The Medical Journal of Tikrit University (2022) 28 (2): 148-160
DOI: http://dx.doi.org/10.25130/mjotu.28.2.13

IRAQI Academic Scientific Journals

ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at:www.mjotu.com

MJTU

The Medical Journal of Tikrit University

Role of Three-dimensional Ultrasound Imaging in the detection of the Intra Uterine Contraceptive Device Malposition

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***Keywords*:**

Malposisition, IUCD, three-dimensional, ultrasonography

ARTICLE INFO

Article history:

Received 19 Aug 2022
Accepted 25 Sep 2022
Available online 31 Sep 2022

Citation: Mariam S. Ibrahem; Israa H. Abdulkareem. Role of Three-dimensional Ultrasound Imaging in the detection of the Intra Uterine Contraceptive Device Malposition. The Medical Journal of Tikrit University (2022) 28 (2): 148-160

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ABSTRACT

Background: Three-dimensional ultrasonography enhances the imaging capabilities of two-dimensional ultrasonography because of its additional capability to reconstruct the coronal view. It is particularly useful for visualizing the intrauterine contraceptive device position in relation to the endometrial cavity.

Aim: To estimate the role of three-dimensional ultrasonography ultrasound in the detection and evaluation of intrauterine contraceptive device malposition and other complications. To determine the commonest risk factors and presentations of the intrauterine contraceptive device malposition.

Patients and Method: A cross-sectional study was conducted in the Salahadeen General Hospital and a private ultrasound clinic during the period from the 1st of January to the 30th of June 2022. A convenient sample of 100 women who had an intrauterine contraceptive device.

Results: The pain was presented in 24% of the participants, while 22% of them had bleeding. The conspicuity was significantly higher with three-dimensional ultrasonography ultrasound use than with two-dimensional ultrasonography use. About 33 (33%) of participants had intrauterine contraceptive device malposition by using three-dimensional ultrasonography ultrasound, and 11(33.3%) of them had normal positions on two-dimensional ultrasonography ultrasound

Conclusion: Three-dimensional ultrasonography was better than two-dimensional ultrasonography in the detection of intrauterine contraceptive device malposition in symptomatic and asymptomatic women.

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Introduction:

Intrauterine contraceptive device (IUCD) is considered one of the most acceptable and effective contraceptive methods used[1]. These devices are reliable, cost-effective, long-acting, and reversible and can be used by a wide range of women[2]. According to the 2018 Iraq Multiple Indicator Cluster Survey, 52.8% of currently married Iraqi women used a contraceptive method at some time during their life[3].

In 1960, a T-shaped product that was better suited to the uterus' natural shape gave rise to the modern IUCD. IUCD started to gain popularity in the middle of the 1960s and has fewer potential cardiovascular risks than oral contraceptives. The IUCDs are now a crucial part of family planning[4].

Their placement in the uterus is usually a simple and safe gynecological procedure[2]. The most renowned advantage of IUCD uses is the long-acting reversible system with minimal complications and needs lesser clinical follow up visits. Albeit its advantages, IUCD could cause some harmful and undesirable effects. Malposition of IUCD is considered one of the most undesirable events that may occur[5]. IUCD malposition can be classified into expulsion, displacement, embedment, and perforation[6]. Among them, the majority were missing the IUCDs, and most of the missing IUCDs were found in the uterus[7].

Several risk factors for uterine perforation have been described including breastfeeding, postpartum state, lack of experience of the healthcare professional performing the insertion, multiparity, nulliparity, and history of cesarean delivery[8].

For the assessment of women who present with a variety of gynaecological complaints, ultrasound is frequently used. It also offers clear images of an IUCD inside the uterus[9]. Therefore, after an IUCD has been implanted, ultrasound is frequently used to check its location. If the threads are hidden, they can also be used to find

an IUCD. In gynaecology, particularly in the areas of reproductive medicine and assisted reproduction, ultrasound-guided procedures are frequently used. During intrauterine gynaecological procedures, ultrasound guidance may also be used to reduce the risk of uterine perforation and other complications[10].

Without the coronal view, the IUCD might not be fully visible on a two-dimensional (2D) ultrasound scan. Additionally, according to reports, 2D ultrasonography is unable to diagnose about 9% of cases of IUCD malposition. Due to its additional ability to reconstruct the coronal view, three-dimensional (3D) ultrasonography improves the imaging capabilities of two-dimensional (2D) ultrasonography. When using 3D ultrasonography, the coronal view of the uterus is especially helpful for determining the position of the IUCD in relation to the endometrial cavity[11].

The study aimed to estimate the role of 3D ultrasound in the detection and evaluation of IUCD malposition and other complications and determine the commonest risk factors and presentations of IUCD malposition.

Patients and method

A cross-sectional study was conducted in the Salahadeen General Hospital /Gynecology and Obstetrics department and a private ultrasound clinic for the period from the 1st of January to the 30th of June 2022.

A convenient sample of 100 women who had IUCD and attended because of gynaecological symptoms related to IUCD or other causes. There were no exclusion criteria. All women who accepted to participate in this study were enrolled.

The data was collected through a direct interview and history taking, examination, and ultrasound examination, including 2D and 3D ultrasounds. The questionnaire contained closed-end questions that were prepared by the researcher with the revision of the supervisor. The

data collection was done through three steps:

Step one: History taking, including age, gravidity, number of previous cesarean sections (CS), history of the gynaecological disease, and type of IUCD. In addition to gynaecological symptoms, including pelvic pain and bleeding.

Step two: Calculation of body mass index by examination of the weight and height.

The weight and height were measured and accordingly, the body mass index (BMI) was calculated according to the formula:

BMI= weight (Kg) / **(**height (m)**)**^{2}[12]

Step three: Ultrasound examination

All women undergoing gynaecological sonography have a 3D volume acquisition of the uterus in addition to the standard 2D ultrasound evaluation, regardless of the indication for the scan.

To standardize the visualization of the IUCD, we formulated a quantitative conspicuity score. The conspicuity of the IUCD was scored on 2D sagittal and transverse planes and a 3D coronal view according to a 7-point scale. In the sagittal plane, 1 point each was given if the lower and upper poles of the IUCD shaft could be seen, with 3 points given if the shaft was seen in its entirety. In the transverse plane, 1 point each was assigned for visualization of the right and left arms of the IUCD and 1 point for visualization of the intersection of the crossbar and shaft, with 4 points given if the entire crossbar was seen in the transverse plane. In the 3D coronal view, the IUCD was scored using the same scale described. The IUCD was considered malpositioned if any part extended into the myometrium, isthmus, or endocervix[13, 14].

The software package of social science (SPSS) version 22 was used for data entry and analysis. The descriptive analysis will focus on frequencies and percentages. Continuous variables will be presented as mean (± Standard Deviation (SD)). Chi-square test,

Fisher's Exact test, and t-test were used to determine the significance of the difference between the study groups. A P-value of less than 0.05 will be considered statistically significant.

A total of 100 women were included in the current study, more than half of the participants had aged between 20-29 years old and more than half of them had overweight, as shown in table 1.

Results

Table1: Age, body mass index, and obstetrical history of the participants

Characteristics of the participants		NO. (%)
Age group (years)	<20	7 (7)
	20-29	58 (58.0)
	30-39	28 (28.0)
	≥40	7 (7.0)
Body mass index	Underweight	0 (0.0)
	Normal weight	39 (39.0)
	Overweight	51 (51.0)
	Obese	10 (10.0)
Parity	3	3 (3.0)
	4	34 (34.0)
	5	28 (28.0)
	6	17 (17.0)
	7	11 (11.0)
	8	3 (3.0)
	9	4 (4.0)
Cesarean section	0	69 (69.0)
	1	13 (13.0)
	2	11 (11.0)
	3	7 (7.0)

Regarding the type of IUCD, most of the participants (72%) had non-hormonal IUCD (Figure 1).

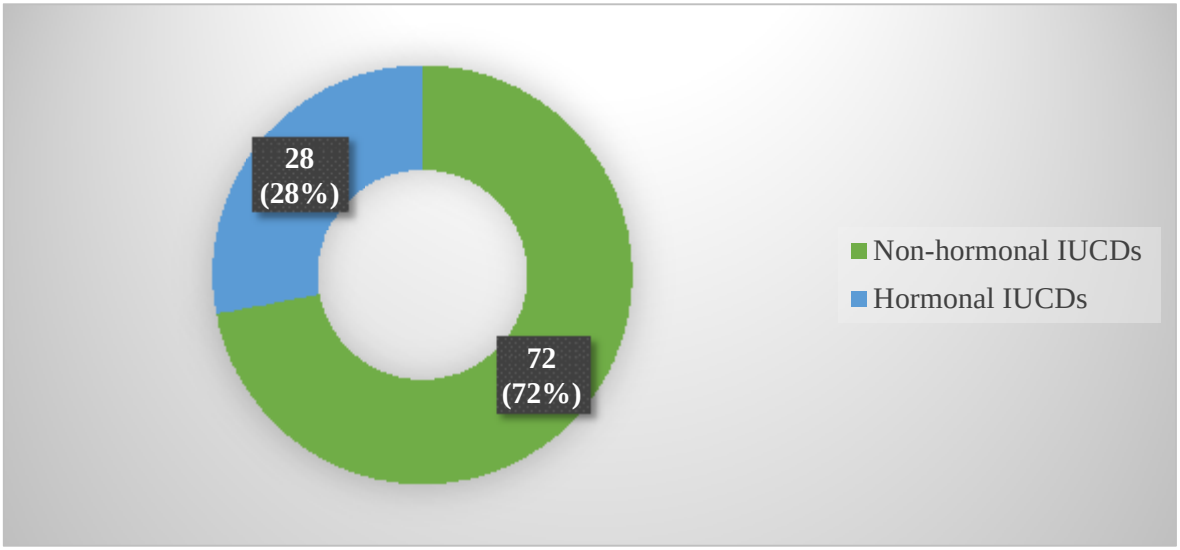

Figure 1: Type of the intrauterine contraceptive device

The pain was presented in 24% of the participants, while 22% of them had bleeding. The fibroid was discovered incidentally during the ultrasound examination in 9%of the participants, as shown in table 2.

Table 2: Symptoms and uterine abnormalities

Chronic disease		No. (%)
Symptoms (N=25)	Pain	24 (24.0)
	Bleeding	22 (22.0)
Uterine abnormalities (N=11)	Fibroid	9 (9.0)
	Septate	2 (2.0)
	Bicornuate	2 (2.0)

Some women had more than one symptom and more than one uterine abnormality

The conspicuity was significantly higher with 3D ultrasound use than with 2D ultrasound use (Table 3). between the

Table 3: Association between Conspicuity and the type of the intrauterine contraceptive device

Types of IUCD	Conspicuity of IUCDs		
	2D ultrasound	3D ultrasound	P-value
	Mean (±SD)	Mean (±SD)	
All IUCD	3.2 (1.0)	5.9 (0.8)	0.001
Hormonal IUCD	4.1 (0.9)	6.3 (0.8)	0.001
Non-hormonal IUCD	2.6 (0.6)	5.7 (0.7)	0.001

t-test

About 33 (33%) participants had IUCD malposition by using 3D ultrasound, and 11 of them had normal positions on 2D ultrasound (Table 4).

Table 4: the intrauterine contraceptive device malposition according to the 2D and 3D ultrasound

		3D ultrasound		Total	P-value
		Normal position NO. (%)	Malposition NO. (%)		
2D ultrasound	Normal position	67 (100.0)	11 (33.3)	78 (78.0)	0.001
	Malposition	0 (0.0)	22 (66.7)	22 (22.0)	
Total		67	33	100	
		(67.0)	(33.0)	100.0%	

Pearson Chi-Square

Out of 33 participants who were diagnosed with IUCD malposition, 8 (24.2) had low lying IUCD that was not extended to the cervix, and 4 (12.1%) of them had completely embedment IUCD, as shown in figure 2.

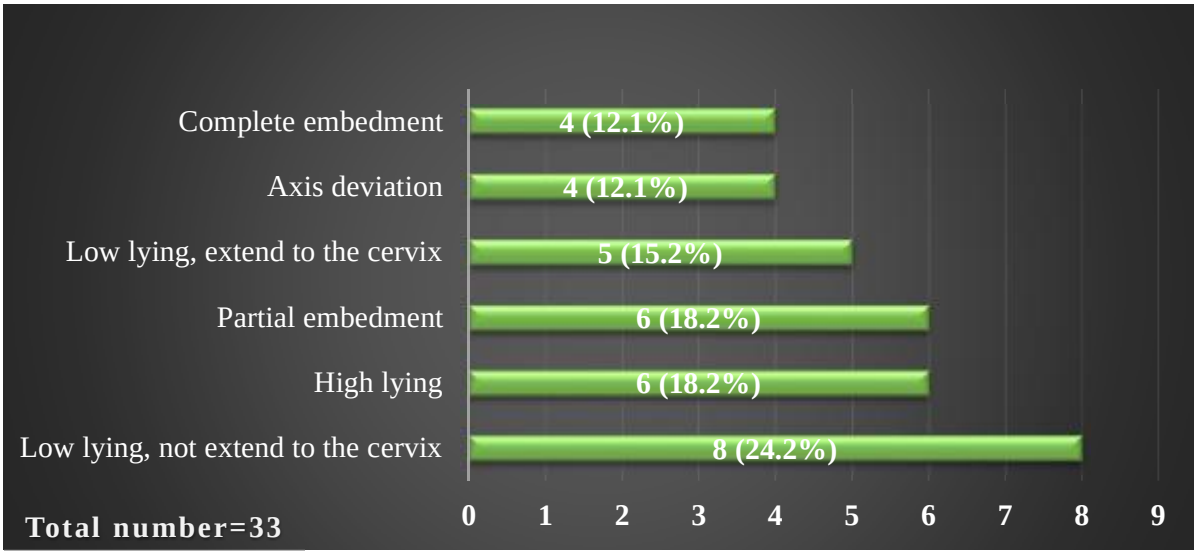

Figure 2: Frequency of the malposition among the participants

There was s significant association between uterine abnormalities and IUCD malposition, as shown in table 5.

Table 5: Association between the IUCD position and uterine abnormalities

Uterine abnormalities		3D ultrasound		Total	P-value
		Malposition NO. (%)	Normal position NO. (%)		
Fibroid	Yes	7 (21.2)	2 (3.0)	9 (9.0)	**0.005**
	No	26 (78.8)	65 (97.0)	91 (91.0)	
Septate	Yes	1 (3.0)	1 (1.5)	2 (2.0)	1.000
	No	32 (97.0)	66 (98.5)	98 (98.0)	
Bicornuate	Yes	1 (3.0)	1 (1.5)	2 (2.0)	1.000
	No	32 (97.0)	66 (98.5)	98 (98.0)	

Fisher's Exact test (2 cells (50.0%) have an expected count of less than 5.

A significant association was obtained between the presence of pain (P-value= 0.001) bleeding pain (P-value= 0.001), missing IUCD string and IUCD malposition pain (P-value= 0.001) (Table 6).

Table 6: Association between the IUCD position and symptoms of abnormalities

		3D ultrasound		Total	P-value
		Malposition N. (%)	Normal position NO. (%)		
Bleeding	Yes	20 (60.6)	2 (3.0)	22 (78.0)	0.001
	No	13 (39.4)	65 (97.0)	78 (78.0)	
Pain	Yes	22 (66.7)	2 (3.0)	24 (76.0)	0.001
	No	11 (33.3)	65 (97.0)	24 (24.0)	
missing IUCD strings	Yes	25 (75.8)	3 (4.5)	28 (28.0)	0.001
	No	8 (24.2)	64 (95.5)	72 (72.0)	

Pearson Chi-Square

The percentage of IUCD malposition was significantly higher in participants with overweight (P-value=0.001), as shown in table 7.

Table 7: Association between the IUCD position and age and body mass index of the participants.

		3D ultrasound		P-value
		Malposition NO. (%)	Normal position NO. (%)	
Age	<20	2 (28.6)	5 (71.4)	0.569
	20-29	18 (31.0)	40 (69.0)	
	30-39	9 (32.1)	19 (67.9)	
	≥40	4 (57.1)	3 (42.9)	
Body mass index	Underweight	0 (0.0)	0 (0.0)	0.001
	Normal weight	6 (15.4)	33 (84.6)	
	Overweight	19 (37.3)	32 (62.7)	
	Obese	8 (80.0)	2 (20.0)	

Pearson Chi-Square test

The was a significant association between IUCD malposition and the number of CS (P-value=0.001), as shown in table 8.

Table 8: Association between the IUCD position and parity, cesarean section, and IUCD type

		3D ultrasound		P-value
		Malposition NO. (%)	Normal position NO. (%)	
Parity	3	0 (0.0)	3 (100.0)	0.007
	4	8 (23.5)	26 (76.5)	
	5	7 (25.0)	21 (75.0)	
	6	5 (29.4)	12 (70.6)	
	7	7 (63.6)	4 (36.4)	
	8	3 (100.0)	0 (0.0)	
	9	3 (75.0)	1 (25.0)	
Cesarean section	0	18 (26.1)	51 (73.9)	**0.037**
	1	4 (30.8)	9 (69.2)	
	2	6 (54.5)	5 (45.5)	
	3	5 (71.4)	2 (28.6)	
IUCD type	Non-hormonal	24 (333)	48 (66.7)	0.909
	Hormonal	9 (32.1)	19 (67.9)	

Pearson Chi-Square test

Discussion

The first finding of the current study was that most participants (62%) used non-hormonal IUCD. The same result was obtained by another as most of the participants there used non-hormonal IUCD[15].

In the current study, the conspicuity of the 3D ultrasound was significantly higher than the 2D ultrasound. In addition, the percentage of women who were diagnosed with IUCD malposition by 3D ultrasound was significantly higher than that of 2D ultrasound. In agreement, the same results were obtained by another study that was done in the United States by Elysia et al.[14]. The same results were obtained by another study that was done by Benacerraf et al.[13].

About one-third of the women had IUCD malposition, lying low without extending to the cervix was the most common malposition followed by high lying and partial embedment. In comparison, another study that was done revealed that 3.52% (17/482) of the patients had partial perforations or IUCD embedded in the uterine wall and 0.6% (3/482) had misplaced IUCD (transmigrated IUCD)[16]. In India, a study was done there that revealed that 44% of the participating women had IUCD malposition[17].

There was no significant association between the IUCD malposition and the type of the IUCD. In comparison, the same results were obtained by another study that was done by Sabrina et al[15].

The IUCD malposition was significantly associated with bleeding, pain, and/or missing IUCD strings. In comparison, the same results were obtained by the other study that was done in the United States by Sabrina et al.[18]. Another study reported that, in cases of missing threads with interval IUCD, 98% of IUCD were normally positioned, in 1.2% the IUCD was expelled and in 0.7%, the IUCD had caused uterine perforation. In women with IUCDs and missing threads, one should always consider the

possibility of a malpositioned IUCD[19].

The current study revealed a significant association between IUCD malposition and the number of CS. The same result was obtained by another study that was done by Sabrina et al. as the increased number of CS was associated with an increased risk of IUCD malposition[15].

In conclusion, the 3D ultrasound was better than the 2D ultrasound in the detection of the IUCD malposition in symptomatic and asymptomatic women. The prevalence of IUCD malposition was significantly associated with missing IUCD strings, pain, bleeding, pain, presence of fibroid, and the number of previous CS.

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