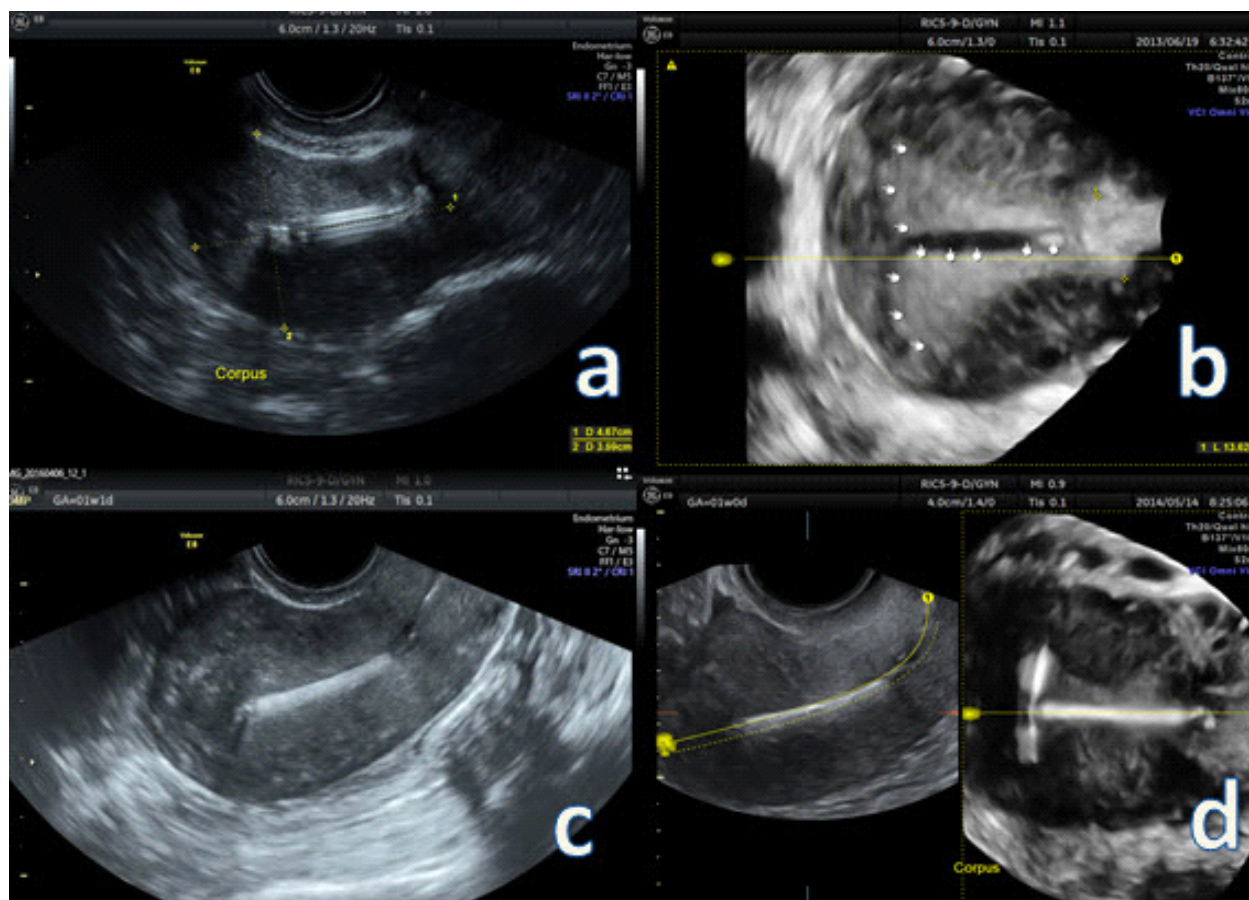
The detection rate of malpositioned IUDs using 3D reconstructions (96.1%) was higher than using 2D scans (76.9%) .

One single case of levonorgestrel-releasing IUD and one single case of copper IUD were recorded in a normal position both in 2D and also 3D (Figure 2.).

Only in one symptomatic patient, with recurrent vaginal bleeding, we could not obtain satisfactory 3D evaluation. Hysteroscopy was



**Figure 1.** a: 2D image of an apparently correct positioned IUD. b: 3D reconstruction of the same IUD, proving malposition.



**Figure 2.** a,b. 2D and 3D images of a correct positioned levonorgestrel-releasing IUD. c,d: 2D and 3D images of a correct positioned copper IUD.

performed to establish the condition of the uterine cavity and the position of the DIU, and a malpositioned levonorgestrel-releasing IUD was diagnosed.

In 83.3% of patients (5 out of 6 cases) with not satisfactory visualised IUDs in 2D, we found a uterine deviation (retroversion, laterodeviation or associations). In all these cases a malpositioned IUD was diagnosed further during the investigation protocol. Contrary, when using 3D technique, only one case out of 12 uterine deviations was improperly evaluated, requiring additional hysteroscopy. Therefore, using 3D technique, IUDs were properly seen in 91.6% cases of uterine deviations, compared with 58,3% when we used classic 2D investigation.

We present a diagram which synthesizes the results of our study (Figure3.).

### Discussions

Ultrasound assessment provides detailed information regarding the pelvic female anatomy and

has important advantages regarding the costs and the absence of exposure to radiation [3]. When compared to pelvic computed tomography and magnetic resonance, imaging 3D ultrasound reconstructions were introduced much recent, in addition to the 2D technique, but with very good accuracy regarding many gynecological conditions [4].

A study from 1998 indicated that approximately half of the women with malpositioned IUD have no symptoms, which is the reason that a migrated IUDs may remain undiagnosed for a long time [8]. Around 10% of IUDs are not correctly placed in the uterus and there is some concern that the malposition of an IUD can reduce its contraceptive efficacy. Although there is no recommendation for routine transvaginally ultrasound monitoring [9], still if women with IUD are symptomatic, ultrasound may be of great use

2D ultrasound evaluation of the IUD position has some limits as this imaging technique is based on

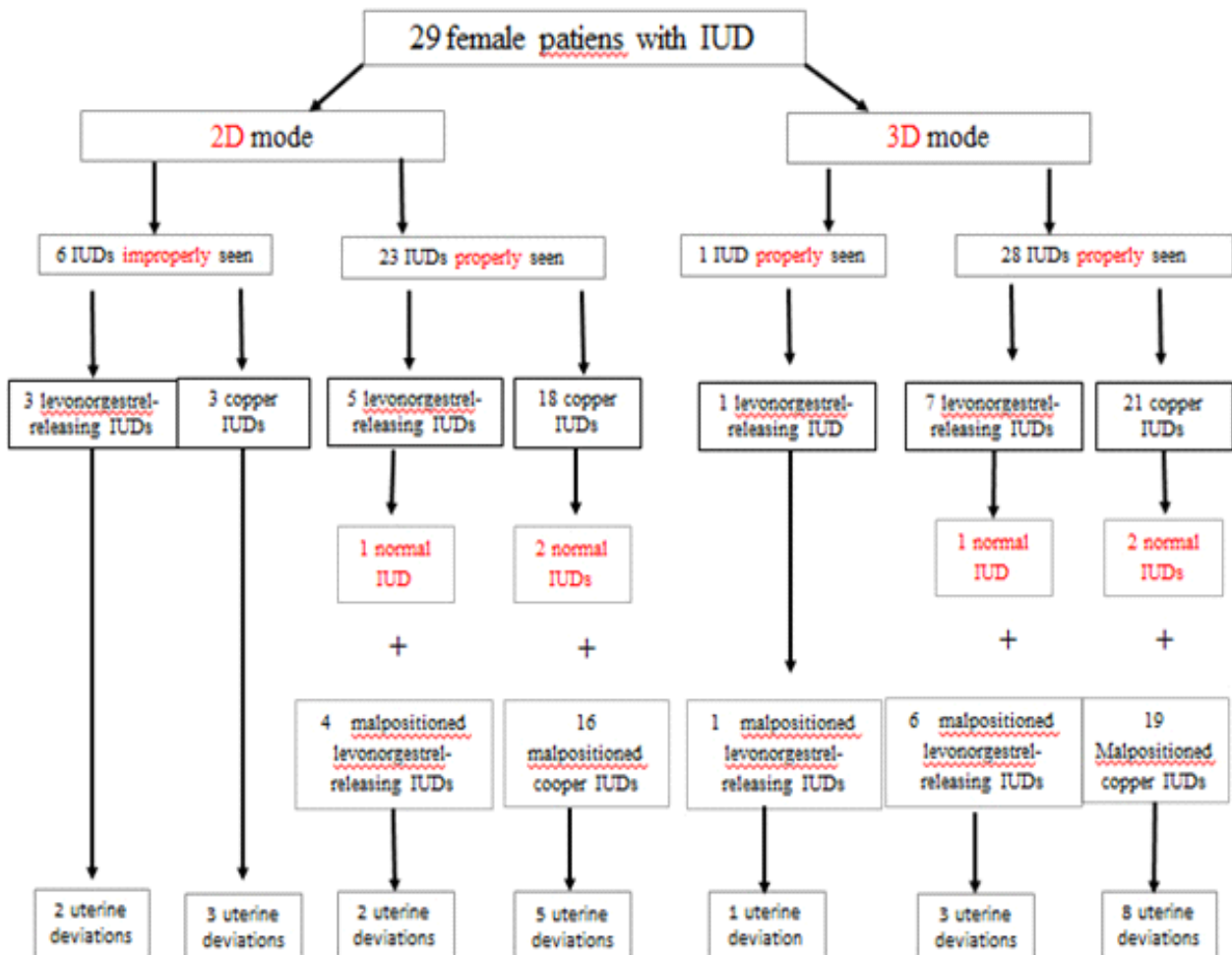


Figure 3. The results diagram of the study

the visualization of the IUD in the longitudinal and transverse plane and does not allow the assessment in the coronal plane, that usually coincides with the endometrial cavity and assures a much better evaluation of the IUD position. The advantage of the 3D technique is the capacity of obtaining a volume, with a subsequent reconstruction in the coronal plane that allows clearer information about the position and the structure of the IUD. Three-dimensional ultrasound enhances the conspicuity of both types of IUD [10]. This fact was shown by our study, as we obtained a better visualization of the uterine cavity and of the IUD in 79,3%, using 2D scan and in 96,5%, using 3D reconstruction. The detection rate for the incorrect position of the IUD was significantly higher using 3D reconstruction (96.1%) when compared to 2D assessment (76.9%).

2D ultrasound is considered in the literature the primary method to identify and to locate the copper IUDs due to its echogenicity. Indeed, in our study, 2D investigation performed well in satisfactory visualizing the ecogenic cooper IUD (85.7%) and in the diagnostic of its' incorrect position (84.2%). However, 3D ultrasound was superior, providing 100% rates of these parameters.

Regarding the assessment of the levonorgestrel-releasing IUDs, the 2D evaluation proved to be challenging due to the lack of echogenicity. In our study, 37.5% of the levonorgestrel-releasing IUDs were improperly seen using the 2D scan, while only 12.5% (1 out of 8 cases) could not be satisfactory evaluated using 3D technique.

Our present study showed IUDs malposition in cases with uterine deviations, diagnosed with 2D and 3D ultrasound evaluation. However, 3D ultrasound performed better in IUD malposition diagnosis, especially in the cases of uterine deviations (91.6% versus 58.3%), indifferently the echogenicity of the IUD. The lack of ultrasound investigation, or the solely use of 2D scan, may imply an incorrect etiological diagnosis of symptomatic IUD cases and also a potential failure of the IUD extraction, due to the unknown certain position of the IUD[11].

## Conclusion

3D ultrasound assessment followed by coronal plane reconstruction has proven a higher accuracy when compared to the 2D technique in the visualizaion of IUDs and the diagnosis of malpositioned IUDs. Although 2D ultrasound evaluation is recommended as routine follow-up of all users of IUD, 3D reconstructions should be recommended to symptomatic women when a malposition of the IUDs is suspected, especially in cases with abnormal uterine positions or levonorgestrel-releasing IUD users.

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