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Descriptive Cross-Sectional Study on Menstrual Irregularities in Patients Undergoing Tubal Ligation

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ABSTRACT

Menstrual abnormalities continue to be a problematic consequence of tubal ligation, despite conflicting results from pertinent studies. Menorrhagia, metrorrhagia, polymenorrhagia, and dysmenorrhea are common disorders that may require a hysterectomy. **Objective:** To ascertain how frequently women who had tubal ligation experienced irregular menstruation. **Methods:** The Department of Obstetrics and Gynecology at Government Maula Baksh Hospital in Sargodha carried out this descriptive cross-sectional study between August 1, 2023, and January 31, 2024. Ethical approval for this study was obtained from the Research Evaluation Unit, CPSP (Reference No. CPSP/REU/OBG-2020-147-10091; dated 1st August 2023). Using non-probability consecutive sampling, 303 women between the ages of 20 and 40 who were having tubal ligation were included. Women with gynecological conditions (polycystic ovarian syndrome, endometriosis, adenomyosis, fibroid uterus), diabetes mellitus, hypertension, thyroid or cardiovascular disorders, or thyroid dysfunction were excluded. Tubal ligation was performed by a consultant gynecologist using the standard method. Patients were followed 6 months post-ligation, with menstrual irregularities self-reported via a specially designed proforma and clinically validated through menstrual diaries where possible. **Results:** This study found oligomenorrhea in 83 (27.4%), abnormal uterine bleeding in 61 (20.1%), dysmenorrhea in 55 (18.2%), and polymenorrhea in 37 (12.2%) post-TL. **Conclusion:** Oligomenorrhea is the most common menstrual irregularity post-tubal ligation, followed by abnormal uterine bleeding.

INTRODUCTION

Although many options exist for postpartum contraception, tubal sterilization/ligation remains one of the most widely used techniques globally, particularly among women who have had two or more children [1]. Women may seek reversal for reasons such as child loss or remarriage [2]. Approximately 30% of women completing family planning opt for tubal ligation as a safe, efficient, permanent fertility control method [3]. In the 1960s in the United States, female sterilization was primarily for medical reasons (e.g., risky subsequent pregnancies). Many centers used a formula requiring that age multiplied by parity ≥120 for elective sterilization, which was endorsed by the American College of Obstetricians and Gynecologists until 1969 [4, 5]. Annually, about 700,000 bilateral tubal procedures occur in the US, half of which are postpartum and half are interval operations [6]. Family planning considers desired children, timing, and contraception for sexually active individuals [7].

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Preconception counseling, STI prevention and treatment, sexuality education, and infertility management are all included [3]. The average menstrual cycle is 21–35 days long, with 25–80 mL of flow volume and 7 days of bleeding [8, 9]. Menorrhagia must be distinguished from polymenorrhea (less than 21-day intervals), metrorrhagia (irregular flow), menometrorrhagia (frequent excessive flow), and dysfunctional uterine bleeding (abnormal bleeding without pathology) [9]. Due to expenses and the aim to preserve the uterus, treatment has changed from surgical to conservative [10]. Treatment approaches and result measurement are complicated by the subjective definition of severe menstrual bleeding [11]. Despite the procedure's safety, there is a dispute regarding post-tubal sterilization syndrome, which includes vaginal bleeding [12]. Research on changes in ovarian reserve after sterilization has yielded conflicting results [13]. One troublesome side effect of tubal ligation (TL) is menstrual disruptions, which may be caused by hormonal alterations, altered gonadotropin signaling, and reduced follicular growth as a result of a disrupted ovarian blood supply [14]. Menstrual disturbances are a problematic effect of tubal ligation (TL), potentially due to disrupted ovarian blood supply leading to impaired follicular growth, altered gonadotropin signaling, and hormonal changes [14].

There is a dearth of evidence on menstrual abnormalities after tubal ligation (TL), especially in local communities where the procedure is widely practiced, leaving a knowledge gap in evidence-based counseling and reproductive health over the long term. Irregular menstruation following TL poses a clinical problem as it impacts physical, mental, and reproductive health, quality of life, and increases medical needs. The study aimed to assess post-TL menstrual changes and use them to inform counseling on the advantages/disadvantages. Irregular menstruation impacts physical, mental, and reproductive health, quality of life, and medical needs. The knowledge of the effects of TL can support informed decision-making, counseling, and care. It recognizes the risk factors and correlations and provides evidence-based practices, which will enhance knowledge in long-term reproductive health in areas where TL occurs frequently.

METHODS

This descriptive cross-sectional study was carried out in the Department of Obstetrics and Gynecology, Government Maula Baksh Hospital, Sargodha, between August 1, 2023, and January 31, 2024. Ethical approval for this study was obtained from the Research Evaluation Unit, CPSP (Reference No. CPSP/REU/OBG-2020-147-10091; dated 1st August 2023). After outlining the goals of the study and guaranteeing data confidentiality, each participant gave their informed consent. Using non-probability consecutive sampling, 303 women between the ages of 20 and 40 who were having tubal ligation and had at least three regular cycles before the procedure were included. The formula $n = Z^2 p(1-p)/e^2$ was used to determine the sample size. Z=1.96 for 95% confidence, p=0.269 and e=0.05 (margin of error) yielded n≈99. Women with gynecological conditions (polycystic ovarian syndrome, endometriosis, adenomyosis, fibroid uterus), chronic conditions (diabetes mellitus, hypertension, thyroid, cardiovascular), or thyroid dysfunction were not included. A consultant gynecologist used the conventional technique to conduct tubal ligation. After ligation, patients were monitored for six months. When possible, menstruation diaries were used to validate the self-reported monthly irregularities on a specifically created proforma. Monthly clinic visits or phone calls were used to guarantee compliance, and there were no losses to monitor. Every piece of information was noted on the proforma. A structured, pre-tested Menstrual Disorder Assessment Questionnaire (MDAQ), modified from the Menstrual Disorder Questionnaire (MDQ), was used to evaluate menstrual irregularities. Menstrual cycle length, bleeding duration, flow pattern, and related symptoms, including dysmenorrhea and polymenorrhea, were all covered by the tool. Self-reported information was checked using menstrual diaries when available. The MDAQ has demonstrated strong psychometric properties, with a reported Cronbach's alpha of 0.84 in prior studies. In the present study, internal consistency was satisfactory (Cronbach's alpha=0.82). Content validity was confirmed through review by three obstetric and gynecological experts.

Data analysis was performed using SPSS version 26.0. Normality of quantitative variables (age, BMI) was checked using the Shapiro-Wilk test; since normal, they were presented as mean ± standard deviation. Qualitative variables (education level, parity, menstrual irregularities: oligomenorrhea/dysmenorrhea/polymenorrhea/AUB, previous contraceptive method) were presented as frequencies and percentages. Effect modifiers (age, BMI, education, parity, and previous contraceptive use) were controlled for by stratification. Post-stratification chi-square test was applied; $p<0.05$ was significant.

RESULTS

The demographic characteristics of the 303 participants. The mean age was 29.10 ± 4.23 years, with 178 (58.70%) aged 20-30 years and 125 (41.30%) aged 31-40 years. Mean parity was 3.19 ± 0.89, with 199 (65.7%) having ≤3 parity and 104 (34.3%) >3. Mean BMI was 28.25 ± 2.53 kg/m^2, with 205 (67.7%) ≤30 kg/m^2 and 98 (32.3%) >30 kg/m^2. Education levels were: illiterate 34 (11.20%), primary 37 (12.2%), middle 119 (39.3%), matric & above 113 (37.3%). Previous contraceptive methods: pills 187 (61.7%), condom 116 (38.3%) (Table 1).

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Table 1: Demographic Characteristics of Patients (n=303)

Variables	Category	Frequency (%)
Age (Years)	20–30	178 (58.7%)
	31–40	125 (41.3%)
	Mean ± SD	29.10 ± 4.23
Parity	≤3	199 (65.7%)
	>3	104 (34.3%)
	Mean ± SD	3.19 ± 0.89
BMI (kg/m^2)	≤30	205 (67.7%)
	>30	98 (32.3%)
	Mean ± SD	28.25 ± 2.53
Education Level	Illiterate	34 (11.2%)
	Primary	37 (12.2%)
	Middle	119 (39.3%)
	Matric & above	113 (37.3%)
Previous Contraceptive Method	Pills	187 (61.7%)
	Condom	116 (38.3%)

The frequency of menstrual irregularities post-tubal ligation. Oligomenorrhea occurred in 83 patients, abnormal uterine bleeding in 61, dysmenorrhea in 55, and polymenorrhea in 37 (Table 2).

Table 2: Frequency of Menstrual Irregularities (n=303)

Type of Irregularity	Yes, n (%)	No, n (%)
Oligomenorrhea	83 (27.4%)	220 (72.6%)
Abnormal Uterine Bleeding	61 (20.1%)	242 (79.9%)
Dysmenorrhea	55 (18.2%)	248 (81.8%)
Polymenorrhea	37 (12.2%)	266 (87.8%)

Stratification analysis demonstrated that oligomenorrhea, abnormal uterine bleeding, dysmenorrhea, and polymenorrhea were distributed across age, parity, BMI, contraceptive use, and educational status, with no significant associations (p>0.05) between irregularities and modifiers (Table 3).

Table 3: Stratification of menstrual irregularities by demographic and clinical variables

Variables	Categories	Yes, n (%)	No, n (%)	p-value
Presence of Oligomenorrhea				
Age (years)	20–30	40 (22.5%)	138 (77.5%)	0.197
	31–40	43 (34.4%)	82 (65.6%)	
Parity	≤3	58 (29.1%)	141 (70.9%)	0.545
	>3	25 (24.0%)	79 (76.0%)	
BMI (kg/m^2)	≤30	61 (29.8%)	144 (70.2%)	0.405
	>30	22 (22.4%)	76 (77.6%)	
Previous Contraceptive	Pills	49 (26.2%)	138 (73.8%)	0.768
	Condom	34 (29.3%)	82 (70.7%)	
Education	Illiterate	6 (17.6%)	28 (82.4%)	0.792
	Primary	9 (24.3%)	28 (75.7%)	
	Middle	31 (26.1%)	88 (73.9%)	
	Matric & above	37 (32.7%)	76 (67.3%)	
Presence of Abnormal Uterine Bleeding				
Age (years)	20–30	37 (20.8%)	141 (79.2%)	0.886
	31–40	24 (19.2%)	101 (80.8%)	
Parity	≤3	37 (18.6%)	162 (81.4%)	0.551
	>3	24 (23.1%)	80 (76.9%)	
BMI (kg/m^2)	≤30	49 (23.9%)	156 (76.1%)	0.187
	>30	12 (12.2%)	86 (87.8%)	
Previous Contraceptive	Pills	37 (19.8%)	150 (80.2%)	0.868
	Condom	24 (20.7%)	92 (79.3%)	
Education	Illiterate	6 (17.6%)	28 (82.4%)	0.947
	Primary	9 (24.3%)	28 (75.7%)	
	Middle	21 (17.6%)	98 (82.4%)	
	Matric & above	25 (22.1%)	88 (77.9%)	
Presence of Dysmenorrhea				
Age (years)	20–30	31 (17.4%)	147 (82.6%)	0.773
	31–40	24 (19.2%)	101 (80.8%)	
Parity	≤3	37 (18.6%)	162 (81.4%)	0.921
	>3	18 (17.3%)	86 (82.7%)	
BMI (kg/m^2)	≤30	37 (18.0%)	168 (82.0%)	0.919
	>30	18 (18.4%)	80 (81.6%)	
Previous Contraceptive	Pills	28 (15.0%)	159 (85.0%)	0.263
	Condom	27 (23.3%)	89 (76.7%)	
Education	Illiterate	6 (17.6%)	28 (82.4%)	0.157
	Primary	9 (24.3%)	28 (75.7%)	
	Middle	9 (7.6%)	110 (92.4%)	
	Matric & above	31 (27.4%)	82 (72.6%)	
Presence of Polymenorrhea				
Age (years)	20–30	22 (12.4%)	156 (87.6%)	0.985
	31–40	15 (12.0%)	110 (88.0%)	
Parity	≤3	31 (15.6%)	168 (84.4%)	0.169
	>3	6 (5.8%)	98 (94.2%)	
BMI (kg/m^2)	≤30	24 (11.7%)	181 (88.3%)	0.936
	>30	13 (13.3%)	85 (86.7%)	
Previous Contraceptive	Pills	22 (11.8%)	165 (88.2%)	0.803
	Condom	15 (12.9%)	101 (87.1%)	
Education	Illiterate	3 (8.8%)	31 (91.2%)	0.939
	Primary	6 (16.2%)	31 (83.8%)	
	Middle	15 (12.6%)	104 (87.4%)	
	Matric & above	13 (11.5%)	100 (88.5%)	

DISCUSSION

The most common form of family planning is tubal ligation. In 1990, the percentage of married women of reproductive age who were sterilized was 22% in developing countries and 11% in industrialized countries, corresponding to 44% and 18% of contraceptive users, respectively. Menstrual irregularities associated with post-tubal ligation syndrome continue to raise concerns. Decades of discussion followed by initial observation of Stein *et al.* increased menorrhagia and metrorrhagia following sterilization [15]. Following TL, this study discovered oligomenorrhea in 83 (27.4%), atypical uterine bleeding in 61 (20.1%), dysmenorrhea in 55 (18.2%), and polymenorrhea in 37 (12.2%). The abnormal uterine bleeding 24.35%,

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polymenorrhea 13.46%, dysmenorrhea 19.87%, and oligomenorrhea 26.92%. In a local study of 200 patients, 41% were between the ages of 32 and 40, 53% had parity 4-6, and 47% had heavy bleeding, 28% had irregular cycles, 13% had polymenorrhea, 5% had dysmenorrhea, and 7% had oligomenorrhea [16]. Menstrual disorders did not significantly change after TL, according to Zhu *et al.* [17]. With comparable bleeding durations, flow volumes, cycle lengths, and irregularities in sterilized and non-sterilized women, concluded that TL does not cause menstruation issues [18]. Age at sterilization influences abnormalities; it is more common in those aged 20 to 29 than in those over 30, and it may be a risk factor for menorrhagia and irregular bleeding [19]. Although tubal ligation is one of the most used permanent contraceptive techniques in the world, there is ongoing debate regarding its potential link to subsequent irregular menstruation. Without aiming to demonstrate causality, the current descriptive cross-sectional study was carried out to record the prevalence and pattern of menstrual irregularities among women after tubal ligation. The results of this study show that a significant percentage of women experienced irregular menstruation following tubal ligation. The most commonly reported abnormality was oligomenorrhea, which was followed by polymenorrhea, dysmenorrhea, and irregular uterine hemorrhage. International and regional literature has documented similar trends. Similar rates of oligomenorrhea and irregular uterine hemorrhage after tubal sterilization were reported in studies by Abbas *et al.* confirming the consistency of findings across various populations [14]. Uncertainty surrounds the underlying mechanism of post-tubal ligation menstruation problems. One theory is that tubal ligation disrupts the mesosalpinx, changing the ovarian blood flow and potentially impacting hormone control and follicular growth. Changes in estrogen levels and gonadotropin secretion have also been proposed as important causes. These biological theories are still up for debate, though, because several controlled trials have not shown any appreciable changes in hormones or menstruation following the surgery. There is evidence in the literature to the contrary. There is no statistically significant change in menstrual cycle characteristics between sterilized and non-sterilized women, according to certain large cohort and case-control studies. Variations in study design, age at sterilization, parity, baseline menstrual cycles, and follow-up time may account for these disparities. Although no significant correlations were found in the current investigation, younger age at the time of tubal ligation and higher parity have been proposed as potential risk modifiers for post-procedural menstrual abnormalities. Menstrual changes after tubal ligation may be multifactorial rather than directly related to a single factor, as evidenced by the lack of statistically significant correlations between menstrual irregularities and clinical or demographic variables like age, body mass index, parity, education level, and previous use of contraceptives. Menstrual patterns following sterilization may also be influenced by psychological variables, recollection bias, and age-related hormonal changes. By offering local data on menstrual disruptions after tubal ligation in a Pakistani population—where such data are still scarce—this study adds to the body of existing knowledge. While stressing that the evidence is still equivocal, these findings may help doctors counsel women contemplating tubal ligation on potential menstrual abnormalities. Because of decreased follicles and ovarian non-responsiveness to FSH, Burger *et al.* connected high E2 and FSH to menstruation issues [20]. Current study (mean age study group 44.4 ± 5.7, control 45.2 ± 5.3; p=0.424; mean parity 3.8±1.8 vs. 3.5 ± 1.4; p=0.220) found no significant difference in hysterectomy for irregular bleeding (RR=0.85; 95% CI: 0.56-1.28; p=0.418). When analyzing the results, it is important to take into account the many constraints of this case series. Since it is a descriptive case series without a control group, it is impossible to establish a causal link between menstrual abnormalities and tubal ligation. Despite reflecting the whole accessible population during the study period, the very small sample size (n=99) lowers the results' statistical power and generalizability. Selection bias is a possibility in this single-center study that uses non-probability consecutive sampling. The majority of menstrual irregularities were self-reported, which raises the risk of reporting bias and memory. Furthermore, the six-month follow-up period might not be long enough to record long-term or delayed menstruation changes.

CONCLUSIONS

The most frequent menstrual irregularity following tubal ligation is oligomenorrhea, which is followed by irregular uterine bleeding. In order to avoid anomalies and community morbidity, public awareness campaigns should inform the public about the importance of prompt clinician consultation.

Authors' Contribution

Conceptualization: SL
Methodology: AP, AF, SS
Formal analysis: AA, SMB
Writing and Drafting: SM
Review and Editing: SL, AA, SMB, AF, SS, SM

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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