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# EVALUATION OF CHANGES OVER TIME IN MENSTRUAL PATTERN AFTER POSTPARTUM TUBAL LIGATION

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**Abstract**

**Aim:** A wide range of menstrual problems might be seen in women who had undergone bilateral tubal ligation (BTL). There are few studies examining the course of menstrual abnormalities subsequent to BTL with conflicting results. In this study, we aimed to investigate the over-time changes in the severity of menstrual abnormalities experienced by women after to BTL.

**Methods:** Women who had undergone postpartum BTL at our clinic between January 2018 and October 2021 and had menses for at least 6 months were included in the study. Patients were divided into two groups according to the time since BTL; group 1 included women who had undergone BTL between 1 to 3 years and group 2 included women who had undergone BTL between 3 to 5 years. The severity of menstrual disturbances and premenstrual syndrome (PMS) symptoms were compared between the two groups.

**Results:** There was no statistically significant difference between groups regarding menstrual regularity (p=0.476). The most commonly experienced menstrual abnormality was delayed menses in group 1 (42.9%) and frequent menses in group 2 (41.2%). There was no significant difference regarding the type of menstrual irregularity between groups (p=0.299). The amount of menstrual blood loss and the severity of dysmenorrhea were also similar between groups (p= 0.880 and, p= 0.473 respectively).

**Conclusions:** There is no significant change in menstrual disturbances, dysmenorrhea, and PMS symptoms over time among women who had undergone postpartum BTL. Women should not refrain from BTL because of the concern for the long-term occurrence of menstrual problems afterward.

***Keywords:*** *Bilateral tubal ligation, female sterilization, menstrual disorders, post-tubal ligation syndrome, premenstrual syndrome*

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*Received: 15.10.2022, Accepted: 03.12.2022, Available Online Date: 31.12.2022*

*Cite this article as: Yucel Cicek OS, Sari F. Evaluation of Changes Over Time in Menstrual Pattern After Postpartum Tubal Ligation. J Cukurova Anesth Surg. 2022;5(3):382-8.*

*doi: 10.36516/jocass.1204339*

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## Introduction

Bilateral tubal ligation (BTL) is one of the most commonly preferred contraceptive methods [1]. BTL or female sterilization is a highly effective contraceptive method but suitable only for women who have completed their families [1]. BTL can be performed at the time of cesarean delivery, called postpartum BTL, or separate from pregnancy, called interval BTL [2]. Different techniques can be used for BTL including laparoscopic, hysteroscopic, and laparotomy. Laparoscopy is generally used for interval BTL while postpartum BTL requires laparotomy [2]. Overall, the procedure is safe with very low mortality and complication rates [2].

Although the contraceptive efficacy of BTL is quite high, the method has some drawbacks [1]. Apart from surgical complications, contraceptive failure, and ectopic pregnancy risks, menstrual problems might be seen in women who had undergone BTL [2]. Menstrual disorders following BTL were first described by Williams et al. in the 1950s [3]. A wide range of menstrual disorders including menorrhagia, metrorrhagia, spotting, oligomenorrhea, and psychological disturbances including premenstrual syndrome (PMS) was reported in the studies and the situation was named post-tubal ligation syndrome (PTLS) [2, 4, 5]. It has been suggested that the ligation of the fallopian tubes, and sometimes mesosalpinx results in a reduction of blood flow to the ovaries. This decrease in ovarian blood flow causes impairment of follicular growth and corpus luteum function. In the end, changes in ovarian hormone levels would lead to menstrual irregularities [4]. Furthermore, an increased risk of hysterectomy due to menstrual irregularities was reported in women who had undergone BTL [6, 7].

There are few studies examining the course of menstrual abnormalities subsequent to BTL with conflicting results. A previous study showed that menstrual irregularities were more likely to occur during the fifth year compared to the second year following sterilization [8]. On the other hand, another study found no difference in menstrual abnormalities both at 2 years and 5 years follow-up after BTL [9]. In this study, we aimed to investigate the over-time changes in the severity of menstrual abnormalities experienced by women after BTL. Our further aim was to investigate the long-term risk of hysterectomy following BTL

## Materials and Methods

### *Ethics*

This study was approved by the Institutional Review Board of Kocaeli University Faculty of Medicine, Kocaeli, Turkey (approval number: GOKAEK-2022/18.37). All patients gave informed consent to participate in the study.

### *Study design and participants*

This was a retrospective cohort study conducted at Kocaeli University Medical Faculty Department of Obstetrics and Gynecology. Women who had undergone postpartum BTL at our clinic between January 2018 and October 2021 and had menses for at least 6 months were included in the study. We included women who had been using this contraceptive method (postpartum BTL) at least for one year. Because women within the first year of postpartum BTL might be amenorrheic or have irregular periods due to lactation, these women were excluded from the study. Women who are breastfeeding or stopped breastfeeding less than 6 months ago, amenorrheic, have an endocrinologic disease, or are taking medications that might interfere with the menstrual pattern (e.g uncontrolled thyroid disease, prolactinoma, corticosteroid or oral contraceptive use) were also excluded from the study.

A total of 472 women had undergone postpartum BTL at our clinic during the study period. These women were divided into two groups according to the time passed since BTL; group 1 included women who had un-

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dergone BTL between 1 to 3 years and group 2 included women who had undergone BTL between 3 to 5 years. The severity of menstrual disturbances, the presence of premenstrual symptoms, and also hysterectomy rate were compared between the two groups.

The data regarding the demographic characteristics of the patients and the date and method of BTL were collected from the hospital records. Data regarding the educational status of the patients, chronic medical conditions, and drug use were collected from the patients during interviews.

*BTL technique*

Postpartum BTL defines the ligation of tubes at the time of cesarean delivery [2]. The standard method of postpartum BTL at our clinic is the modified Pomeroy technique [10]. The method involves the placement of a suture around a loop of the fallopian tube, and the excision of that portion of the tube. The excised tubal parts were sent for pathological examination to confirm tubal excision.

*Menstrual evaluation and PMS scale*

Patients were interviewed via phone calls and fulfilled a questionnaire regarding their menstrual patterns and PMS symptoms. All the patients were interviewed by the same interviewer who is an obstetrics and gynecology resident and also a co-author of this manuscript. An average phone call lasted for 10-15 minutes. To evaluate their menstrual pattern; patients were asked how they would define their menstrual regularity: quite regular/regular/seldom irregularities/irregular. The patients who reported their menstrual pattern to be irregular were asked to define their irregularity: intermenstrual bleeding/prolonged menstrual bleeding/frequent menstruation/delayed menstruation. They were also asked about the amount of menstrual bleeding: very heavy/ heavy/ normal/ reduced/ very reduced and the severity of dysmenorrhea: very severe/ severe/ moderate/ mild/ none. A PMS scale developed by Gencdogan et al. was used to evaluate PMS symptoms [11]. The scale is comprised of 44 items. These items measure 9 symptoms of PMS including depressive mood, anxiety, fatigue, irritability, depressive thoughts, pain, appetite changes, sleep disturbances, and edema. Every item is scored from 1 to 5 depending on the severity of the symptom. Therefore, the total score ranges from 44 (no symptoms) to 220 (maximal symptoms).

*Statistical analysis*

All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Corp, Armonk, NY, USA). The normality of data distribution was tested using the Kolmogorov-Smirnov test. Normally distributed data were expressed as mean±standard deviation (SD). Data without normal distribution were expressed as median (25th-75th percentile). Categorical data were expressed as numbers (percentages). Student's t-test was used to compare data with normal distribution. Mann-Whitney U test was used to compare data without normal distribution. Chi-square tests were used to test the categorical variables. A p-value <0.05 was considered statistically significant.

## Results

Of 472 women who had undergone BTL during the study period, we were able to contact 249. Of these women, 74 refused to participate in the study. A total of 80 patients were not eligible due to the inclusion criteria or did not answer all the questions. The remaining 95 patients who completed the questionnaire were eligible and included in the analysis. Of these, 47 underwent BTL within 3 years (group 1) and 49 underwent BTL between 3 to 5 years (group 2). The mean age of the groups was 34,5± 3,3 in group 1 and 36,6± 3,3 in group 2 (Table 1). There was a statistically

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significant difference between the groups regarding patient age (p=0.003). When body mass index (BMI), gravidity, and the educational status of the two groups were compared, no significant difference was present between the groups (p>0.05).

In group 1, 55.3% of the patients reported that their menses were quite regular or regular while 65.3% reported regular menses in group 2. There was no statistically significant difference between groups (p=0.476). The most commonly experienced menstrual abnormality was delayed menses in group 1 (42.9%) and frequent menses in group 2 (41.2%). Overall, there was no significant difference regarding the type of menstrual irregularity between groups (p=0.299). The amount of menstrual blood loss and the severity of dysmenorrhea were also similar between groups (p= 0.880 and, p= 0.473 respectively).

The median PMS score was 116 (97-154) in group 1 and 123 (95-150) in group 2 (p=0.855). There was no statistically significant difference between groups regarding PMS symptoms. None of the patients in both groups underwent a hysterectomy (Table 2).

**Table 1.** Baseline characteristics of the patients

| Characteristics | | Group 1 (n=47) | Group 2 (n=49) | *p* |
|---|---|---|---|---|
| Age (y) | | 34.4± 3.3 | 36.5± 3.3 | 0.003* |
| Gravidity | | 3 (3-4) | 3 (2-4) | 0.591 |
| BMI (kg/m2) | | 26.7 (24.3-31.5) | 28.3 (24.8-32.4) | 0.373 |
| Education | Primary school | 21 (44.7%) | 17 (34.7%) | 0.677 |
| | Secondary school | 7 (14.9%) | 9 (18.4%) | |
| | High school | 12 (25.5%) | 12 (24.5%) | |
| | University | 7 (14.9%) | 11 (22.4%) | |

*Data are presented as mean± standard deviation, median (25th-75th percentile) or n (%).*
*BMI; body mass index.*
**The result is significant at the p level <0.05*

## Discussion

Although BTL is a safe and effective method of contraception [1], there is a concern that BTL might lead to menstrual disturbances as a long-term sequela. However, our results have shown that there was no over-time increase in the prevalence of menstrual disorders or PMS symptoms among women who underwent postpartum BTL.

The presence of menstrual abnormalities following BTL was suggested nearly 80 years ago [3]. Since then, millions of women have undergone the procedure [1]. However, the occurrence of menstrual irregularities after BTL is still under debate. There are several studies investigating the long-term course of the menstrual pattern after BTL with conflicting results. A prospective controlled study found that at 1-year follow-up, dysmenorrhea and heavy bleeding were common among women with BTL compared to controls [12]. Another study found higher levels of menstrual pain and heavy menstrual flow five years after BTL. Importantly, menstrual function in the first year of follow-up was similar to pre-sterilization status. The authors concluded that menstrual changes secondary to BTL may take some time to develop [8].In contrast with this study, a prospective study found no

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**Table 2.** Evaluation of menstrual pattern and PMS symptoms

| | Parameters | Group 1 (n=47) | Group 2 (n=49) | *p* value |
|---|---|---|---|---|
| Menstrual regularity | Quite regular | 11 (23.4%) | 15 (30.6%) | 0.476 |
| | Regular | 15 (31.9%) | 17 (34.7%) | |
| | Seldom irregularities | 7 (14.9%) | 9 (18.4%) | |
| | Irregular | 14 (29.8%) | 8 (16.3%) | |
| Type of irregularity | Intermenstrual bleeding | 3 (14.3%) | 1 (5.9%) | 0.556 |
| | Prolonged bleeding | 4 (19.0%) | 4 (23.5%) | |
| | Frequent menstruation | 5 (23.8%) | 7 (41.2%) | |
| | Delayed menstruation | 9 (42.9%) | 5 (29.4%) | |
| Amount of bleeding | Very heavy | 9 (19.1%) | 8 (16.3%) | 0.880 |
| | Heavy | 5 (10.6%) | 7 (14.3%) | |
| | Normal | 25(53.2%) | 23 (46.9%) | |
| | Reduced | 4 (8.5%) | 7 (14.3%) | |
| | Very reduced | 4 (8.5%) | 4 (8.2%) | |
| Dysmenorrhea severity | Very severe | 7 (14.9%) | 7 (14.3%) | 0.473 |
| | Severe | 4 (8.5%) | 5 (10.2%) | |
| | Moderate | 11 (23.4%) | 6 (12.2%) | |
| | Mild | 8 (17.0%) | 15 (30.6%) | |
| | None | 17 (36.2%) | 16 (32.7%) | |
| PMS Score | | 116 (97-154) | 123 (95-150) | 0.855 |
| Hysterectomy | | 0 (0) | 0 (0) | |

*Data are presented as median (25th-75th percentile) or n (%).*
*PMS; Premenstrual syndrome*

long-term effect of BTL on menstrual indices or pelvic pain. In this study, patients were followed up for 3 to 4.5 years [13]. In line with this study, we found that the prevalence of menstrual disturbances and PMS symptoms were similar among women who had undergone BTL between 1 to 3 years and 3 to 5 years. This data suggests no increase in menstrual disturbances over time.

Several studies found an increased incidence of hysterectomy in women who underwent BTL [14, 15]. These studies suggested that incresed hysterectomy rate in sterilized women is evidence for menstrual abnormalities following BTL [4]. However, most of these studies were uncontrolled for potential confounders such as previous oral contraceptive use. Other studies either found no risk or a slightly increased risk, especially in women who underwent BTL under 30 [4, 13, 16]. In line with these studies, we found no increase in hysterectomy risk in sterilized women over time, suggesting the absence of a serious menstrual irregularity requiring surgery after BTL.

The suggested pathophysiology mechanism for PTLS was that decrease in ovarian blood supply as a result of tubal destruction would lead to follicular dysfunction and subsequent disturbances in ovarian hormone levels [4]. However, studies comparing the hormone levels and ovarian blood flow before and after tubal ligation did not confirm this theory. No difference was found in ovarian artery blood flow or ovarian hormone secretion postoperatively in comparison with

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baseline values [17]. In addition, studies failed to show any detrimental effect of BTL on ovarian reserve [18]. Therefore, tubal ligation does not lead to ovarian damage and the underlying mechanism suggested for PTLS is invalid [8]. These results question the existence of PTLS and support the findings of the present study which showed no long-term increase in menstrual abnormalities following BTL.

There are some limitations of the study. The main limitation is the small sample size and the evaluation of self-reported symptoms rather than an evaluation based on an objective scale. Furthermore, the mean age was older in group 2. Group 2 constituted women who had undergone postpartum BTL 3 to 5 years ago. Every population has a mean female age for the last birth and completion of childbearing [19]. Since postpartum BTL is performed during the final childbirth, it is conceivable that more time has passed since the final childbirth in group 2 compared to group 1. Therefore, the mean age of women in group 2 is older. Another limitation is the lack of a control group of women without BTL. The main strength of the study is the long-term follow-up of up to 5 years. Secondly, in addition to menstrual disturbances, we also evaluated PMS symptoms. Finally, the modified-Pomeroy technique was used in all procedures, excluding the effect of different BTL techniques on the outcome [12].

## Conclusion

Our results showed that there is not a significant change in menstrual disturbances, dysmenorrhea, PMS symptoms, and hysterectomy rate over time among women who had undergone postpartum BTL. Women should not refrain from BTL because of the concern for the long-term occurrence of menstrual problems afterward.

**Author contributions**
All authors have made substantial contribution to the design of the study, data collection and analysis, writing of the manuscript and critical analysis. All authors have read and approved the submitted version of the manuscript.

**Conflict of interest**
The authors declare that they have no conflict of interest.

**Funding**
Authors declared no financial support.

**Ethical approval**

This study was approved by the Institutional Review Board of Kocaeli University Faculty of Medicine, Kocaeli, Türkiye (approval number: GOKAEK-2022/18.37). All patients gave informed consent to participate in the study. This study was conducted in accordance with the ethical standards of the Helsinki Declaration and its later amendments

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