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: To evaluate the effectiveness of using uterine artery color Doppler and location of intrauterine copper device by three dimensional transvaginal ultrasound in relation to abnormal vaginal bleeding and pain.

Methods: Three dimensional transvaginal ultrasound examinations were carried out to 180 women 3-6 months after IUD insertion. Seventy six women were suffering from pain (group I), forty four presenting with abnormal vaginal bleeding (group II), and sixty women with no complaint (group III). The distance between top of the IUD and inner endometrium E-IUD, IUD and fundus F-IUD and ends of IUD to sidewall of uterus S-IUD were measured. Uterine artery pulsatility index was measured by color Doppler for all women.

Results: No statistical significant differences between the three groups regarding E-IUD, F-IUD and S-IUD. Mean uterine artery pulsatility index was significantly lower in women suffering from pain with IUD than women with excess menses; and both had lower mean pulsatility index than control group (1.1±1.0, 1.8±0.41, 2.4 ±0.8 respectively, P

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

Introduction

Intrauterine devices (IUD) is one of the most effective contraceptive methods due to its simplicity, reversibility and practicability; copper IUDs failure rate is, 0.8% for the first insertion year, and also for a 10-year period (1). The copper IUD is more effective than inert IUDs, because of safety, contraceptive action and decreasing risk of pelvic inflammatory disease. The most common copper (IUD)-related side effects are uterine bleeding and/or menstrual pain, and these side effects often directly affect compliance with, and, consequently, the continuation rates of the method (2,3).

It has been suggested that IUD-related side-effects, such as secondary dysmenorrhea and metrorrhagia, may be caused by an increased prostaglandin synthesis in the endometrium that could lead to changes in endometrial blood flow and capillary permeability and such changes may cause menorrhagia.(3,4). Generally, it is thought that bleeding, or dysmenorrhea induced by an IUD may be secondary to a decrease in uterine arterial resistance and an increase in uterine blood flow, which are both detectable by color Doppler sonography(5,6).

Routine follow up of asymptomatic women with IUDs ,and evaluation ofsymptomatic patients include transvaginal ultrasonography to rule out IUD malposition and other complications are recommended(7).

Because failed contraceptive action of the IUD may be secondary to device malposition, a sonographic survey can identify displaced devices. However, because the frontal view of the IUD may be impossible to visualize by two-dimensional ultrasound ,evaluation of the two arms of the device can be very difficult ,and 2 D sonography may fail in the detection of misplacement of the IUD in about 9% of cases (8).

The use of 3Ds Ultrasound in studying IUD allowed complete simultaneous imaging of all parts of the IUD. In three plane mode, all parts of the IUD could be visualized after volume rendering (8).

The objective of this study was to evaluate the effectiveness of using uterine artery Doppler and IUD location by three dimensional transvaginal ultrasound in relation to IUD side effects.

Methods

Between May 2007 and November 2009 women attending the family planning clinic of Obstetrics and Gynecology Department, Zagzig University for IUD insertion were enrolled in this prospective study. Exclusion criteria were patients with irregular menstrual cycles, bleeding diathesis, pregnancy, acute or chronic pelvic inflammatory disease, cervicitis, benign or malignant gynecologic tumors, congenital uterine anomalies. The study was approved by the
local hospital ethics committee and an informed consent was obtained from all participants. Transvaginal ultrasonographic examination was performed to ascertain uterine position and to exclude any contraindication prior to IUD insertion. Patients were advised to attend the family planning clinic 3–6 months after IUD insertion on the 3rd or 4th day of the menstrual cycle. During the second follow up visit, three dimensional TVS examinations were done using ( GE, Healthcare, Voulson 730 PRO V) medical system equipped with (6-9 MHz) transvaginal probe. Women’s satisfaction with IUD were the basis for categorizing them into three groups: Seventy six women were suffering from pain (group I), forty four presenting with excess vaginal bleeding were (group II), and sixty non complainin women were taken as a control group (group III). Two trained Ob/Gyn consultant blinded to patients complaint performed the ultrasound examinations. The uterus was displayed in three orthogonal planes, Volume rendering was used in order to visualize the arms of the IUD in y-axis.

To identify the position of the uterus sonographically three measurements are taken. The distance from upper end of the IUD to the inner surface of the endometrium IUD-E. The distance of upper end of IUD to the peritoneal surface of uterine fundus IUD-F, and the distance between mean ends of T IUD and side wall of uterus IUD-S.

The color guided pulsed wave Doppler signals were obtained at the site of visualization of the uterine artery near its origin from the iliac artery. The angle of insonation was kept less than 30?, Doppler parameters/pulsatility index) was calculated with machine software whenever at least three similar sequential waveforms.

Statistical analysis was performed using One way ANOVA for comparing groups of study in addition to ROC curve for tests of sensitivity, specificity

Discussion

In this study, We choose 3D ultrasound because 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 completely. This runs in agreement of Lee et al who mentioned that 3DUS enables imaging of the entire IUD (the shaft and the arms) \(^{(8)}\). Furthermore Bonilla-Musoles compared 2D with 3D ultrasound regarding identification and location of IUDs in 66 asymptomatic women. The IUD was misidentified in eight cases (12.2%) with 2D-TVU ,and it was failed to identify the position of the device In six cases (9.1%). Whereas, all IUDs were identified and located accurately with 3D-TVU \(^{(9)}\).

Most bleeding and pain side effects were found to decrease over time as the T shaped IUD accommodate its position in the uterine cavity during the first 3 months following insertion\(^{(10)}\). For this reasons we choose to evaluate three to six months after insertion. In a study by Petta et al trans abdominal and /or trans vaginal 2D ultrasound were performed to compare 155 patients presenting with complains related to IUD use with 56 without complains. About 50% of complainers had top-fundal distance more than 4 mm, compared to 28% of non complainers. An inter cornual diameter, too small (less than 30 mm) or too wide (greater than or equal to 38 mm), was significantly more frequent in women complaining of bleeding and pain \(^{(13)}\).

On the other hand, an earlier cross sectional study had shown a total lack of association between 2D sono graphically determined IUD position and complaints of bleeding and pain \(^{(11)}\) and found that that IUD may be unnecessary removed as they were incorrectly displaced as determined by ultrasound.

In contrast, other researchers found that sonography is important in assessing the complications of IUDs including a low position, associated infection, myometrial migration, uterine perforation, associated intrauterine or extrauterine pregnancy and retention of fragmentation of IUD, and considered trans vaginal ultrasound to be the best technique to determine the intrauterine location of IUDs \(^{(14)}\).It is even better than hysteroscopy and thread length. Moreover, some studies have suggested some association between displacement of the IUD and failure of contraception, tubal pregnancy, abdominal pain metrorrhagia and higher rate of expulsion \(^{(13,14)}\).

In this cross sectional study, sixty non complaining women were compared to one hundred twenty women complaining from IUD side effects. No differences regarding body mass index, parity and mode of last delivery were found. Using 3D ultrasound, we found E-IUD, and F-IUD in S-IUD Did not differe significantly among any of the groups. A similar study by Hösl et al to estimate the distance measurement between copper IUD and myometrium or endometrium with 2D and 3D did not differ significantly in complaining and non complaining women \((19.54\pm6.13 \text{ vs. } 19.48\pm6.39, 5.58\pm4.57 \text{ vs. } 5.21\pm4.57)\).

We found a significant increase in uterine artery blood flow in patients who presented with copper IUD side effects reflected as decreased uterine artery pulsatility
index with a statistically significant difference between the control group (PI = 2.6 ± 0.8, group II (bleeding induced IUD, PI = 1.8 ± 0.41) and group III (pain induced IUD, PI = 1.1 ± 1.0). Our results runs in agreement with Frajndlich et al (16) who Conducted a study on 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 or in women not using any method of contraception. The author concluded that patients with uterine artery pulsatility index less than 2 had a higher risk for development of intrauterine contraceptive device – induced bleeding (16,17).

Souza and Geber(18) compared uterine artery pulsatility index before and after IUD insertion., and found that the presence of an IUD does not interfere with the vascular flow of the uterine arteries as shown by Doppler flow assessments 1 month after insertion.

In this study when we used 1.5 as a cut-off value for uterine artery pulsatility index after Cu T IUD insertion: the sensitivity, and specificity were 81.7%, and 69.2%, respectively for the prediction of abnormal bleeding and pain with copper T IUD.

In conclusion Location of IUD using 3D transvaginal ultrasound did not differ between IUD complaining and non complaining women, however uterine artery pulsatility index is lower in women suffering from bleeding or pain with IUD.

References

19. Souza MA, Geber S. Doppler color flow analysis of the uterine arteries before and after intrauterine device
Illustrations

Illustration 1

fig1: ROC CURVE FOR UA PI IN COMPLAINING AND NON COMPLAINING WOMEN

[Diagram: ROC Curve with Sensitivity on the y-axis and 1 - Specificity on the x-axis. Diagonal segments are produced by ties.]
Illustration 2

Results

Table (1) Compares between women suffering from pain during menses (group I), or from excess bleeding during menses (group II) and control women with no complaint (group III).

<table>
<thead>
<tr>
<th>$p$-value</th>
<th>$t$-value</th>
<th>group III mean±SD</th>
<th>group II mean±SD</th>
<th>group I mean±SD</th>
<th>parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07</td>
<td>2.72</td>
<td>3.0±1.5</td>
<td>2.4±1.7</td>
<td>2.7±1.1</td>
<td></td>
</tr>
<tr>
<td>0.16</td>
<td>1.9</td>
<td>24.2±5.0</td>
<td>25.8±4.7</td>
<td>26.0±7.6</td>
<td>Basal body mass index (kg/m$^2$)</td>
</tr>
<tr>
<td>0.14</td>
<td>3.89</td>
<td>45 (68%)</td>
<td>60 (85.7%)</td>
<td>34 (77.3%)</td>
<td>Method of last delivery</td>
</tr>
<tr>
<td>0.6</td>
<td>1.01</td>
<td>11 (32%)</td>
<td>10 (14.3%)</td>
<td>10 (22.7%)</td>
<td>Vaginal</td>
</tr>
</tbody>
</table>

There were not significant differences between three groups of study regarding maternal age, parity, basal body mass index, and mode of last delivery.
Table (2) compares between different groups of study regarding Doppler parameters, E-IUD, M-IUD, F-IUD distances, and S-IUD

<table>
<thead>
<tr>
<th></th>
<th>groupIII</th>
<th>groupII</th>
<th>groupI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>p-value</strong></td>
<td>0.05</td>
<td>0.001</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>t-value</strong></td>
<td>4.0</td>
<td>50.8</td>
<td>3.98</td>
</tr>
<tr>
<td><strong>mean±SD</strong></td>
<td>2.6±0.8</td>
<td>5.0±2</td>
<td>1.6±0.9</td>
</tr>
<tr>
<td><strong>Doppler uterine artery (PI)</strong></td>
<td>1.8±0.41</td>
<td>8.4±1.6</td>
<td>2.1±1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Duration of the menstrual cycle (days)</strong></td>
<td>1.1±1.0</td>
<td>5.7±1.8</td>
<td>2±1.1</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td><strong>End-IUD (mm)</strong></td>
<td>18.8±4.4</td>
<td>20.5±5.0</td>
<td>19.0±4.0</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td><strong>Fundus-IUD (mm)</strong></td>
<td>14.5±4</td>
<td>16.3±8.0</td>
<td>15.9±5.2</td>
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<tr>
<td><strong>Lateral wall-tip arms of T (mm)</strong></td>
<td>14.5±4</td>
<td>16.3±8.0</td>
<td>15.9±5.2</td>
</tr>
</tbody>
</table>

**P≥0.05** not significant

**P<0.05** significant

**P<0.01** high significant

**P<0.001** very high significant
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Reviews

Review 1

Review Title: does uterine artery doppler or copper intrauterine device location by three dimensional transvaginal ultrasound correlates with clinical symptoms

Posted by Prof. Syed A Gilani on 27 Mar 2011 04:30:11 PM GMT

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<tr>
<td>1</td>
<td>Is the subject of the article within the scope of the subject category?</td>
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<tr>
<td>2</td>
<td>Are the interpretations / conclusions sound and justified by the data?</td>
<td>Partly</td>
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<td>3</td>
<td>Is this a new and original contribution?</td>
<td>No</td>
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<td>4</td>
<td>Does this paper exemplify an awareness of other research on the topic?</td>
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<td>5</td>
<td>Are structure and length satisfactory?</td>
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<td>6</td>
<td>Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?</td>
<td>Yes</td>
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<td>7</td>
<td>Can you suggest any reductions in the paper, or deletions of parts?</td>
<td>No</td>
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<td>8</td>
<td>Is the quality of the diction satisfactory?</td>
<td>No</td>
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<td>9</td>
<td>Are the illustrations and tables necessary and acceptable?</td>
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<td>10</td>
<td>Are the references adequate and are they all necessary?</td>
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<td>11</td>
<td>Are the keywords and abstract or summary informative?</td>
<td>Yes</td>
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</table>

Rating: 3

Comment:
The authors have chosen a good topic for publication and its a nice contribution to the literature. It seems to need more details in discussion. As a whole it is a good article.

Competing interests: nil

Invited by the author to make a review on this article?: No

Experience and credentials in the specific area of science:
15 years

Publications in the same or a related area of science: No

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