Does Uterine Artery Doppler or Copper Intrauterine Device Location by Three Dimensional Transvaginal Ultrasound Correlates with Clinical Symptoms?

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Abstract

Aim of Study: Evaluation of using 3Ds ultrasound in location of intrauterine copper T 380 A IUD and Doppler uterine artery study in patients complaining of vaginal bleeding and pain.

Methods: This cross sectional study was conducted in Zagazig University Hospital, Obstetrics & Gynecology departments, 3D transvaginal ultrasound examinations were carried out to 180 women whom inserted the IUD 6-12 months duration. Seventy women were suffering from pain (group I) and forty four complaining of menorrhagia (group II) compared to sixty six control women (group III). Measurements were defined as the distance between top of the IUD and inner endometrium (IUD-E) as well as IUD and myometrium at the fundus (IUD-M), IUD and fundus (IUD-F) and lastly the distance between the ends of IUD and the sidewall of uterus (IUD-S). Doppler uterine artery pulsitility index was measured in all women.

Results: No statistical significant differences were found between the three groups as regards IUD-E, IUD-M, IUD-F and IUD-S. Mean uterine artery pulsitility index was significantly lower in women suffering from pain with IUD than women with menorrhagia; and both groups had lower mean pulsitility index than control group (2.1±1.0, 2.4±0.41, 2.6±0.8 respectively, p<0.05). Pulsitility index PI ≤1.5 could predict IUD complains with the sensitivity 71.1%, specificity 65.2%, positive predictive value 77.9%, negative predictive value 56.6% and accuracy 68.8%.

Conclusion: 3D ultrasound IUD site did not differ between IUD complaining and non complaing women but pulsitility index of uterine artery is lower in women with IUD and suffering from bleeding or pain.

Key Words: Uterine artery doppler – IUD – 3Ds – Transvaginal.

Introduction

AN intrauterine device is highly effective and prevalent form of birth control with a law failure rate [1,2].

Irregular bleeding, pelvic pain, perforation, expulsion and pregnancy are possible complications. Therefore, investigations of the symptomatic patients and routine follow-up of asymptomatic women with IUDs include transvaginal ultrasonography to rule out IUD malposition and other complications are recommended [2]. However, because the frontal view of the IUD may be impossible to visualize by two-dimensional ultrasound, examination of the two arms of the IUD can be very difficult. Therefore sonography may fail in the detection of misplacement of the IUD in about 9% of cases [3].

Aim of study:

Was to evaluate the correlations between of Doppler readings of uterine artery and 3D ultrason with clinical symptoms in women inserting copper T 380 A IUD.

Subjects and Methods

The study was conducted in Obstetrics and Gynecology Department, Zagazig University Hospitals between November 2007 and March 2009. The research protocol was approved by the ethical review committee. After patient consent, registration and full medical history, general and pelvic examination were done. All women participating in this study were counseled about the different methods of family planning. If women’s choice was intrauterine contraceptive device, a schedule was given just last day of menses, all patients in this study were matching regarding to their age, parity and body mass index. A routine transvaginal sonographic examination of pelvic organ, especially the uterine anatomy (uterine position, size and direction) with exclusion of uterine myoma and congenital anomalies is crucial before insertion of
an IUD. Regular normal menstrual flow without any inter menstrual bleeding, pain or discharge were the obligatory inclusion criteria in this study. At time of insertion, well-trained OB/GN resident inserted copper T 380 A IUD without anesthesia and followed by transvaginal ultrasonographic examinations immediately after the insertion and months later, is recommended [4]. The women were given postmenstrual appointment six months after the insertion of IUD. All women were re-evaluated through history taken, general and gynaecological examination. Initially the study included two hundred and forty women but only one hundred and eighty women came for second visit.

During the second visit, women's satisfaction of IUD helped in categorizing them into three groups in this cross sectional study: Forty four women suffered from abdominal pain (group I), seventy women suffered from excessive or prolonged menstruation (group II) and sixty six women were not complaining from bleeding or pain (group III). After that 3Ds ultrasound (GE, Healthcare, Voulson 730 PRO V) were done via transvaginal ultrasound probe by one Ob/Gyn consultant who blindly examined all groups of the study. During Doppler measurements, the preferable angle of insonation was less than 30º in uterine artery, Doppler parameters (pulsitility index) was calculated with machine software whenever at least three similar sequential wave forms appear.

The IUD was imaged by usual 2D ultrasound then we switched on 3D button. Once the area of interest became obvious, the volume m de is switched and the volume box is upper imposed and adjusted to the uterine cavity. The automatic rotation of machine transducer through 360º, the different sections (automatically) were freezed and analyzed. In a longitudinal section IUD could be seen as hyperechoic strip while, in the transverse section the IUD presents as hypoechoic point in middle of the corpus. In fundal area the arms of IUD are seen as hyperechic horizontal line.

To identify the position of the IUD sonographically there are IUD-E, IUD-M, IUD-F and IUD-S. IUD-E is the distance from upper end of the IUD to the inner surface of the endometrium. IUD-M is the distance from upper end of IUD to myometrium/endometrium limit. IUD-F is the distance of upper end of IUD to the peritoneal surface of uterine fundus. IUD-S is the distance between mean ends of IUD and side wall of uterus.

**Statistical studies:**

We used (SPSS) version 9.0 for Windows (SPSS, Inc., Chicago, IL) for calculation of One-Way ANOVA to compare between groups of study; and Ipi Info for calculation probability values.

**Results**

Table (1): Compares different groups of study. No statistical significant differences as regards mean maternal age, parity, body mass index and method of last delivery.

Table (2): Demonstrates that there were statistical significant differences between the three groups as regards mean uterine artery pulsatility index $(p<0.05)$, duration of menstrual cycle $(p<0.001)$ and distance between IUD and endometrium $(p<0.05)$.

There were no statistical significant differences between the three groups $(p>0.5)$ as regards mean distance between IUD and myometrium, IUD and uterine fundus; and tips of IUD to lateral endometrial wall $(p>0.5)$.

If pulsatility index of uterine artery Doppler cut values 1.5: The sensitivity is 71.1%, specificity is 65.2%, +ve predictive value is 77.9%, –ve predictive value is 56.6%, likelihood positive 2.04 (2-5 fair, 5-10 good, >10 excellent clinical test), likelihood negative 0.44 (0.5-0.2 fair, 0.2-0.1 good, <0.1 excellent test) and accuracy reached 68.8%.

<table>
<thead>
<tr>
<th>Table (1): Demographic characters of the three groups.</th>
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<tbody>
<tr>
<td>Group I $\quad$n=44</td>
</tr>
<tr>
<td>Maternal Age (y)</td>
</tr>
<tr>
<td>Parity</td>
</tr>
<tr>
<td>Body Mass Index</td>
</tr>
</tbody>
</table>

**Last Delivery Method:**

- **Vaginal**: 34 (77.3%) | 60 (85.7%) | 45 (68%) | 3.89 | 0.14
- **Cesarean Section**: 10 (22.7%) | 10 (14.3%) | 11 (32%) | 1.01 | 0.6
Table (2): Compares between different groups of the study regarding Doppler uterine artery indices, IUD-E, IUD-M, IUD-F and IUD-S distances.

<table>
<thead>
<tr>
<th>I (With dysmenorrheal)</th>
<th>II (With menorrhagia)</th>
<th>III (Without complaint)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=44</td>
<td>N=70</td>
<td>N=66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doppler uterine artery (PI)</td>
<td>2.1±1.0</td>
<td>2.4±0.41</td>
<td>2.6±0.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Duration of the menstrual cycle (days)</td>
<td>5.7±1.8</td>
<td>8.4±1.6</td>
<td>5.0±2</td>
<td>50.8</td>
</tr>
<tr>
<td>End-IUD (mm)</td>
<td>2±1.1</td>
<td>2.1±1.2</td>
<td>1.6±0.9</td>
<td>3.98</td>
</tr>
<tr>
<td>M-IUD (mm)</td>
<td>3.4±1.8</td>
<td>4.3±1.5</td>
<td>4.1±0.9</td>
<td>2.56</td>
</tr>
<tr>
<td>Fundus-IUD (mm)</td>
<td>19.0±4.0</td>
<td>20.5±5.0</td>
<td>18.8±4.4</td>
<td>2.73</td>
</tr>
<tr>
<td>Lateral wall-tip arms of T (mm)</td>
<td>15.9±5.2</td>
<td>16.3±8.0</td>
<td>14.5±4</td>
<td>1.57</td>
</tr>
</tbody>
</table>

p≥0.05 : Not significant.  
ρ<0.05 : High significant.  
ρ<0.001 : Very high significant.

Table (3): Importance of uterine artery Doppler readings in women complaining of Dysmenorrhea and/or menorrhagia.

<table>
<thead>
<tr>
<th></th>
<th>PI&lt;1.5 (True +ve)</th>
<th>PI≥1.5 (True -ve)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complaining (True +ve)</td>
<td>81</td>
<td>23</td>
<td>104</td>
</tr>
<tr>
<td>Not Complaining (True -ve)</td>
<td>33</td>
<td>43</td>
<td>76</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td>66</td>
<td>180</td>
</tr>
</tbody>
</table>

Discussion

The IUD offers an excellent contraceptive option. Moreover, common side effects are bleeding and dysmenorrhea [5]. Since T-shaped IUD tend to accommodate in their position during the first 3 months after insertion. Therefore removal of all abnormally located IUD at TVS may result in high number of unnecessary removal [6]. That is why this study was conducted in women inserted Cu T IUD 380 six to 12 months ago.

De Kroon, et al. [7] performed transvaginal ultrasound to 195 women, just after IUD insertion and 6 weeks later. They found that prevalence of abnormal positioned IUD was 7.7% using transvaginal ultrasound, compared with clinical evaluation which reached to 4%. During menses, mostly bleeding and pain side effects were found to decrease over time (p<0.05) [8]; as the T shaped IUD accommodate its position in the uterine cavity during the first 3 months following insertion, and that ultrasound evaluation of its position is not a good predictor of future evaluation [6].

The copper T IUD should be visualized as centrally located within the endometrial cavity, with the crossbar in the fundal portion of the endometrial cavity [9]. Transvaginal ultrasound is considered to be the best technique to determine the intrauterine location of IUDs. It is better than hysteroscopy. After IUD insertion, failure of contraception, tubal pregnancy, abdominal pain and metrorrhagia may be observed [10].

Contradictly Farmer and Webb [11] mentioned that complications were unpredictable, indicating the need for constant vigilance and the inserting doctor being trained and prepared to deal with any complication arising. An earlier cross sectional study had shown a total lack of association between 2D sonographically determined IUD position and complaints of bleeding and or pain, while the other authors have suggested some association between displacement of the IUD and higher rate of expulsion [6,12].

Petta, et al. [12] mentioned that IUD may be unnecessary removed as they were incorrectly displaced as determined by ultrasound. However, sometimes removal of IUD determined by ultrasound significantly decreased the expulsion rate [12]. About half of complainers had top-fundal distance more than 4mm, compared to twenty eight percent of non-complainers.

Hence, a more cost effective and reliable approach is to stress counseling in self-examination to check a first follow-up visit 3 months after insertion when expulsions are more likely to occur [12]. A cervically located IUD was identified in seven of 97 women (7.2%) after insertion and in 13 of 25 pregnant women (52%) with the device in situ. Sonographic follow-up of the pregnant women revealed no change in IUD location during early gestation. Antebly, et al. [13] suggested that cases of failed contraceptive action of the IUD may be secondary to a mal positioned device. A sonographic survey can identify displaced devices. Re-insertion of the IUD in such cases is recommended [13].

There is a study by Lee, et al. 1997 [3], using 3Ds Ultrasound in studying IUD. They observed complete simultaneous imaging of all parts of the IUD was possible in 95% of cases. In three plane...
mode, all parts of the IUD could be visualized in 64% and in a further 30 cases this was possible only after volume rendering. In two women, incomplete opening of the two arms of the device was demonstrated. In one of these cases, the entire IUD was displaced into the cervical canal. In another case an intrauterine pregnancy was found together with an IUD in the correct position. In a study by Zang, et al. 2002 [14], they found that by using 3D ultrasound, some IUD were incarcerated, some were rotated but did not correlate between abnormal position of IUD and patient complain.

The 2D ultrasound is limited to transverse views of the shaft and the arms or other smaller parts of the IUD and, as a result, it cannot be investigated the position of the loop completely [3]. Bonilla-Musoles, et al. [15] compared between 2D and 3D ultrasound regarding identification and location of IUDs in 66 asymptomatic women. In eight cases (12.2%) the IUD was misidentified with 2D-TVS. In six cases (9.1%) it was failed to identify the position of the device. In contrast, all IUDs were identified and located accurately with 3D-TVS.

In this study, which was cross sectional study on 180 women inserting the commonly-used copper T 380 IUD in Egypt? Sixty six of them were not suffering from abnormal vaginal bleeding or pain related to IUD, were compared to one hundred fourteen women complaining, forty four of them were suffering from pain related to IUD and seventy were suffering from bleeding after IUD insertion. There were no differences regarding mean age, body mass index, parity and mode of last delivery. 3D transvaginal ultrasound was used to compare between these groups, in which the whole shaft, arms and even the threads of the IUD can be detected. We measured the mean IUD-E, IUD-M and IUD-F in all patients. There was no statistical significant difference between the groups. This agrees with Lee, et al. [3] who mentioned that 3D U.S provides useful information on the IUD position following insertion. It enables imaging of the entire IUD (the shaft and the arms). They examined 96 women after insertion of a T Cu 380A IUD and they could visualize all parts of the IUD in 95% of the patients.

By using 3Ds transvaginal ultrasound on our 114 patients complaining from either bleeding or pain induced by IUD, we identified 4 abnormal cases, 2 cases with ovarian cysts, one with uterine polyp and last with cervical polyp. Aleem, et al. [16] studied 211 women using Cu T IUD. By using transabdominal and/or transvaginal 2D ultrasound, they compared 155 patients represented with complains related to IUD use to 56 with no complains. About 50% of complainers had top-fundal distance more than 4mm, compared to 28% of non-complainers. An intercornual diameter, too small (less than 30mm) or too wide (greater than or equal to 38mm), was significantly more frequent in women complaining of bleeding and pain. Other abnormal findings were diagnosed in 25% of complainers compared to 7% in those without complaint. These findings included partial expulsion, appearance suggestive of pelvic inflammatory disease, ovarian swellings, embedding and fibroid uterus. Ultrasonography can give useful insights in managing IUD-related complaints in selected cases.

The relationship between using intrauterine contraceptive devices and menstrual disorders has been well documented, only a few studies have tried to show whether there are any vascular modifications [17]. During menses, there was a significant increase in uterine artery blood flow in patients who presented with copper IUD side effects, as indicated by decreased pulsatility [18].

A study included 68 women, 44 were using intrauterine contraceptive device and 24 women not using any method of contraception, uterine artery Doppler PI was significantly lower in women with IUD induced bleeding than those without abnormal vaginal bleeding (p<0.001) or in women not using any method of contraception (p<0.001). No significant variations in PI (p>0.05) was found with the duration of IUD application or the duration of IUD induced bleeding in patients using the device [19].

There were no significant changes in the uterine artery blood flow after the insertion of the IUD during menstruation or in the mid luteal phase. In patients with increased IUD-related pain during menstruation, however there was a decrease in PI (2.87±0.52 versus 2.41 ±0.23, p=0.05) after IUD insertion [20].

We found statistical significant difference between the group III (no complain PI=2.6 ±0.8), group II (bleeding induced IUD, PI=2.4±0.41) and group I (pain induced IUD, PI=2.1 ±1.0). Mean Uterine artery pulsatility index is highest in women inserting IUD without bleeding or pain.
Souza and Geber found that the presence of an IUD does not interfere with the vascular flow of the uterine arteries that can be shown by Doppler flow assessments 1 month after insertion [17]. If we use pulsatility index of uterine artery Doppler cut values as gold standard 1.5 after T-Cu 380 IUD insertion: The sensitivity is 46.5%, specificity is 65.2%, +ve predictive value is 69.7%, –ve predictive value is 41.3% and accuracy reached 68% in prediction of bleeding and pain with copper T 380 IUD.

Conclusion:
3D ultrasound IUD site did not differ between IUD complaining and non complaining women but pulsatility index of uterine artery is lower in women with IUD and suffering from bleeding and or pain.

References