

# Role of Ultrasound in Follow Up of Intrauterine Contraceptive Device

**Amr Mostafa Abo Alfath, Ahmed Mohamed Elhousini, Lubna Elhassanin Awad, Ahmed Mohamed Abdelkader**

*Obstetrics and Gynecology Department, Faculty of Medicine, Zagazig University, Egypt*

**\*Corresponding author:** Lubna Elhassanin Awad

## **Abstract:**

Intrauterine contraceptive devices are safe, effective, reversible, and long-acting contraceptive methods that require accurate follow-up to confirm proper intrauterine position and detect possible complications. Ultrasound plays an essential role in the assessment of IUCD position, malposition, expulsion, embedment, and perforation. Although two-dimensional transvaginal sonography is commonly used for IUCD evaluation, it may be limited in visualizing the side arms and exact relationship of the device to the endometrial cavity. Three-dimensional transvaginal sonography provides a reconstructed coronal view of the uterus, allowing better visualization of the entire IUCD, especially the shaft and both arms, and improves detection of subtle malposition, embedment, and uterine cavity abnormalities. This mini-review highlights the role of ultrasound, particularly 3D transvaginal sonography, in the follow-up and evaluation of copper IUCD position and related complications.

**Keywords:** IUCD; Copper IUCD; Intrauterine contraceptive device; Ultrasound; 2D transvaginal sonography; 3D transvaginal sonography; IUCD malposition; IUCD displacement; IUCD embedment; IUCD perforation; IUCD expulsion.

## **Introduction:**

The intrauterine contraceptive device (IUCD) is a small, flexible contraceptive device made of plastic and other materials that is placed in the uterine cavity to prevent pregnancy. All types of IUCDs have one or two strings, or threads, attached to them. When the IUCD is in place, the strings hang through the opening of the cervix into the vagina. The IUCD provides safe, effective, reversible, long-term contraception for women effective for up to 12 years for the TCu-380A. However, since they are easy to remove, they also may be used for shorter periods of time for instance, for 2 or 3 years (1)

Intrauterine devices (IUDs) are a safe, cost-effective method of contraception and can be used in the management of idiopathic menorrhagia. The majority consist of a T-shaped frame, either copper-containing or hormone based. The only hormone-based IUD currently available in the UK is the levonorgestrel-releasing intrauterine system (LNg-IUS) marketed as Mirena. Diagnostic imaging plays an important role in the evaluation of IUDs, to visualise and assess if they are in the correct position to be effective and identify complications such as mal-position and perforation into, or even through, the myometrium. Traditionally, two-dimensional transvaginal ultrasound (2D TV US) is accepted as the best imaging technique to visualise and assess the position of an IUD within the uterus. 2D TV US is usually limited to longitudinal and transverse slices through the uterus. Three-dimensional transvaginal ultrasound (3D TV US) produces a volume of data containing any desired anatomical plane through the uterus. This allows a reconstructed coronal slice through the uterus to be commonly produced with 3D TV US, which is rarely seen with 2D TV US. The 3D-reconstructed coronal image can demonstrate the entire IUD in relation to the endometrial cavity, helping to rule out associated complications (Figure 1) (2).



Fig. (1) 3D-reconstructed coronal section of the uterus with an intrauterine device normally situated within the endometrial cavity (2).

Intrauterine devices (IUDs) are effective long-acting reversible contraceptives that are becoming increasingly utilized due to their high efficacy, ease of use, and ability to be placed postpartum. However, IUD migration can occur after insertion, with rates of malpositioning ranging from 10.4% to 25%. This can be associated with pain, bleeding, potentially decreased contraceptive efficacy, and expulsion (3). IUD positioning was historically evaluated with a string check by the patient or physician after insertion and more recently with routine two-dimensional transvaginal ultrasound (2D TVUS). While 2D imaging can confirm intrauterine positioning, it is often difficult to visualize the arms of the IUD, and it has been shown that an IUD that appears to be correctly placed on 2D ultrasound may actually be embedded or otherwise malpositioned. Furthermore, 2D ultrasound is inferior in detecting levonorgestrel-IUDs versus copper IUDs (4).

With the emergence of three-dimensional TVUS (3D TVUS), a reconstructed coronal view of the uterus can be obtained. This allows for imaging of the entire IUD including both arms and its orientation within the uterine cavity, which provides an improved ability to detect subtle changes in positioning such as embedment and malrotation (5). Three-dimensional imaging has also been shown to have significantly better diagnostic accuracy than 2D imaging and allows measurement of uterine cavity width on the coronal plane, which is important for women who are nulliparous and have a narrower mean width that may not accommodate a standard IUD. Despite these benefits, IUD placement is still not routinely evaluated with 3D ultrasound imaging by all physicians (6).

#### **Difference between 2D TVS and 3D TVS in follow up of copper IUCD**

Ultrasonography of the pelvis and especially the transvaginal route, plays an essential role in evaluating the IUD position and its potential complications, thus is considered the gold standard for this gynaecological condition (7). 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. 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. 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 (8).

Ultrasound assessment provides detailed information regarding the pelvic female anatomy and has important advantages regarding the costs and the absence of exposure to radiation. 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 (7).

2D ultrasound evaluation of the IUD position has some limits as this imaging technique is based on 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. 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%) (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 **Drăgușin et al., (8)** 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.

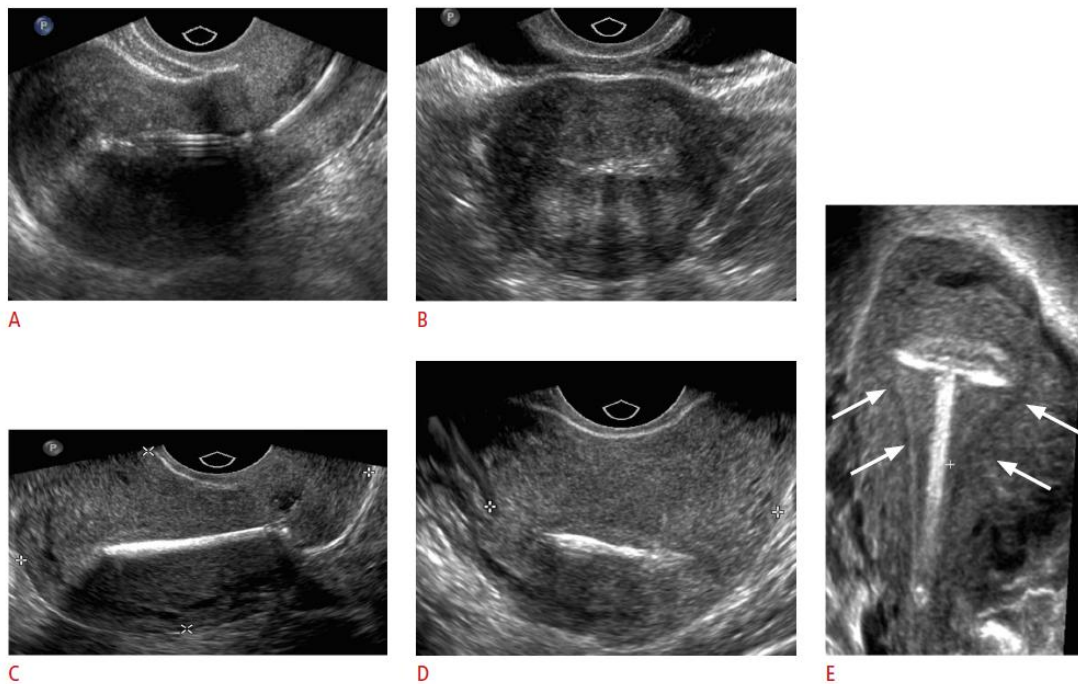
**Chen et al., (6)** showed that IUDs malposition in cases with uterine deviations, diagnosed with 2D and 3D ultrasound evaluation. However, 3D ultrasound performed better in IUD malposition diagnosis, especially in the cases of uterine deviations (91.6% versus 58.3%), indifferently the echogenicity 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.

IUDs are often seen incidentally during pelvic ultrasound examination, and it is important to be able to determine their position within the uterus accurately. Typically, a standard two-dimensional (2D) ultrasound examination demonstrates the shaft of the IUD with reasonable precision, but is often unable to show the location of the IUD side arms that are found on most IUDs currently in use. Three-dimensional (3D) ultrasound can be used to acquire a volume containing the entire uterine anatomy, from which the coronal plane of the endometrial cavity can be reconstructed. The coronal view of the uterus is particularly well-suited to demonstrate the relationship of the entire IUD, including the shaft and both arms, to the endometrial cavity. Such a coronal reconstructed view can demonstrate the exact position of the IUD, and specifically whether the side arms of the device are located abnormally, embedded within the myometrium (10).

Three-dimensional ultrasound has been introduced in the evaluation of women with IUDs and appears to be more clinically useful than 2D ultrasound because 3D ultrasound can locate the IUD in a volume, which is more accurate. However, these studies comparing 2D with 3D ultrasound have primarily focused on women with copper-containing IUDs (9).

#### **Criteria of normal and abnormal position of copper IUCD by 2D TVs and 3DTVS**

Imaging plays a crucial role in the management of patients with IUDs. Ultrasonography is the most common initial method of evaluation due to its cost-effectiveness, lack of ionizing radiation, and greater detail of pelvic anatomy. The stem is usually easily identified on standard two-dimensional (2D) transvaginal ultrasonography (TVUS) as a linear echogenic structure (Fig. 2AD). While the arms of the copper IUD are also fully echogenic, the arms of the levonorgestrel-releasing IUD are only echogenic at the proximal and distal ends, with characteristic central posterior acoustic shadowing on transverse images (Fig. 2D). Three dimensional (3D) reconstructions are increasingly being used, particularly in the coronal view, which allows for a more careful evaluation of the arm positioning (Fig. 2E) (4). In one study, all 28 cases of side-arm embedment into the myometrium could only be detected on the 3D coronal view (11).



**Fig 2:** Transvaginal ultrasonographic appearance of T-shaped intrauterine devices (IUDs). A, B. Two-dimensional (2D) sagittal (A) and transverse (B) sonograms show hyperechoic levonorgestrel-releasing IUD in the endometrial cavity. C, D. 2D sagittal (C) and transverse (D) sonograms show the bright echo of the copper IUD with marked posterior shadowing. E. Three-dimensional coronal reformatted sonogram demonstrates the properly positioned copper IUD within the endometrial cavity (arrows) (4).

The malpositioned IUD can be considered a spectrum of abnormal positioning (Table 1). At one end of the spectrum is complete ‘expulsion’ through the external cervical os. At the other end is complete ‘perforation’ through the uterine serosa with migration of the device into the intraperitoneal space. Along the spectrum is ‘displacement’ from the proper positioning within the fundus into the lower uterine segment or cervix and ‘embedment’ of a portion of the stem or arms into the myometrium without penetration of the serosa. These descriptions are non-exclusive. For instance, a displaced IUD may also be partially embedded. In one retrospective study of ultrasonography for any indication in patients with IUDs, almost 11% were malpositioned. Malposition is more often associated with symptoms of pain and excess bleeding but can also be asymptomatic. It is suspected clinically when there is shortening, lengthening, or absence of retrieval strings on pelvic exam (12).

**Table 1.** Types of malpositioned intrauterine devices

Malposition	Definition
Expulsion	Passage either partially or completely through the external cervical os
Displacement	Rotation or inferior positioning in the lower uterine segment or cervix
Embedment	Penetration of the myometrium without extension through the serosa
Perforation	Penetration through both the myometrium and the serosa, partially or completely

### Expulsion

The expelled IUD has passed inferiorly, either partially or completely through the external cervical os. The expulsion risk is greatest in the first year of use and the expulsion rate is highest with immediate postpartum placement after vaginal delivery. A large retrospective study showed first-year expulsion rates of approximately 6% with TCu280A and 3% with Mirena (13).

### Displacement

Displacement refers to any IUD that is rotated from the normal transverse position or located away from the fundus and within the lower uterine segment or cervix (Fig. 3 A,B). Early studies defined displacement as a distance of more than 3 mm between the IUD and the uterine fundus, which was initially thought to be associated with a high risk of expulsion (4).

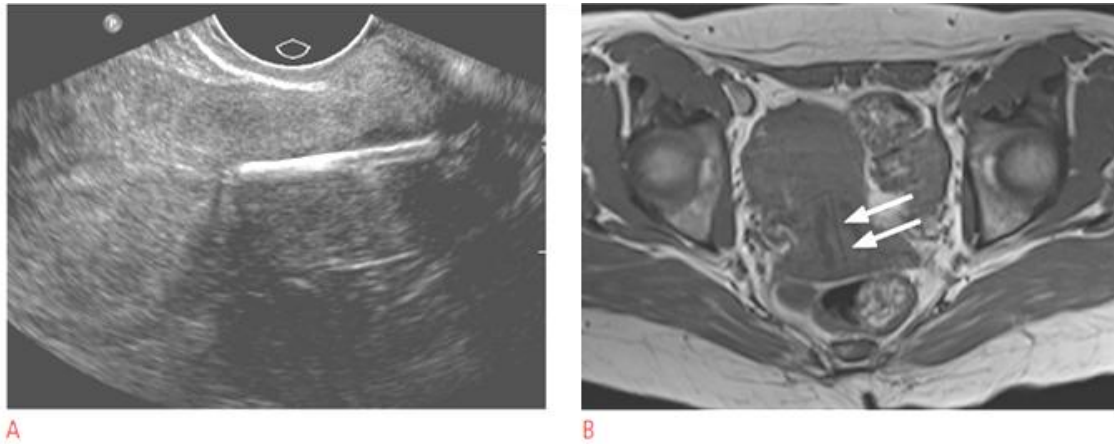


Fig. 3. Incidentally detected displaced intrauterine device (IUD) in a 38-year-old female. A. Sagittal transvaginal sonogram demonstrates the echogenic IUD stem within the cervix. B. Axial T1-weighted magnetic resonance image shows the low-signal IUD stem within the cervix (arrows). (4)

#### Embedment

Embedment refers to the penetration of the myometrium by the arm or stem of the IUD without extension through the serosa. When involving the stem, this may be obvious on standard 2D TVUS, but in cases of more subtle arm embedment, 3D coronal images allow for better detection (Figs. 4,5). With the added sensitivity of 3D techniques, the incidence of embedment was found to be as high as 16.8%. Extension into the myometrium is thought to occur at the time of insertion. When these findings are associated with symptoms of pain or abnormal bleeding, IUD removal is recommended (14).

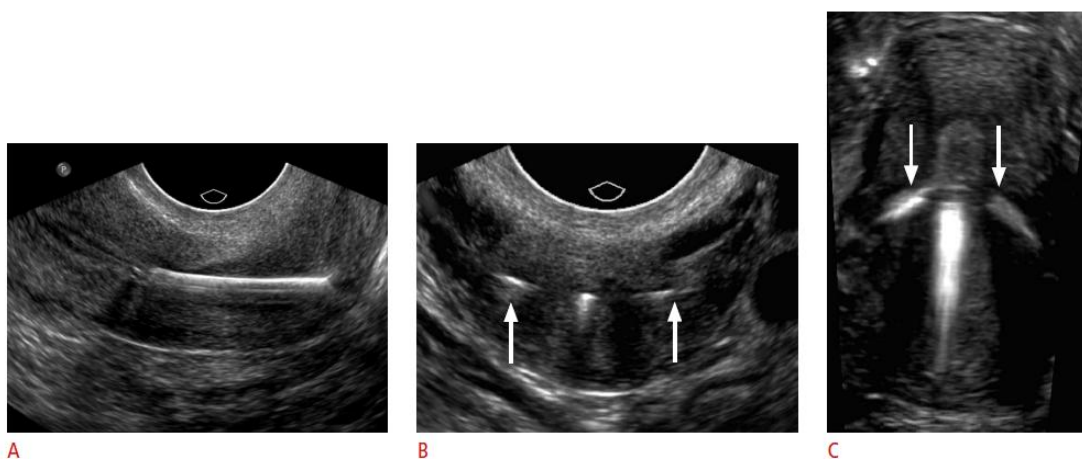
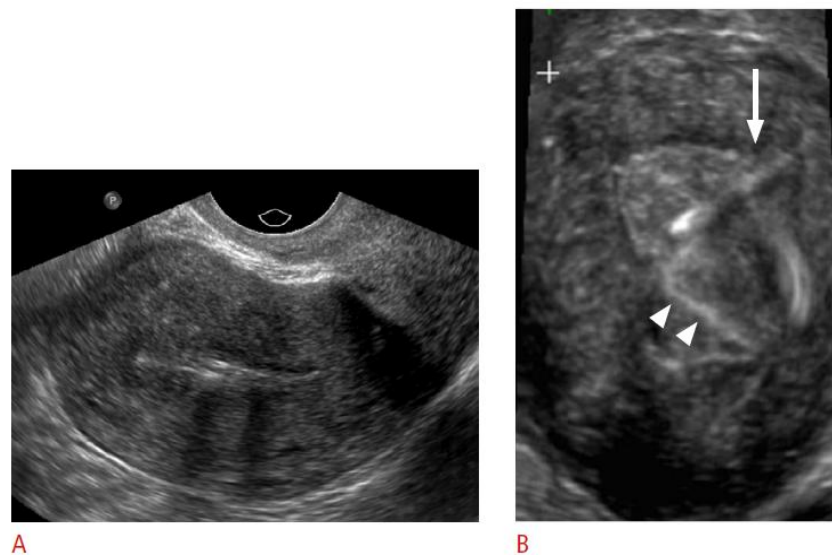


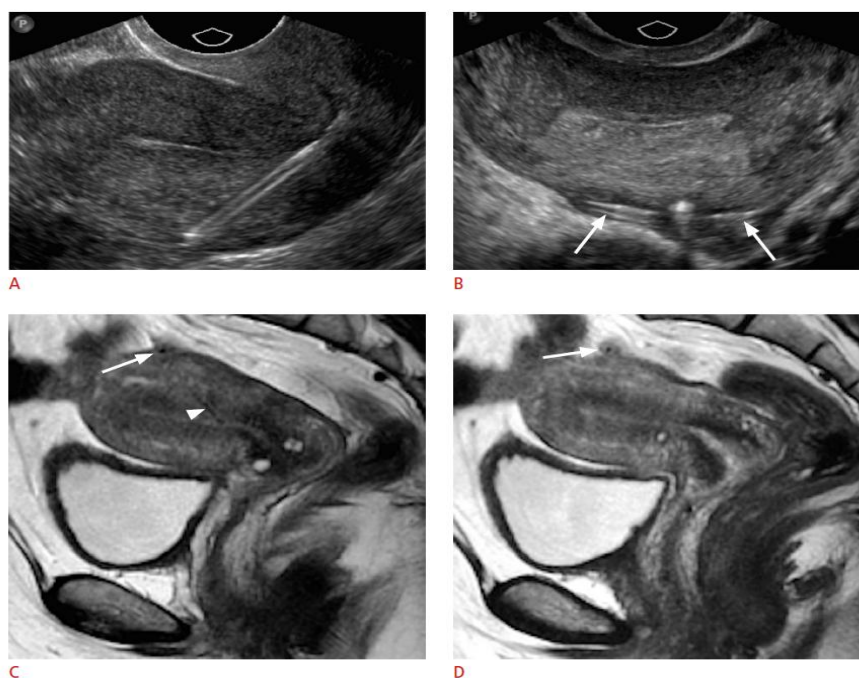
Fig. 4. Embedded intrauterine device (IUD) in a 24-year-old female with menorrhagia and unsuccessful attempts at IUD removal. A. Sagittal transvaginal sonogram shows inferior displacement of a copper IUD within the cervix. B. Transverse transvaginal sonogram of the cervix shows the arms of the IUD extending into the cervical wall (arrows). C. Three-dimensional coronal sonogram better demonstrates both arms embedded within the myometrium (arrows). The IUD was subsequently removed under anesthesia (4).



**Fig. 5.** Embedded intrauterine device (IUD) in a 31-year-old female presents with the absence of retrieval strings. A. Sagittal transvaginal sonogram shows the IUD within the endometrial canal. B. Three dimensional coronal sonogram more clearly demonstrates the IUD obliquely tilted and embedded in the left uterine myometrium (arrow). The echogenic retrieval string is seen within the endometrial canal (arrowheads) (4).

### Perforation

The perforated IUD may penetrate through the serosa, either partially (Fig. 6) or completely with migration into the intraperitoneal cavity (Fig. 7). As with embedment, perforation occurs at the time of insertion. Perforation through the serosa occurs in one to two cases per 1,000 and is more often seen with inexperienced operators, with early postpartum placement, and in women with either few prior pregnancies or multiple miscarriages (15).



**Fig. 6.** Partially perforated intrauterine device (IUD) in a 43-year-old female with shortened retrieval strings. A. Sagittal transvaginal sonogram shows the stem extending through the myometrium of the posterior wall. B.

Transverse transvaginal sonogram shows the arms extending outside the serosa (arrows). C, D. Midline (C) and left lateral (D) sagittal magnetic resonance images demonstrate correlated findings of the low-signal IUD coursing through the posterior myometrium (arrowhead) with the arms extending through the serosa (arrows). (4)

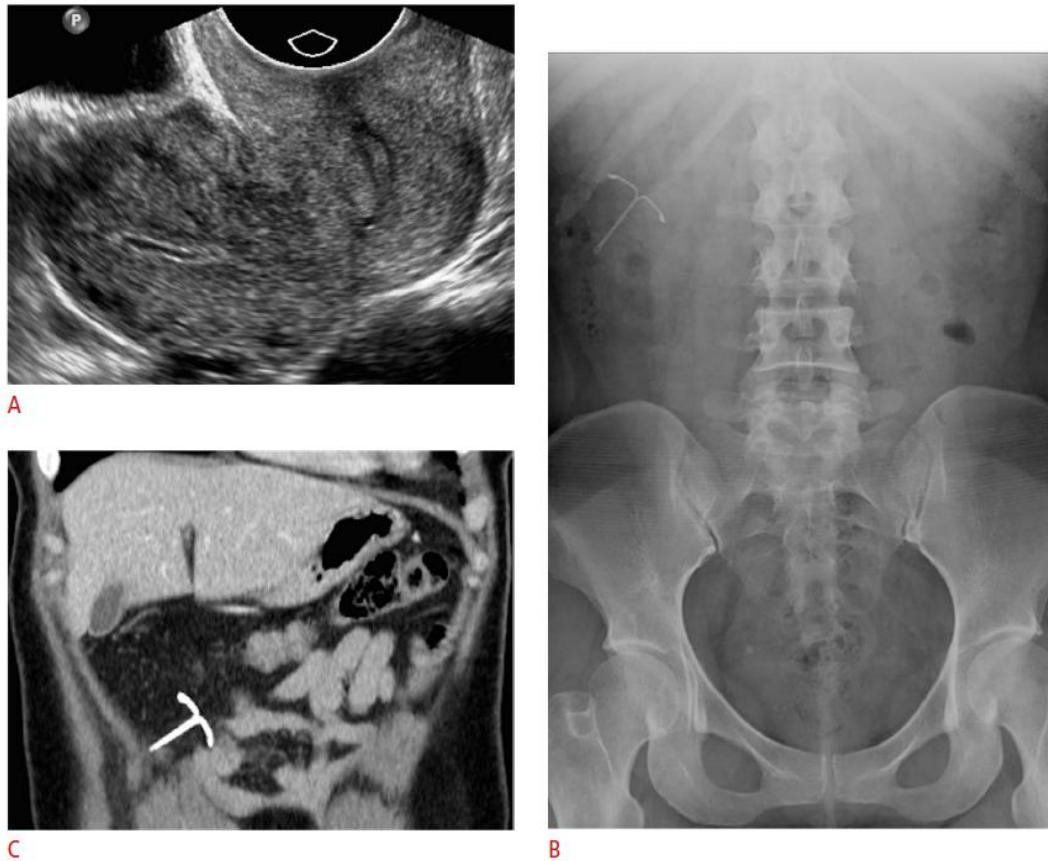


Fig. 7 Complete intrauterine device (IUD) perforation with intraperitoneal migration in a 30-year-old female with absent retrieval strings and right upper-quadrant abdominal pain. A. Transvaginal ultrasonography was unable to identify an IUD within the uterus or cervix. B. Frontal radiograph of the abdomen and pelvis shows the IUD in the right upper-quadrant. C. Contrast-enhanced computed tomography (CT) was ordered to assess for bowel injury given the patient's abdominal pain. Coronal CT image demonstrates the IUD within the omentum without evidence of bowel injury. The IUD was removed laparoscopically and was found to be entangled within the greater omentum. (4)

Adhesions that form as a result of a foreign body reaction to the perforated IUD can involve the fallopian tubes and result in decreased fertility. Cases of complete perforation can also rarely be associated with injury to adjacent structures, most often the bowel. If an IUD cannot be identified on initial ultrasonography, abdominal radiographs are required to locate the IUD. Cross-sectional imaging can be used for surgical planning and to evaluate for complications such as abscess formation or bowel injury. Management includes surgical removal, which can usually be done laparoscopically (15).

#### References:

1. Jatlaoui, T. C., Riley, H. E., & Curtis, K. M. (2017). The safety of intrauterine devices among young women: a systematic review. *Contraception*, 95(1), 17-39.
2. Kerr, N. K., Dunham, R., Wolstenhulme, S., et al. (2014). Comparison of two-and three-dimensional transvaginal ultrasound in the visualisation of intrauterine devices. *Ultrasound*, 22(3), 141-147.
3. Buhling KJ, Zite NB, Lotke P, et al. (2014). Worldwide use of intrauterine contraception: a review. *Contraception* 2014;89:162-173.

4. Nowitzki, K. M., Hoimes, M. L., Chen, B., et al. (2015). Ultrasonography of intrauterine devices. *Ultrasonography*, 34(3), 183-194.
5. Benacerraf, B. R. (2019). Three-dimensional volume imaging in gynecology. *Obstetrics and Gynecology Clinics*, 46(4), 755-781.
6. Chen, X. Y., Guo, Q. Y., Wang, W., et al. (2015). Three-dimensional ultrasonography versus two-dimensional ultrasonography for the diagnosis of intrauterine device malposition. *International Journal of Gynecology & Obstetrics*, 128(2), 157-159.
7. Kristina M. Nowitzki, Matthew L. Hoimes<sup>1</sup>, Byron Chen, Larry Z. et al. (2015). Ultrasonography of intrauterine devices. *Ultrasonography*. 2015 Jul;34(3):183- 94.
8. Drăgușin, R., Florea, M., Pătru, C., et al. (2016). Benefits of 3D ultrasound in the diagnosis of intrauterine device malposition. *Obstet Gynecol*, 64, 97-101.
9. Moschos, E., & Twickler, D. M. (2011). Does the type of intrauterine device affect conspicuity on 2D and 3D ultrasound?. *American journal of roentgenology*, 196(6), 1439-1443.
10. Nosseir, M. A., Sharaf Eldeen, A. A., Soliman, M. T., et al. (2024). Role of 3D-Ultrasound in Patients with Abnormal Uterine Bleeding for Detection of IUCD Malposition. *Benha medical journal*, 41(4), 1-9.
11. Berger-Kulemann V, Einspieler H, Hachemian N, et al. (2013). Magnetic field interactions of copper-containing intrauterine devices in 3.0-Tesla magnetic resonance imaging: In vivo study. *Korean J Radiol*;14:416-422
12. Braaten KP, Benson CB, Maurer R, et al. (2011). Malpositioned intrauterine contraceptive devices: risk factors, outcomes, and future pregnancies. *Obstet Gynecol*;118:1014-1020
13. Aoun, J., Dines, V., Stovall, D., et al. (2014). Effects of age, parity, and device type on complications and discontinuation of intrauterine devices. *Obstetrics & Gynecology*, 123(3), 585-592.
14. Braaten, K. P., & Goldberg, A. B. (2012). Malpositioned IUDs: when you should intervene (and when you should not). *OBG management*, 24(8), 38-46.
15. Caliskan, E., Öztürk, N., Dilbaz, B. Ö., et al. (2003). Analysis of risk factors associated with uterine perforation by intrauterine devices. *The European Journal of Contraception & Reproductive Health Care*, 8(3), 150-155.