

## **Uterine and Ovarian Arteries Doppler Indices in Women Undergoing Tubal Sterilization via Laparoscopy or Laparotomy**

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### **Abstract**

**Aim:** This study was planned to investigate the possible effects of different types of tubal ligation methods on uterine and ovarian arteries doppler indices and hormone profiles.

**Method:** Fifty patients admitted for tubal ligation were included in the study. Patients were allocated for either laparoscopic tubal ligation via Yoon ring or Pomeroy's type tubal ligation via mini-laparotomy. Preoperative menstrual cycle characteristics and uterine/ovarian arteries doppler data were recorded in both groups. Color Doppler flow analysis of uterine and ovarian arteries were carried out on the 2th day of the cycle prior to the procedure and on the postoperative third months following the tubal ligation. PI and RI data were measured and noted in Doppler examination. Preoperative and postoperative hormone profiles of the patients were also measured.

**Results:** Only two cases had a menstrual period of more than 35 days. The number of patients whose menstrual period was longer than 35 days after tube ligation was 4. Dysmenorrhea was seen in 1 patient and the amount of menstrual bleeding was increased in 2 cases. Intermenstrual bleeding was not detected in any of the cases. When the PI and RI values of uterine and ovarian arteries were compared with preoperative values, there was no significant change. Neither the laparotomy nor the laparoscopy group showed a significant change in preoperative doppler findings. Similar to doppler measurements alteration in the serum levels of sex steroids including FSH, LH, E2, progesterone and PRL were not detected after tubal ligation.

**Conclusion:** Tubal ligation has no adverse effect on uterine and ovarian arteries doppler indices and hormone profile. Moreover, tubal ligation did not alter the menstrual characteristics of the patients.

**Keywords:** Pomeroy; Yoon Ring; Tubal Ligation; Doppler; Hormones; PI; RI

### **Introduction**

An increasing number of clinicians are now offering colour flow-directed measurements such as pulsatility (PI) and resistance indices (RI) as well as flow velocities in women undergoing tubal sterilization. The pulsatility index is calculated by the following formula: Systolic Velocity-Diastolic Velocity/Mean Velocity. The resistance index (RI) of the ovarian or uterine arteries is a noninvasive measure of intraovarian compliance; the RI is determined by averaged measurements in the segmental arteries branching off the ovarian or uterine arteries. It is calculated from the index of peak systolic blood velocity (Vmax) relative to the minimal diastolic velocity (Vmin), expressed as  $1 - (Vmin/Vmax)$ . Higher RI values reflect vascular resistance. RI can be correlated with many factors, including the site of measure-

ment, intra-abdominal pressure, tubal ligation, and older age. Noninvasive measurement of the PI or RI of uterine or ovarian arteries have become widely used tools for monitoring the reproductive potential of the ovaries following reproductive tissue surgery [1-5].

There is some evidence that ovarian reserve is reduced due to decreased blood flow after tube ligation and that patients enter early menopause. However, early menopause and ovarian reserve reduction were not found in clinical studies. On the other hand, after tube ligation, the frequency of findings such as menstrual irregularities, decrease in menstrual volume or increase was detected. Alteration in menstrual cycle pattern after tubal ligation have been reported for more than five decades ago. However, studies reported that tubal ligation has no significant adverse effect on doppler flow indices and hormonal markers. On the other hand, there are studies showing that tubal ligation leads to changes in uterine and ovarian artery doppler indices [1-5].

When the literature is reviewed, there is no detailed study showing the effects of tubal ligation on ovarian function and its blood supply, hormone levels and menstrual cycle features. To clarify this issue, we aimed to investigate the effect of different surgical methods used in tubal ligation on doppler indices and hormonal markers. In the present study, we therefore investigated the effect of laparoscopic or laparotomic tubal ligation methods on utero-ovarian arteries pulsatility index, resistance index and hormonal markers.

### Materials and Methods

#### Patients selection

The patients included in the study were selected among the patients who applied to Zekai Tahir Burak Gynecology and Obstetrics Clinic for contraception. The study was a prospective case-controlled thesis study and it was initiated after ethical approval. Verbal and written informed consent was obtained from all patients before surgery. Pre-operative history and demographic findings of the patients were recorded. The patients were given detailed information about the possible complications and failure rates of the procedures.

Fifty consecutive fertile women applying for voluntary tubal ligation were recruited in this prospective study. Patients were allocated for either laparoscopic tubal ligation via Yoon ring (group 1) or Pomeroy's type tubal ligation via mini-laparotomy (group 2) according to their preference. Preoperative menstrual cycle characteristics and uterine artery doppler data were recorded in both groups. Color Doppler flow analysis of uterine and ovarian arteries were carried out on the 2<sup>th</sup> day of the cycle prior to the procedure and on the postoperative 3 months following the tubal ligation. PI and RI data were measured and noted in Doppler examination. The same analysis were performed 3 months after surgery and compared with preoperative findings. The significance of difference between the measurements was analyzed by using analysis of variance. Kolmogorov-Smirnoff test was used to analysis of data. Continuous variables were analyzed with Mann-Whitney U test. A *P* value of <.05 was accepted as significant. The results are expressed as mean ± SD. Preoperative and postoperative hormone profiles of the patients were also measured. Detailed information about the Pomeroy's style tubal ligation and Yoon ring methods can be found elsewhere. All of the participants were required to meet the inclusion criteria: 1) no hormonal medication use within the past 6 months before enrollment the study; and 2) absence of history of any congenital disease that may lead to die of living childrens. Excluded cases were the ones with: 1) diagnosis of pelvic inflammatory disease, deep endometriosis, or hydrosalpinx at the time of the study; and 2) previous pelvic surgery, especially to ovaries or fallopian tubes.

### Results

The age and BMI values of the women undergoing laparoscopic or laparotomic tubal ligation groups were similar. Preoperative and postoperative PI, RI and hormone profile values of the patients are shown in table 1-3. Tubal ligation was performed successfully in all cases. No complications occurred. As seen in table 1 and 2, tubal ligation did not lead to a significant change in the menstrual characteristics of the patients. Only two cases had a menstrual period of more than 35 days before tubal ligation. The number of patients whose menstrual period was longer than 35 days after tube ligation was 4. Dysmenorrhea was seen in 1 patient and menstrual bleeding was found to increased in 2 cases. No intermenstruel bleeding was detected in any of the cases. When the postoperative PI and RI values of

uterine and ovarian arteries were compared with preoperative values, there was no significant change. Although there was some increase in uterine and ovarian artery RI after tubal ligation, this did not reach statistical significance (Table 3). Neither the laparotomy group nor the laparoscopy group showed a significant change in preoperative doppler data. Similar to doppler measurements no alternation in the serum levels of sex steroids including FSH, LH, E2, progesterone and PRL were not changed after tubal ligation.

Cycle length	%	Length of menstrual bleeding	%	Dismenorrhea	%	Amount of bleeding	%	Intermenstruel Bleeding	%
< 21	0	< 4	0	No pain	12	Low	8		
21 - 35	96	4 - 8	94	Mild pain	88	Normal	92	No	100
> 35	4	> 8	0	Severe pain	0	Increased	0		

Table 1: Preoperative menstrual characteristics of women studied.

Cycle length	%	Length of menstrual bleeding	%	Dismenorrhea	%	Amount of bleeding	%	Intermenstruel Bleeding	%
< 21	0	< 4	6	No pain	12	Low	10		
21 - 35	92	4 - 8	94	Mild pain	80	Normal	86	No	100
> 35	8	> 8	0	Severe pain	0	Increased	4		

Table 2: Post-ligation menstrual characteristics of women studied.

Uterine artery doppler indices	Preoperative	Postoperative	P value
PI	1.63 ± 0.34	1.63 ± 0.33	0.83
RI	0.72 ± 0.06	0.74 ± 0.06	0.71
Ovarian artery doppler indices	Preoperative	Postoperative	P value
PI	1.42 ± 0.10	1.37 ± 0.06	0.53
RI	0.51 ± 0.07	0.60 ± 0.08	0.78

Table 3: Pre-ligation and post-ligation uterine and ovarian arteries doppler indices.

### Discussion

Studies on relationship between tubal ligation and Doppler findings of uterine and ovarian arteries have led to contradictory findings. In several studies, however, unchanged serum hormone levels was reported following tubal ligation [1-3]. In the current study we aimed to compare the changes in uterine and ovarian arteries PI and RI following laparoscopic sterilization via Yoon ring and Pomeroy’s type tubal ligation via mini-laparotomy in patients who had voluntary surgical sterilization. Circulating ovarian hormone levels and ovarian artery blood flow rates measured by Doppler ultrasonography, were determined 2 days before the operation and on the post-operative third month.

The results of 50 participants who finished the follow-up period were analyzed. Prior to tubal ligation, the mean pulsatility index of the uterine artery, left and right ovarian arteries were found to similar in both Yoon ring and Pomeroy group (Table 3). There was no statistically significant difference between group 1 and group 2 in terms of preoperative doppler values. The postoperative 3<sup>rd</sup> month measurements of both uterine and ovarian arteries in group 1 and group 2 did not show any statistically significant difference from that

of the preoperative values (Table 3). Similar to doppler measurements, serum levels of sex steroids including FSH, LH, E2, progesterone and PRL were not changed after tubal ligation.

There was no change in ovarian hormone levels after laparoscopic and/or Pomeroy's type tubal sterilization. There is slight but statistically non-significant decrease in ovarian artery and uterine artery blood flow rate following tubal sterilization, signifying a local increase in vascular resistance. There are several possible reasons for the absence of significant changes in postoperative doppler indices and hormone levels. The fact that the control measurements were made after 3 months can be interpreted as early [2-4]. No significant changes in hormone production or doppler indices may be detected during the three-month period. If the follow-up period was extended, we might have a different outcome. However, it is satisfactory that most of the patients who underwent tubal ligation had no signs of early menopause. On the other hand, the occurrence of spontaneous pregnancies in patients with reopened fallopian tubes suggest that tubal ligation has no negative effect on ovarian functions.

### Limitation of the Study

There are some limitations of the present study. The study population was small in the laparoscopy and laparotomy groups. Measurement of RI or PI was performed at only a single time point after tubal ligation. Changes in doppler indices should be repeated monthly. This time interval was chosen because the time needed for the normalization of the uterine and ovarian arteries flows after surgery is considered to be 3 months. Performing sequential monthly doppler measurement to determine the progressive change would have been ideal, but this was not possible owing to technical, and economic concerns. Therefore, the timing of optimal improvement in doppler indices after tubal ligation remains undetermined.

### Conclusion

The lack of significant changes in both doppler indices and hormone levels after tubal ligation reinforces our knowledge about the reliability of this contraceptive method. However, care must be taken when performing this surgical procedure and the vessels should not be unnecessarily damaged.

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