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Original Research Article

Uterine artery doppler indices may predict intrauterine contraceptive device-related abnormal uterine bleeding

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ABSTRACT

Background: The aim of the study was to assess the role of colour Doppler velocimetry of the uterine arteries as a predictor of intrauterine contraceptive devices (IUCD)-induced abnormal uterine bleeding.
Methods: A prospective study was performed on 120 women (60 without AUB and 60 with AUB) who had copper IUCD inserted as a method of contraception. Detailed history, general and local examination and relevant investigations were done. Pulsatility index (PI) and resistance index (RI) of uterine artery measured at 3 months after IUCD insertion.
Results: Cut-off levels for PI and RI of uterine arteries were set. PI cut-off level <2.09 with sensitivity of 58.3%, specificity of 61.67% and area under the curve (AUC) of 0.666. RI cut-off level ≤0.83 with sensitivity of 53.33%, specificity of 66.67% and AUC of 0.703. These cut-off levels were associated with abnormal uterine bleeding.
Conclusions: Initial measurement of uterine artery Doppler indices (PI and RI) before IUCD insertion could be useful in predicting IUCD-induced abnormal uterine bleeding which is the major cause of method withdrawal during the first year of use and accordingly women could be counseled to consider another method of contraception.

Keywords: IUCDs, Abnormal uterine bleeding, Doppler ultrasound

INTRODUCTION

IUCDs are very popular method of contraception in the family planning and is used worldwide. Its mechanism of action is due to the spermicidal effect of copper ion released. In addition, the device creates a hostile uterine environment as a result of an inflammatory process.[1] The most common side effects of use of IUCD are abnormal uterine bleeding, dysmenorrhea and pelvic pain.[2]

The excessive bleeding in women using IUCD is due to COX-2 (cyclooxygenase isoenzyme 2) up expression which causes increase in prostaglandins (PGI2 "Prostacyclin" and PGE1) production, which in turn increase endometrium vascularity, vascular permeability, and inhibition of platelet function.[3] Another mechanism is that the IUCD increases the fibrinolysis due to injury of the capillary plexus.[4] Blood loss for copper IUCD users increased by about 30-50% from the average. About 10-20% of users want to remove IUCD during the first year of insertion.[5] There is also an increased development of micro-vascularization of the sub-endometrium in those women who complain of IUCD-induced heavy bleeding.[6] Based on these findings, PI and RI for uterine artery was investigated for the detection of vascular changes of the uterus in patients with IUCD.

The aim of the study was to assess the role of color Doppler velocimetry of the uterine arteries, as a predictor of IUCD-induced abnormal uterine bleeding.

METHODS

This prospective study was conducted in the department of obstetrics and gynaecology, SMS medical college, Jaipur. Study duration was from June 2019 to May 2020. The 120

women attending family planning outpatient department of a tertiary care hospital who had Cu-T insertion 3-4 months back were recruited for the study. These women were divided into two groups. Group A-60 women with abnormal uterine bleeding and group B without any abnormal uterine bleeding.

Women aged 20-40 years, parity 1-5, with regular menstrual cycles in past, no history of medical disorder or coagulation defect, no history of hormonal treatment for at-least 3 months before IUCD insertion, non-steroidal anti-inflammatory drugs has not been taken 24 hours before examination were included in the study population.

Data collection

After taking informed written 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 to visualize the IUCD thread and exclude any other local cause of bleeding and pelvic examination to identify uterine size and position.

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 7.5 mHz on Hitachi machine by the same experienced radiologist to remove inter observer and instrumental error.

Data analysis

Statistical analyses were performed using the STATA software (release 12.1, Stata Corp). Receiver operating characteristic (ROC) curve analysis was used to assess the predictive value of PI and RI of uterine artery at the highest levels of sensitivity and specificity.

RESULTS

In this study 120 women were included, 50.0% of them did not suffer from abnormal menstrual bleeding and (50.00%) suffered from abnormal menstrual bleeding.

Lower uterine artery PI and RI was significantly associated with abnormal uterine bleeding (Table 2). The area under curve (AUC) of the PI and RI for predicting heavy bleeding was 0.666 (95% CI: 0.569-0.763) (p=0.002) and 0.703 (95% CI: 0.609-0.797) (p<0.001) respectively (Figures 1 and 2). The optimized cut-off value for PI of uterine artery was set at <2.09 with sensitivity of 58.3%, specificity of 61.67%. Similarly, the optimized cut-off value for RI of uterine artery was set at <0.83 with sensitivity of 53.33%, specificity of 66.67%. These cut-off levels were associated with abnormal menstrual bleeding.

Table 1: General characteristics.

Characteristics	Variables
Mean age (years)	27.01±2.79
Primi: multipara	21:79

Table 2: Baseline characteristics of the study population, (n=60).

Variables	Controls, n (%)	Cases, n (%)
Average age (years)	27 (22-33)	27 (20-35)
Parity		
Primipara	8	13
Multipara	52	47
Literacy		
Illiterate	25	19
Literate	35	41
Area of residence		
Rural	29	27
Urban	31	33
Religions		
Hindu	48	51
Muslim	12	9

Table 3: Uterine artery Doppler findings of the study population, (n=60).

Variables	Controls, n (%)	Cases, n (%)	P value
Average PI	2.19 (1.73-2.63)	2.02 (1.74-2.80)	0.002
Average RI	0.88 (0.68-1.04)	0.82 (0.71-1.03)	<0.001

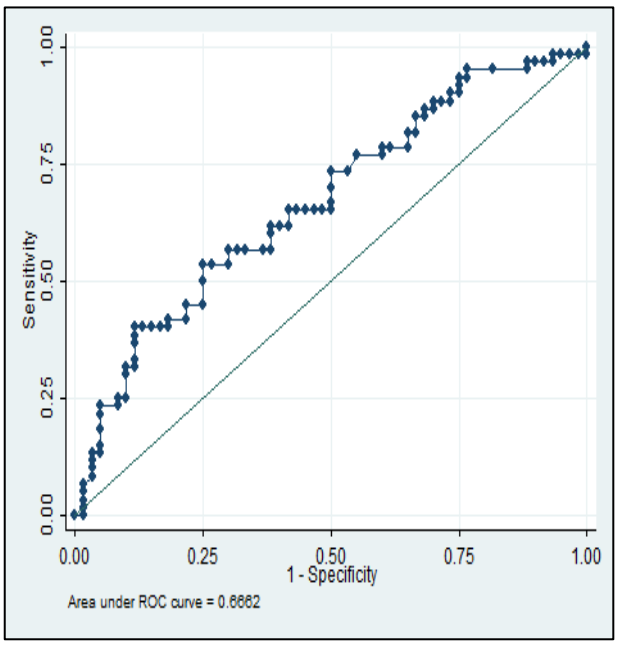

Figure 1: Receiver-operating characteristic (ROC) curve for prediction of heavy bleeding using average PI of uterine Doppler artery of both sides.

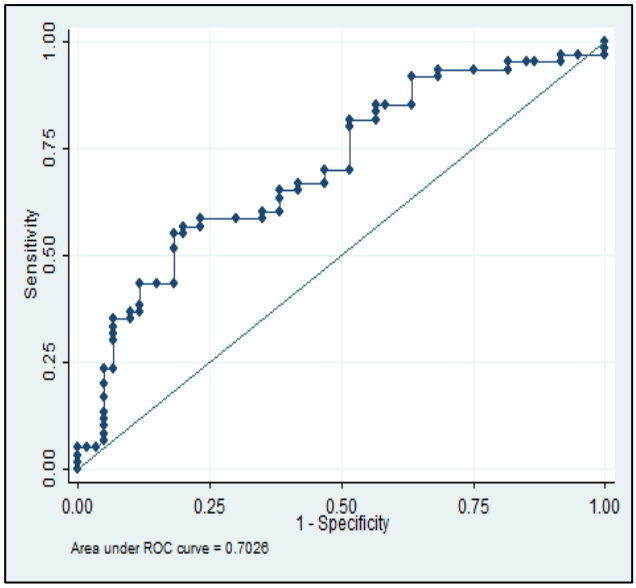

Figure 2: Receiver-operating characteristic (ROC) curve for prediction of heavy bleeding using average RI of uterine Doppler artery of both sides.

DISCUSSION

An IUCD is one of the most frequently used methods for birth control around the world. However, menorrhagia is among its common side effects. Menorrhagia may cause iron deficiency anemia and usually ends by removing the IUCD in the first year after its insertion in many cases.[6] Thus, measurement of the predictive factors can help us identifying these high-risk patients who may have significant menorrhagia. This, in turn, will reduce the overall post-IUCD complication rate and improve compliance and acceptability among women.

This study aimed to assess uterine artery vascular indices in relation to abnormal menstrual bleeding as a predictor of the risk of bleeding before IUCD insertion. In our study, we found lower PI and RI to be a significant predictor of abnormal uterine bleeding. We further calculated cut-offs based on ROC curves. In our study, cut-off levels for uterine artery PI and RI were set with PI <2.09 and RI <0.83, these values are associated with abnormal uterine bleeding.

There have been few studies which have also found the role of uterine artery Doppler indices in predicting IUCD related bleeding.[7,8] Attia et al conducted a prospective study on 100 women and measured uterine artery Doppler PI and RI before insertion and followed up the patients for 6 months. They found lower PI and RI indices to be significantly associated with prospective menorrhagia. Based on the ROC curves, they provided cut-offs for uterine artery PI≤2.02 (sensitivity of 95.8%, specificity of 100%, and area below the curve (AUC) of 0.97 at p<0.001) and RI≤0.83 (sensitivity of 93.8%, specificity of 100%, and AUC of 0.949 at p<0.001) which were correlated with significant menstrual bleeding following insertion of IUCD.[7] However, not all studies have reported significant association.[5,9] A similar study done by Mutlu et al with a 6-month follow-up found that no major changes in uterine blood flow (PI and RI) were observed in women experiencing increased menstrual bleeding, dyspareunia or dysmenorrhea after insertion of a copper IUD.[9] However, all these studies are single-center and small sample size studies. Considering the conflicting results, this requires multicentric study with larger sample size.

Limitations

Limitations of the study were it was a single center study and sample size was less.

CONCLUSION

Initial measurement of uterine artery Doppler indices (PI and RI) before IUCD insertion could be useful in predicting IUCD-induced abnormal uterine bleeding which is the major cause of method withdrawal during the first year of use and accordingly women could be counseled to consider another method of contraception. Several studies have found different sets of cut-off levels for prediction of IUCD related menorrhagia, and this needs meta-analysis of such studies or further large studies to put a standard cut-off value.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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