

The effect of bilateral tubal ligation on menopause age and symptoms

Yunus İbik, Hüseyin Durukan, Faik Gürkan Yazıcı

Obstetrics and Gynecology Department, Mersin
University Faculty of Medicine, Yenişehir,
Mersin, Turkey

ORCID ID of the author(s)

Yİ: 0000-0002-1638-5828
HD: 0000-0001-5894-3421
FGY: 0000-0003-1890-5863

Corresponding Author

Hüseyin Durukan
Mersin Üniversitesi Tıp Fakültesi, Kadın
Hastalıkları ve Doğum AD, 33343 Yenişehir,
Mersin, Turkey
E-mail: huseyindurukan@gmail.com

Ethics Committee Approval

Clinical Research Ethics Committee of Mersin
University: registration number: 2019/48.
All procedures in this study involving human
participants were performed in accordance with
the 1964 Helsinki Declaration and its later
amendments.

Conflict of Interest

No conflict of interest was declared by the
authors.

Financial Disclosure

The authors declared that this study has received
no financial support.

Published

2021 May 3

Copyright © 2021 The Author(s)

Published by JOSAM

This is an open access article distributed under the terms of the Creative
Commons Attribution-NonCommercial-NoDerivatives License 4.0 (CC
BY-NC-ND 4.0) where it is permissible to download, share, remix,
transform, and buildup the work provided it is properly cited. The work
cannot be used commercially without permission from the journal.



Abstract

Background/Aim: Bilateral tubal ligation (BTL) is an effective and safe method for family planning; however, the blood supply of the ovaries may be affected during the procedure. There is suspicion that women may enter menopause early once BTL is performed. Although some studies in the literature have evaluated bilateral tubal ligation's effect on ovarian reserves and function, studies investigating its effect on menopause age and symptoms are lacking. The aim of this study was to investigate the effect of bilateral tubal ligation on menopause age and symptoms, eliminate women's hesitations, and guide the clinicians.

Methods: Two hundred postmenopausal women with no comorbidities which may affect the ovarian reserve and menopause symptom severity were included in this case-control study. One hundred women who had undergone bilateral tubal ligation constituted the bilateral tubal ligation (BTL) group, while 100 women who had not undergone any surgery, including bilateral tubal ligation, and who had not received medical treatment and naturally gone through menopause, constituted the control group. Data of all patients regarding menopause age, obstetric history, and educational status were collected. The 'Menopause Rating Scale' was applied to the groups to assess the severity of menopause symptoms. Bilateral tubal ligation age was recorded for the study group. The results were compared using statistical methods.

Results: The mean menopause ages of the bilateral tubal ligation and control groups were 48.30 (3.5) and 47.67 (4.3) years, respectively ($P=0.250$). The two groups were similar in terms of somatic ($P=0.744$), psychological ($P=0.930$), and urogenital ($P=0.477$) menopause symptoms. The mean age at which bilateral tubal ligation was performed in the bilateral tubal ligation group was 37.33 (4.6) years.

Conclusion: The bilateral tubal ligation procedure did not affect menopause age or the severity of menopause symptoms.

Keywords: Contraception, Bilateral tubal ligation, Menopause age, Menopause symptoms

Introduction

'Menopause' is defined as the permanent loss of menstruation due to the loss of ovarian function [1]. One-fifth of the world's female population is in menopause, and according to data published in 2019, women's life expectancy is 74.2 years [2]. With increased quality and access to health services, life expectancy has increased, along with the proportion of the female population in menopause [3]. During menopause, somatic, psychological, and urogenital complaints may occur, including hot flashes, cardiovascular diseases, anxiety, irritability, personality changes, physical and mental fatigue, depression, genital atrophy, sexual problems, and pelvic floor dysfunction [4].

Meanwhile, the subject of family planning has been on the agenda of people for a long time. Bilateral tubal ligation (BTL) is an easy-to-perform, effective, and economical contraceptive method. In addition to these positive aspects, it has been reported to protect against tubal and ovarian cancers [5]. However, during the tubal ligation procedure, anastomoses between the uterine and ovarian arteries may be affected, and blood supply to the ovaries may be impaired. Furthermore, the reduced paracrine, endocrine and neural stimulation of the ovaries resulting from tubal damage may adversely affect ovarian function and the severity of menopause symptoms. Although some studies in the literature evaluated BTL's short-term effects on ovarian reserves and function, studies investigating BTL's long-term effects on menopause age and symptoms are lacking.

The current study, therefore, compares women who have undergone BTL with women who have not undergone the procedure in terms of menopause age and the severity of menopause symptoms.

Materials and methods

This case-control study was conducted at the Gynecology and Obstetrics Clinic of Mersin University Hospital between 30 January 2019-31 May 2019. Before beginning this research, approval for the study was obtained from the Mersin University Clinical Research Ethics Committee on January 23, 2019, with the decision number 2019/48.

The BTL Group: The hospital records were reviewed retrospectively, and women who had undergone the BTL procedure at Mersin University Hospital using the Pomeroy method were invited to the Gynecology and Obstetrics Clinic for an interview. Among the participants who accepted this invitation, women who were in menopause constituted the study's BTL group.

The control group: Women who visited the gynecological outpatient clinic at Mersin University Hospital for routine menopause control were evaluated, and those who did not have any comorbidities, had not undergone the BTL procedure, and agreed to participate in the study were included in the control group.

Exclusion criteria: Women with a history of smoking, radiation exposure, radiotherapy and chemotherapy, premature ovarian insufficiency, previous ovarian surgery, and previous myomectomy – all of which might affect the ovarian reserve – were not included in the study. Additionally, women with thyroid diseases, cardiac diseases, pheochromocytoma, leukemia,

pancreatic tumors, migraine, Parkinson's disease, breast cancer, and psychiatric diseases – all of which might affect the severity of menopause symptoms – were also excluded from the study (Figure 1).

All participants were informed of the study's aim and content, as well as the confidentiality of any collected data, which participants were told would be used for scientific purposes only. The women who agreed to participate were included in the study. Interviews were conducted face-to-face by the same investigator (YI) in both the BTL and control groups. To avoid bias, the first participants for both groups who met the criteria were included in the study. The menopause rating scale was applied in a separate room alone and without any intervention.

Power analysis was used to determine the sample size, which revealed that 100 participants in each group were needed for a power of 80% at $\alpha=0.05$.

Both groups were asked about their socio-demographic characteristics, such as current age, onset age of menopause, gravida, parity, living children, number of miscarriages and abortions, educational status, and chronic diseases. Considering symptoms in the first year of menopause, the women were asked to answer the questions in the 'Menopause Rating Scale' (MRS). The women in the BTL group were also asked about the age at which they had undergone bilateral tubal ligation. Both groups were compared in terms of menopause age, demographic features, answers to the MRS questions, and somatic, psychological, and urogenital symptoms. Furthermore, the BTL and control groups were evaluated for gravida, parity, and educational status.

Menopause Rating Scale

To determine the severity of menopausal complaints and their effect on women's quality of life, the Turkish version of the scale (the original scale had been developed by Schneider, Heinemann, et al. [6] in German in 1992) was validated as a reliable and valid measurement tool [7].

The Menopause Rating Scale is a Likert-type scale comprising 11 items. For each item, the following options are available: '0: None', '1: Mild', '2: Moderate', '3: Severe', and '4: Extremely Severe'. Items 1, 2, 3, and 11 use three subgroups to evaluate somatic complaints. Items 4, 5, 6, and 7 evaluate psychological complaints. Finally, items 8, 9, and 10 evaluate urogenital complaints. The Cronbach's alpha reliability coefficient value was 0.65 for somatic symptoms, 0.79 for psychological symptoms, 0.72 for urogenital symptoms, and 0.84 in total. The scale is evaluated by finding the sum of the points assigned for each item. This evaluation results in a total score between 0 and 44. The higher the total score, the higher the severity of menopausal complaints and the lower the quality of life [7].

Statistical analysis

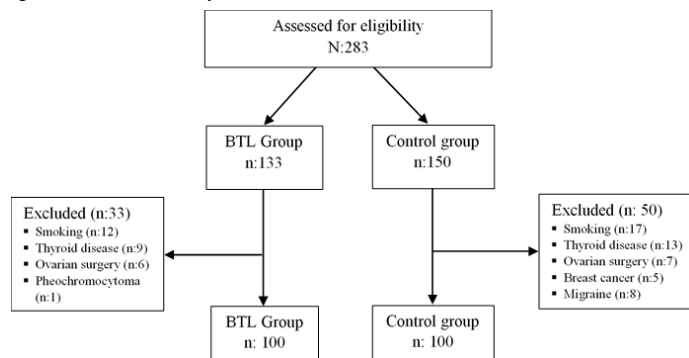
In this study, Statistical Package for Social Sciences (SPSS) 21.0 (SPSS Inc. Chicago, IL, USA) was used for statistical analysis. The Shapiro-Wilk test was used to check whether the data were normally distributed among each group. The mean and standard deviations were used as descriptive statistics for the normally distributed data, and the medians and percentages were used for the non-normally distributed data. The Mann-Whitney U test was used to assess differences between two non-normally

distributed groups. The results were evaluated at a 95% confidence interval and a $P < 0.05$ significance level.

Results

The number of samples as determined by power analysis was reached by interviewing a total of 283 participants, including 133 from the BTL group and 150 from the control group. As they did not meet the criteria, 33 participants in the BTL group and 50 in the control group were excluded from the study. The reasons for these women's exclusion are provided in detail in the flowchart below (Figure 1).

Figure 1: Flowchart of study



The mean ages of the patients in the BTL and control groups were 53.5 (4.6) years and 54.0 (5.0) years, respectively ($P=0.031$). The mean age of menopause in the BTL and control groups were 48.3 (3.5) years and 47.7 (4.3) years, respectively ($P=0.250$). patients in the BTL group had undergone BTL operation at a mean age of 37.3 (4.7) years, and the group's mean time from undergoing the BTL procedure to menopause was 10.3 (5.2) years. No differences were observed between the groups in terms of gravida ($P=0.100$), parity ($P=0.200$), educational status ($P=0.270$) (Table 1), or in the severity of somatic ($P=0.744$), psychological ($P=0.930$), and urogenital ($P=0.477$) complaints related to menopause (Table 2).

Table 1: Descriptive Statistics Between the Groups

Descriptive Information	BTL group (n=100)	Control group (n=100)	P-value
Mean Age	53.5 (4.6)	54.0 (5.0)	0.31
Gravida	4.5 (2.2)	3.9 (2.0)	0.10
Parity	3.7 (2.0)	3.0 (1.6)	0.20
Menopause age	48.3 (3.5)	47.7 (4.2)	0.25
BTL age	37.3 (4.6)	-	-
Time after BTL (years)	10.2 (5.2)	-	-
Educational Status;			
Illiterate/primary school	56 (56%)	64 (64%)	0.27
Secondary/high school	35 (36%)	28 (28%)	
Undergraduate/Postgraduate	9 (9%)	8 (8%)	

BTL: Bilateral tubal ligation, SD: Standard deviation. Mean (SD) values are given. Educational status is indicated by numbers and percentages.

Table 2. Distribution of menopausal complaints by groups

	BTL group (n=100)	Control group (n=100)	P-value
Somatic Complaints	5.7 (3.0)	5.5 (3.1)	0.744
Psychological Complaints	5.5 (3.2)	5.6 (2.0)	0.930
Urogenital Complaints	3.4 (2.2)	3.2 (2.5)	0.477
Total	14.7 (6.8)	14.5 (8.0)	0.731

Mean (SD) values are given

Discussion

Bilateral tubal ligation is a popular family planning procedure, performed upon women's requests. In a recent study, Gurbuz et al. [8] reported that family planning methods do not negatively affect the quality of life. On the other hand, the menopause period decreases the quality of life of women. Whether BTL affects menopause age and menopause symptoms are

important because menopause constitutes at least one-third of women's lives and, if it starts at an early age, its negative effects will be prolonged [2, 3]. The current study clearly emphasizes that no differences were observed between women with and without BTL in menopause age and menopausal complaints. Furthermore, the mean menopause age in this study was consistent with the mean natural menopause age in Turkey.

In our literature review, we found only one study evaluating BTL's effect on menopausal age [9], and we did not find any study interpreting BTL's effect on menopausal symptoms. In 2019, Ainsworth et al. compared various tubal ligation methods' effects on menopausal age and found the mean age of women who entered menopause naturally to be 50.1 years. The mean menopause age was 50.9 years in the cautery method, 51.1 years in the Pomeroy method, 50.1 years in the Hulka and Filshie clip systems, and 50 years in unknown BTL methods. No statistically significant differences were observed between the menopause ages in terms of various BTL methods and the mean menopause age of women who had entered menopause naturally. In Ainsworth et al.'s study, the mean age at which women underwent the BTL procedure was 36–37 years [9]. In our study, the mean age at which women underwent the BTL procedure was 37.3 years.

Ovarian reserve tests can be used to predict menopause age [10], and numerous studies in the literature have investigated tubal sterilization procedures' effects on ovarian reserves. These studies have reported that tubal surgery does not adversely affect ovarian reserves [11-17]. However, some publications have contradicted these studies [18, 19]. In most of the above-mentioned studies, hormonal markers (such as FSH, LH, E2, and AMH), and ultrasonographic findings (such as ovarian or uterine artery Doppler indices and antral follicle counts) were used in the preoperative and postoperative short terms to evaluate ovarian reserves or function. Our study differs from previous studies in the literature in that it evaluates both menopause age and symptom severity in the postoperative long term, comparing the perspectives of women who have undergone BTL to the control group.

The reason why BTL does not affect menopause age can be explained by the fact that tubal ligation is usually performed from avascular areas. Also, the formation of new anastomoses after the procedure, the recanalization of ligated vascular ends, and the compensatory dilatation of other vascular structures involved in ovarian blood supply meet the need for ovarian blood as a result of the procedure. In parallel to this hypothesis, some studies have evaluated the effect of different BTL procedures such as laparoscopic electrocoagulation, the Pomeroy method, and fimbriectomy on ovarian stromal and utero ovarian artery blood flow parameters in women and found no statistically significant differences between preoperative and postoperative values [20-22].

Studies have also examined subjects' reporting a decrease in ovarian reserves, arguing the antithesis of the previously mentioned findings [18, 19]. The factors underlying this difference may be the ligation of the dominant vessels from the uterine or ovarian arteries in the ovarian blood supply, depending on the anatomical variations of ovarian vascularization. While the ovarian blood supply is normally provided by both the

ovarian and uterine arteries, in some women, it may be predominantly provided by either the ovarian or uterine arteries.

Modern medicine aims to improve quality of life and prolong lifespans. For this reason, quality-of-life scales have recently become a particularly important research area. The Menopause Rating Scale is frequently used in clinical practice because it measures the severity of menopausal complaints quantitatively and determines their effect on the quality of life. This scale was compared with scales measuring the severity of menopause symptoms – such as the Kupperman index and Nottingham Health Profile – and it was found to be more realistic, easier to apply, and more reliable in evaluating menopausal complaints [23]. Moreover, a 2018 study found that the mean MRS scores were 12.88 (8.39) for women who had not menstruated for one year and 9.93 (9.11) for women who had not menstruated for more than one year, and the difference between these two groups was statistically significant [24]. Therefore, in our study, women were asked to answer questions on the MRS while considering their complaints in the first year of menopause.

Both groups were found to have symptoms that impaired their quality of life, but no statistically significant difference was observed between the groups. Decreased quality of life for menopausal women has also been reported in various publications [25]. Blumel et al. [26] reported that menopausal women have worse quality-of-life scores than premenopausal women in the vasomotor, psychosocial, physical, and sexual domains. In addition, hot flashes (a somatic complaint) have been reported as the most disturbing quality of life symptom [27].

The current study's strength is that it directly investigates BTL's effect on menopause age and menopause symptoms, unlike other studies evaluating ovarian reserve tests – such as E2, FSH, LH, and AMH – which indirectly affect menopause age. The mean age of women in the BTL and control groups during the data collection period may be considered a limitation of the current study because women may have difficulty remembering their complaints from early menopause due to a long time has elapsed since its onset. In recent years, after the revelation of the relationship between ovarian cancer and tubal epithelium, salpingectomy has become more popular in tubal sterilization. However, since BTL is reversible and salpingectomy is irreversible, BTL is often preferred – especially among young women. Since most women who have undergone salpingectomy for contraceptive purposes are not yet menopausal, no long-term results have been obtained.

Conclusion

The results of this study demonstrate that BTL does not affect menopause age, or the severity of somatic, psychological, and urogenital complaints related to menopause. We think our study will contribute to better informing patients and improving counseling in family planning practices.

Acknowledgments

We would like to thank Prof. Dr. Bahar Taşdelen from the Biostatistics Department of Mersin University for the statistical guidance of this article.

References

1. De Francis P, Colacurci N, Riemma G, Conte A, Pittana E, Guida M, et al. Nutraceutical Approach to Menopausal Complaints. *Medicina (Kaunas)*. 2019;55(9):554.
2. World health statistics Overview 2019 <https://apps.who.int/iris/bitstream/handle/10665/311696/WHO-DAD-2019-1-eng.pdf?ua=1>

3. Türkiye İstatistik Kurumu 2014 www.tuik.gov.tr/PreHaberBultenleri. Access time: 28 May 2019
4. Versi E, Harvey MA, Cardozo L, Brincat M, Studd JW. Urogenital prolapse and atrophy at menopause: a prevalence study. *Int Urogynecol J Pelvic Floor Dysfunct*. 2001;12(2):107-10.
5. Rabban JT, Garg K, Crawford B, Chen LM, Zaloudek CJ. Early detection of high-grade tubal serous carcinoma in women at low risk for hereditary breast and ovarian cancer syndrome by systematic examination of fallopian tubes incidentally removed during benign surgery. *Am J Surg Pathol*. 2014;38(6):729-42.
6. Potthoff P, Heinemann LA, Schneider HP, Rosemeier HP, Hauser GA. Menopause-Rating-Skala (MRS II): Methodische Standardisierung in der deutschen Bevölkerung [The Menopause Rating Scale (MRS II): methodological standardization in the German population]. *Zentralbl Gynakol*. 2000;122(5):280-6.
7. Can-Gürkan Ö. Menopoz Semptomlarını Değerlendirme Ölçeği'nin Türkçe formunun güvenilirlik ve geçerliliği. *Hemşirelik Forumu* 2005;30:35
8. Gürbüz T, Dokuzeyül Güngör N, Tanrıdan Okçu N, Yurci A. Effects of contraception methods on female sexual function and quality of life. *Journal of Surgery and Medicine* 2020;4(12):1231-1235
9. Ainsworth AJ, Baumgarten SC, Bakkum-Gamez JN, Vachon CM, Weaver AL, Laughlin-Tommaso SK. Tubal Ligation and Age at Natural Menopause. *Obstet Gynecol*. 2019;133(6):1247-1254.
10. Depman M, Eijkemans MJC, Broer SL, Scheffer GJ, van Rooij IAJ, Laven JSE, et al. Does anti-Müllerian hormone predict menopause in the general population? Results of a prospective ongoing cohort study. *Human Reprod*. 2016;31(7):1579-87.
11. Moslehi N, Mirmiran P, Tehrani FR, Azizi F. Current Evidence on Associations of Nutritional Factors with Ovarian Reserve and Timing of Menopause: A Systematic Review. *Adv Nutr*. 2017;8(4):597-612.
12. Sezik M, Ozkaya O, Demir F, Sezik HT, Kaya H. Total salpingectomy during abdominal hysterectomy: effects on ovarian reserve and ovarian stromal blood flow. *J Obstet Gynaecol Res*. 2007;33(6):863-9.
13. Findley AD, Siedhoff MT, Hobbs KA, Steege JF, Carey ET, McCall CA, et al. Short-term effects of salpingectomy during laparoscopic hysterectomy on ovarian reserve: a pilot randomized controlled trial. *Fertil Steril*. 2013;100(6):1704-8.
14. Song T, Kim MK, Kim ML, Jung YW, Yun BS, Seong SJ, et al. Impact of opportunistic salpingectomy on anti-Müllerian hormone in patients undergoing laparoscopic hysterectomy: a multicentre randomised controlled trial. *BJOG*. 2017;124(2):314-20.
15. Herman HG, Gluck O, Keidar R, Kerner R, Kovo M, Levran D, et al. Ovarian reserve following cesarean section with salpingectomy vs tubal ligation: a randomized trial. *Am J Obst Gynecol*. 2017;472.e1-472.e6
16. Venturella R, Morelli M, Lico D, et al. Wide excision of soft tissues adjacent to the ovary and fallopian tube does not impair the ovarian reserve in women undergoing prophylactic bilateral salpingectomy: results from a randomized, controlled trial. *Fertil Steril*. 2015;104(5):1332-9.
17. Kotlyar A, Gingold J, Shue S, Falcone T. The effect of salpingectomy on ovarian function. *Minim Invasive Gynecol*. 2017;24(4):563-8.
18. Gemicci A, Şükür YE, Tülek F, Taşkın S, Atabeoğlu CS. Post-partum tubal ligation at time of cesarean delivery or via laparoscopy as an interval sterilization has similar effects on ovarian reserve. *J Turk Ger Gynecol Assoc*. 2020;21(1):24-8.
19. Kaya C, Turgut H, Cengiz H, Turan A, Ekin M, Yaşar L. The effect of tubal sterilization with the Pomeroy technique and bipolar electrocauterization on the ovarian reserve and serum anti-Müllerian hormone levels in a rat model. *Eur J Obstet Gynecol Reprod Biol*. 2015;185:108-13
20. Yazici G, Arslan M, Pata O, Oz U, Aban M. Ovarian function and vascular resistance after tubal sterilization. *J Reprod Med*. 2004;49(5):379-83.
21. Dede FS, Akyuz O, Dilbaz B, Caliskan E, Haberal A. Color doppler flow analysis of uterine and ovarian arteries before and after tubal sterilization: electrocauterization versus pomeroiy. *Gynecol Obstet Invest*. 2006;61(1):45-8.
22. Kelekci S, Yorgancioglu Z, Yilmaz B, Yasar L, Savan K, Sonmez S, Kart C. Effect of tubal ligation on ovarian reserve and the ovarian stromal blood supply. *Aust N Z J Obstet Gynaecol*. 2004;44(5):449-51.
23. Bekiroğlu N, Gürbüz A, Konyaloğlu R, Ayas S, Alkan A, Eren S. Menopoz Semptomlarını Değerlendirme Ölçeği (MSDÖ), Kupperman Menopoz Ölçeği (KMÖ) ve Nothingam Sağlık Profili (NSP) ölçeklerinin güvenilirlik ve yanıtlama etki büyüklüklerinin yeni menopozlu hastalarda karşılaştırılması. *Zeynep Kamil Tıp Bülteni* 2008;39(1):11-5.
24. Alpaslan M. The effect of menopausal symptoms on daily living activities [dissertation]. Ordu University 2018.
25. Schneider HPG, Birkhäuser M. Quality of life in climacteric women. *Climacteric*. 2017;20(3):187-94.
26. Blumel JE, Castelo-Branco C, Binfa L, Gramegna G, Tacla X, Aracena B, et al. Quality of life after the menopause: a population study. *Maturitas*. 2000;34(1):17-23.
27. Williams RE, Levine KB, Khalilani L, Lewis J, Clark RV. Menopause-specific questionnaire assessment in US population-based study shows negative impact on health-related quality of life. *Maturitas*. 2009;62(2):153-9.

This paper has been checked for language accuracy by JOSAM editors.

The National Library of Medicine (NLM) citation style guide has been used in this paper.