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Uterine Artery Doppler Sonography in Intrauterine Contraceptive Device Users with / without Abnormal Uterine Bleeding

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Abstract: ***The aim of the study was to evaluate the effect of copper intrauterine contraceptive device on uterine artery blood flow using transvaginal doppler sonography.The study was conducted on 120 women using copper IUCD after 3 or more months of CuT insertion. They were classified into 2 groups. Group I (60 cases): cases with AUB and group II (60 controls): cases without AUB. Transvaginal doppler analysis of uterine artery was doneon day 5 of menstrual cycle. The Pulsatility Indices (PI) and resistance indices of both right and left uterine arteries were measured. Doppler parameters were compared between both groups.There were no significant differences between the control group and bleeding group as regarding resistance and pulsatility indices (p>0.05). To conclude, neither the presence of an IUCD, nor the associated AUB seem to cause any change in uterine blood flow assessed by Doppler ultrasonography.***

Keywords: Copper intrauterine device, Uterine artery Doppler, Abnormal uterine bleeding

1. Introduction

The copper intrauterine contraceptive device (IUCD) is the most commonly used method of long-acting reversible contraception worldwide[1]. It is currently believed that it acts by prevention of fertilization through a sterile inflammatory reaction and produces tissue injury that is spermicidal. The most common side effects related to the use of an intrauterine device (IUD) are abnormal uterine bleeding (AUB), pelvic pain and dysmenorrhea. Approximately 10% of IUD users need removal in the first year due to side effects[2]which in turn has significant consequences.The IUD increases menstrual bleeding by its impact on several aspects of endometrial haemostasis. IUD causes COX-2 (cyclooxygenase isoenzyme 2) up expression and increase prostaglandins (PGI2 "Prostacyclin" and PGE1). The subsequent elevated prostanoids biosynthesis and signalling can promote the expression of pro-angiogenic factors, such as VEGF (Vascular endothelial growth factor), bFGF (basic fibroblast growth factor), PDGF (platelet-derived growth factor) or downregulate the expression of antiangiogenic genes such as cathepsin-D[3]. The association between transvaginal probes and colour pulsatile Doppler imaging has brought new refinement to gynaecologic sonography[4], improving its capacity to evaluate the pelvic blood flow. In our study, we evaluated the uterine artery doppler indices (resistance index and pulsatility index) in women with and without AUB and compared them in order to identify correlation between IUCD induced bleeding and increase in uterine artery blood flow.

2. Material and Methods

Study Participants: All women after 3 or more months of CuT insertion attending department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

Study Place: Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

Study Design: Cross sectional study.

Study Type: Hospital based comparative study.

Study Duration: June 2019- May 2020**.**

Sample size: 120 women with 60 women in each group after 3 or more months of Cu-T insertion.

Selection criteria

- **Inclusion criteria:** All women after 3 or more months of CuT insertion aged 20-40 years, parity 1-5, had regular menstrual cycles before IUCD insertion, no hormonal treatment for at-least 3 months before IUCD insertion, non-steroidal anti-inflammatory drugs has not been taken 24 hours before examination and who arewilling to participate in the study (written informed consent).
- **Exclusion criteria**: Nulligravida, Pregnancy, Presence of gynecological pathology as endometriosis, polyp or fibroid, Present or past history of pelvic inflammatory disease, uterine anomaly, medical disorders, coagulation defects, non-cooperative patients.

2.1 Methodology

All eligible women attending family planning OPD and Gynaecology OPD with Cu-T insertion for more than 3 months were recruited for study. After taking patient's

consent to participate in the study, all women were subjected to:

Detailed history including Menstrual history, history of other contraceptives used before IUCD insertion, obstetric, personal, family and medical history, general physical examination, per speculum examination, pelvic examination to identify uterine size and position.

All women were classified into 2 groups:

- Group I (60 cases): cases with AUB.
- Group II (60 controls): cases without AUB.

Transvaginal pulsed Doppler was performed on 5th day of the menstrual cycle after instructing the patient to evacuate the bladder. All parameters were measured between 9 am and 11 am to eliminate diurnal variation. TVS was done by probe of 7.5MHz on Hitachi machine by Assistant Professor of Radiology department posted at MCSG, Jaipur to remove interobserver and instrumental error.

Blood flow indices of the uterine artery were then calculated to obtain the pulsatility index and resistance index according to the following equations:

PI = (A-B)/mean and RI = (A-B)/A,

where A is the peak systolic, B is the end diastolic doppler shift, mean is the mean maximum Doppler shift frequency taken over the cardiac cycle.

The mean RI and PI were calculated by combining 3 waveforms of the left and right uterine artery.Statistical analysis of the results was done.

Transvaginal doppler of left uterine artery

3. Results and Analysis

Table 1: Association between Group and Parameters

Parameters	Group		p value
	Case (n = 60)	Control (n = 60)	
Age (Years)* **	27.37 ± 3.36	27.57 ± 2.70	0.499[1]
Age			0.711[2]
20-25 Years	18 (30.0%)	14(23.3%)	
26-30 Years	33 (55.0%)	36 (60.0%)	
31-35 Years	9 (15.0%)	10 (16.7%)	
Religion			0.471[2]
Hindu	51 (85.0%)	48 (80.0%)	
Muslim	9 (15.0%)	12 (20.0%)	
Area			0.714[2]
Rural	27 (45.0%)	29 (48.3%)	
Urban	33 (55.0%)	31 (51.7%)	
Literacy			0.256[2]
Illiterate	19 (31.7%)	25 (41.7%)	
Literate	41 (68.3%)	35 (58.3%)	
Socio-Economic Status			0.391[2]
Upper	1 (1.7%)	0 (0.0%)	
Upper Middle	9 (15.0%)	6 (10.0%)	
Middle	32 (53.3%)	27 (45.0%)	
Lower Middle	14 (23.3%)	19 (31.7%)	
Lower	4 (6.7%)	8 (13.3%)	
Parity			0.684[2]
P1	13 (21.7%)	8 (13.3%)	
P2	29 (48.3%)	31 (51.7%)	
P3	13 (21.7%)	15 (25.0%)	
P4	5 (8.3%)	6 (10.0%)	
Duration of IUCD insertion (Months)* **	8.22 ± 4.67	9.22±4.80	0.169[1]
PI (Right)	2.09 ± 0.24	2.12 ± 0.23	0.464[1]
PI (Left)	2.12 ± 0.22	2.14 ± 0.24	0.642[1]
PI (Mean)	2.10 ± 0.20	2.13 ± 0.20	0.353[1]

Parameters	Group		p value
	Case (n = 60)	Control (n = 60)	
PI (Minimum)	2.02 ± 0.21	2.05 ± 0.22	0.405[1]
RI (Right)	0.84 ± 0.11	0.86 ± 0.13	0.384[1]
RI (Left)	0.85 ± 0.07	0.86 ± 0.08	0.526[1]
RI (Mean)	0.84 ± 0.07	0.86 ± 0.08	0.141[1]
RI (Minimum)	0.80 ± 0.08	0.80 ± 0.08	0.689[1]

****Significant at p<0.05, 1: Wilcoxon-Mann-Whitney U Test, 2: Chi-Squared Test*

There were no significant differences between the 2 groups in terms of distribution of age, religion, literacy, residence, parity, socio-economic status, duration of IUCD insertion.

Table 2: Pulsatility index of right and left uterine artery in study population

Mean PI (SD)	Group		
	Group I	Group II	p value*
Right uterine artery	2.09 (0.24)	2.12 (0.23)	0.464
Left uterine artery	2.12(0.22)	2.14(0.24)	0.642

*Wilcoxon-Mann-Whitney U Test=1660.000, 1711.000

The mean of PI (Right) in the Group I was 2.09 ± 0.24. The mean of PI (Right) in the Group II was 2.12 ± 0.23.The mean of PI (left) in the Group I was 2.12±0.22. The mean of PI (left) in the Group II was 2.14 ±0.24. There was no significant difference between the groups in terms of PI of right and left uterine artery.

Table 3: Mean pulsatility index in study population

PI (Mean)	Group		p value*
	Group I	Group II	
Mean (SD)	2.10 (0.20)	2.13 (0.20)	0.353
Median (IQR)	2.06 (1.96-2.23)	2.14 (1.96-2.27)	
Range	1.77 - 2.86	1.7 - 2.58	

*Wilcoxon-Mann-Whitney U Test=1622.500

The mean of PI (Mean) in the Group I was 2.10±0.20. The mean of PI (Mean) in the Group II was 2.13 ±0.20. There was no significant difference between the groups in terms of PI (Mean)

Table 4: Resistance index of right and left uterine artery in study population

Mean RI (SD)	Group		p value*
	Group I	Group II	
Right uterine artery	0.84 (0.11)	0.86(0.13)	0.384
Left uterine artery	0.85(0.07)	0.86(0.08)	0.526

*Wilcoxon-Mann-Whitney U Test=1634.000, 1679.000

The mean of RI (Right) in the Group I was 0.84±0.11. The mean of RI (Right) in the Group II was 0.86 ±0.13. The mean of RI (Left) in the Group I was 0.85±0.07. The mean of RI (Left) in the Group II was 0.86 ±0.08.There was no significant difference between the groups in terms of RI of right and left uterine artery.

Table 5: Mean Resistance index in study population

RI (Mean)	Group		p value*
	Group I	Group II	
Mean (SD)	0.84 (0.07)	0.86 (0.08)	0.1
Median (IQR)	0.84 (0.8-0.87)	0.86 (0.8-0.91)	
Range	0.72 - 1.05	0.67 - 1.02	

*Wilcoxon-Mann-Whitney U Test=1519.000

The mean of RI (Mean) in the Group I was 0.84±0.07. The mean of RI (Mean) in the Group II was 0.86 ±0.08.There was no significant difference between the groups in terms of RI (Mean).

4. Discussion

IUCD is very safe and effective method for birth spacing and preventing unwanted pregnancies. Abnormal uterine bleeding is one of the most undesirable side effects of use of IUCDs that lead to high prevalence of withdrawal from the method. In this study, transvaginal doppler sonography was done on 5th day of menstrual cycle of 120 women divided into 2 groups, Group (I) 60 women who were using CuTand with AUB and Group (II) 60 women who were using CuT and without Abnormal uterine bleeding and blood flow indices of uterine artery was done. There were no statistically significant differences between the groups in terms of Resistance index and Pulsatility index. The results agreed with the results reported by Zeinab Azkoul et al[5] (2017) who evaluated the effects of CuT on uterine artery blood flow on 40 women and found that there were no significant differences between the control group and bleeding group as regarding pulsatility and resistance indices. The results were also coherent with results observed by Jamenez et al[6] (2008) who reported that there were no statistically significant differences in RI and PI between women IUD induced bleeding and women using with normal menstruation. He measured PI and RI immediately before IUCD insertion in mid luteal phase and 3 months later after controlling age, parity and type of IUCD. The results were not in agreement with Reham Mohammed et al[7] (2015) who showed that PI and RI were significantly lower in women with IUCD induced AUB than in those using IUCD with normal menstrual bleeding. They concluded that results of present study may help to predict future uterine bleeding tendency after IUCD insertion in the group of patients destined to suffer from heavy bleeding when using contraceptive device for long time. The results were also not agreed with the results by Momtaz et al[8] (1994) who measured the RI and PI of uterine arteries in 68 women, 44 using IUCD and 24 not using IUCD. Both PI and RI were significantly lower in women with IUCD-induced bleeding than in those using IUCD and not complaining abnormal bleeding.

The study has few limitations. Because we only analyzed uterine artery doppler, endometrial and sub-endometrial micro-vascularization could also be analyzed. Also, since sample number is small, it might be difficult to confirm these results and give recommendations upon them.

5. Conclusion

To conclude, the study shows that neither the presence of an IUCD nor the associated abnormal uterine bleeding seem to cause any change in uterine artery blood flow assessed by doppler ultrasonography as there were no statistically significant differences in RI and PI between control group who were using IUCD and not complaining of AUB and bleeding group who were using IUCD and complaining of AUB.

Hence, there is no role of uterine artery doppler in evaluation and prediction of abnormal uterine bleedingin female using IUCD.

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