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ORIGINAL ARTICLE

Assessment of Menstrual Irregularities in Reproductive Women Post Tubal Ligation

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ABSTRACT

Objective: To compare menstrual disorders between post-tubal ligated and non-ligated women, and to compare endometrial histopathology between the two groups to evaluate menstrual disorders.
Study Design: Prospective cohort study.
Setting: Department of Obstetrics and Gynecology, Nishtar Hospital, Multan, Pakistan.
Period: 9th April 2022 to 9th July 2023.
Material and Methods: A purposive sampling technique was used to enroll 210 women aged 30 to 50 years, divided into two groups of 105 women each: Group 1 (post-tubal ligated) and Group 2 (non-tubal ligated). Each group was further subdivided into patients with and without abnormal uterine bleeding (AUB). A detailed menstrual history, general and systemic examination, routine investigations, and pre-menstrual endometrial biopsy were performed. Statistical analysis was conducted using the Chi-square test, with categorical variables expressed as frequencies and percentages. Exact p-values were calculated, and a p-value of less than 0.05 was considered statistically significant.
Results: In the case group, polymenorrhea was observed in 38.89% and menorrhagia in 29.63% of patients, whereas in the control group, polymenorrhea was observed in 39.22% and menorrhagia in 31.37% of patients. The differences were not statistically significant ($p = 1.000$). Proliferative endometrium was the most common histopathological finding in both groups (42.59% of cases vs. 41.18% of controls, $p = 1.000$). No significant associations were found between tubal ligation status and age ($p = 0.315$), parity ($p = 0.995$), endometrial thickness ($p = 0.825$), or time since tubal ligation ($p = 0.200$).
Conclusion: The incidence of menstrual disorders does not differ significantly between post-tubal ligated and non-ligated women. Patients concerned about the effects of tubal ligation on their future menstrual patterns should be counseled that the procedure has no adverse impact on menstrual function or endometrial histopathology. Large-scale, multi-center studies with extended follow-up periods are recommended to confirm these findings.
Keywords: Abnormal uterine bleeding, post-tubal sterilization syndrome, tubal ligation, menstrual disorders, endometrial histopathology, Pakistan.

INTRODUCTION

The menstrual cycle comprises a series of tightly regulated events that ready a woman's body for conception. All contraceptive modalities prevent pregnancy by interfering with different phases of the menstrual cycle or by blocking sperm from approaching the ovum. In nations with high population density, such as Pakistan, sterilization serves as an important means of controlling population growth. Although numerous contraceptive alternatives are accessible, tubal sterilization remains a commonly practiced form of birth control and represents a significant component of Pakistan's national family planning initiatives.

Tubal sterilization is carried out across various levels of the healthcare delivery system, extending from primary health facilities to tertiary-level hospitals within governmental healthcare sectors, as well as in private institutions and nursing homes[1]. According to the Pakistan Demographic and Health Survey (PDHS 2017-18), female sterilization accounts for a substantial proportion of modern contraceptive methods used in the country [2]. Previous survey data have indicated that a significant number of women express a desire to undergo tubal sterilization at some point in the future [3,4].

Among women aged 35 to 44 years, surgical sterilization represented the single most important contraceptive method [5]. The CREST investigation (Collaborative Review of Sterilization), a 1983 analysis encompassing 9,475 interval sterilizations performed across numerous locations throughout the USA, documented an overall adverse event rate of 1.7 every 100 cases and 4.7 deaths per 100,000 female sterilizations. In 1951, Williams and his team observed that women experienced rates of menorrhagia and metrorrhagia that were greater than anticipated [6]. They were the first to raise concern regarding the clinical consequences of tubal sterilization, proposing the hypothesis that female sterilization might elevate a woman's risk of excessive bleeding[7]. The phrase post-tubal sterilization syndrome has been employed variably to encompass unusual menstrual bleeding, pre-menstrual pain and dicomfort, hysterectomy, and various other conditions, including the requirement for tubal reversal, feelings of remorse, and menopausal syndrome[8].

Moreover, certain gynecologists advocated hysterectomy as a means of sterilization due to the reportedly frequent development of this syndrome[9]. Since then, the existence of a post-tubal sterilization syndrome has remained a matter of ongoing debate. Abnormal uterine bleeding (AUB) is defined as any deviation in menstrual frequency, flow duration, or volume of blood loss. AUB accounts for 20–30% of gynecology outpatient visits among reproductive-aged women and 69% among those who are perimenopausal or postmenopausal[10]. AUB includes the following categories: excessive menorrhagia or prolonged bleeding occurring at regular intervals; polymenorrhea, defined as bleeding at intervals of less than 21 days; oligomenorrhea, characterized by bleeding at intervals of 35 days or longer accompanied by scanty flow; metrorrhagia, or irregular acyclical bleeding; and menometrorrhagia, involving prolonged and excessive bleeding occurring at irregular intervals. Despite decades of debate regarding post-tubal sterilization syndrome, limited comparative data exist on menstrual disorders and endometrial histopathology between sterilized and non-sterilized women in the Pakistani population. In light of the foregoing, this study was undertaken with the objectives of comparing menstrual irregularities between women who had undergone tubal sterilization and those who had not, as well as comparing endometrial histopathology between the two groups to evaluate menstrual disorders.

MATERIAL AND METHODS

This prospective cohort study was conducted in the Department of Obstetrics and Gynecology at Nishtar Hospital, Multan from 9th April 2022 to 9th April 2023. A prospective cohort design was selected to allow comparison of menstrual results among women who had undergone tubal ligation and those who had not over time

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while minimizing recall bias, which is a common limitation of retrospective studies. A purposive sampling technique was used to enroll women attending the gynecology outpatient department, as this approach ensured equal representation of individuals who had undergone tubal sterilization and those who had not, and allowed deliberate inclusion of women with and without abnormal uterine bleeding for meaningful comparison. A total of 220 women aged 30 to 50 years were initially assessed for eligibility. Of these, 10 women were excluded based on the exclusion criteria. The remaining 210 women were enrolled and divided into two groups of 105 women each. The first group consisted of cases (women who had undergone tubal ligation), while the second group comprised controls (women who had not undergone tubal ligation). Each group was further subdivided into two sub-groups: first subgroup included individuals with abnormal uterine bleeding (AUB), while the second subgroup included those without AUB.

Inclusion requirements consisted of women aged 30 to 50 years who were willing to participate. Exclusion criteria consisted of individuals using intra-uterine contraceptive devices, those who had taken oral contraceptive pills during the year preceding sterilization, women with leiomyoma, those having a uterine size exceeding 9 cm, and any individuals with medical disorders. These exclusion criteria were applied to eliminate known causes of abnormal uterine bleeding that could confound the association between tubal ligation and menstrual disorders. AUB was defined as any alteration in menstrual frequency, duration of flow, or amount of blood loss. AUB was further categorized into the following types: excessive menorrhagia or extended bleeding occurring at regular intervals; polymenorrhea, defined as bleeding occurring at intervals of fewer than 21 days; oligomenorrhea, characterized by bleeding at intervals of 35 days or longer accompanied by reduced blood flow; metrorrhagia, or irregular acyclical bleeding; and menometrorrhagia, involving prolonged and excessive bleeding occurring at irregular times.

The primary outcome of this study was to compare the frequency and types of menstrual disorders (polymenorrhea, menorrhagia, oligomenorrhea, and menometrorrhagia) between women who had undergone tubal ligation and their counterparts . The secondary outcome was to compare endometrial histopathology (proliferative endometrium, secretory endometrium, mixed endometrium, and endometrial hyperplasia) between the two groups. These outcomes were selected because post-tubal sterilization syndrome remains a debated entity, and there is ongoing concern among women and clinicians about whether tubal ligation alters menstrual patterns. Endometrial histopathology was included as a secondary outcome to identify any organic pathology that could explain menstrual disturbances independent of tubal ligation status.

All clinical information was documented in a predesigned proforma that included parameters such as age and socioeconomic status. A thorough history of presenting complaints was obtained. A comprehensive menstrual history was recorded, which included last menstrual period (LMP), bleeding duration, number of pads used per day, cycle length, history of clot passage, and presence of dysmenorrhea. Obstetric history was documented along with the type of contraception used previously or currently. A complete record of the time elapsed since tubal ligation, the surgical technique employed, and the pattern of menstrual disturbances following the procedure was obtained and entered the proforma. Detailed past medical and family histories were recorded to exclude any systemic diseases.

A thorough general and systemic physical examination was carried out to detect any underlying medical conditions that could contribute to menstrual abnormalities. A detailed per abdominal examination and per speculum examination were conducted to evaluate the condition of the cervix, vagina, any discharge, or bleeding per vaginum, thereby excluding cervical or vaginal causes of bleeding. Bimanual examination was performed to assess uterine size, direction, fornices, and uterine mobility, helping to exclude uterine pathology such as fibroids or adnexal masses.

All standard laboratory investigations were carried out, including hemoglobin, random blood sugar, liver function tests (LFT), bleeding time (BT), clotting time (CT), serum electrolytes, serum thyroid-stimulating hormone (TSH), urine routine microscopy, high vaginal swab culture, and sensitivity. Hemoglobin was assessed to detect anemia resulting from chronic blood loss. TSH was performed to exclude thyroid dysfunction, a common cause of menstrual irregularities. Bleeding and clotting times were done to rule out coagulation disorders. High vaginal swab culture was performed to exclude infection as a cause of abnormal bleeding. A pre-menstrual endometrial biopsy was performed as an outpatient procedure in every patient with menstrual disturbances to obtain tissue for histopathological examination. The sample was obtained using an endometrial curette and forwarded for histopathological analysis. The endometrial samples were examined by a pathologist, and histopathological findings were documented. Endometrial biopsy was performed specifically to identify any organic pathology (proliferative, secretory, mixed, or hyperplastic changes) that could explain menstrual disturbances independent of tubal ligation status

Statistical analysis was performed using the Chi-square test, which was selected because the primary outcome variables (types of menstrual disorders) and secondary outcome variables (histopathological findings) are categorical in nature, and the study aimed to compare proportions between two independent groups (cases and controls). Categorical variables were expressed as frequencies (n) and percentages (%). Exact p-values were calculated and reported. A p-value of less than 0.05 was considered statistically significant. The study design was based on standard principles for prospective cohort studies[11]. Abnormal uterine bleeding was classified according to the International Federation of Gynecology and Obstetrics (FIGO) PALM-COEIN classification system[12]. Statistical analysis was performed using the Chi-square test as described in standard biostatistical texts[13].

This study has several limitations. First, purposive sampling may introduce selection bias, as the sample may not be fully representative of the broader population of women undergoing tubal ligation. Second, the one-year study period limits the ability to assess long-term menstrual changes following tubal ligation. Third, the exclusion of women with medical disorders (thyroid dysfunction, diabetes, hypertension, etc.), while necessary to reduce confounding, limits the generalizability of the findings to healthy women without comorbidities. Fourth, the study relied on menstrual history reported by patients, which may be subject to recall bias despite prospective data collection. Fifth, endometrial biopsy was performed only in women with menstrual disturbances, not in all participants, which may limit comparison of histopathological findings between groups. Sixth, the sample size of 210 women, while adequate for basic comparisons, may not be sufficient to detect small but clinically significant differences in menstrual disorder frequencies. Seventh, the study was conducted at a single tertiary care center (Nishtar Hospital, Multan), which may limit the generalizability of findings to primary care or community settings.

RESULTS

In the case group (post-tubal ligated), many women without abnormal uterine bleeding (AUB) were aged 30-40 years (47.06%), whereas in the control group (non-tubal ligated), most women with AUB were aged 41-50 years (56.86%). The association between age and tubal ligation status was not statistically significant ($p = 0.315$).

Parity 5 was the most common across all groups. Among cases with AUB, 50.00% had parity 5; among controls with AUB, 50.98% had parity 5. Among cases without AUB, 60.78% had parity 5; among controls without AUB, 51.85% had parity 5. No significant association was observed between parity and tubal ligation status ($p = 0.995$).

Polymenorrhea was the most common menstrual disorder in both groups, observed in 38.89% of cases and 39.22% of controls.

Menorrhagia was the second most common, occurring in 29.63% of cases and 31.37% of controls. Menometrorrhagia was observed in 20.37% of cases and 15.69% of controls, while oligomenorrhea was the least common, seen in 11.11% of cases and 13.73% of controls. The differences between the two groups were not statistically significant (p = 1.000).

Endometrial thickness of 8 mm or less was observed in 51.85% of cases with AUB and 56.86% of controls with AUB. Thickness of 8 mm or greater was seen in 48.15% of cases and 43.14% of controls. The association between endometrial thickness and tubal ligation status was not statistically significant (p = 0.825).

Table 1: Age-related association comparing women with and without tubal ligation

Age	Case (Post-tubal ligated)				Control (non-tubal ligated)			
	AUB		Without AUB		AUB		Without AUB	
	N	%	N	%	N	%	N	%
30-40 Years	30	55.56%	24	47.06%	22	43.14%	23	42.59%
41-50 Years	24	44.44%	27	52.94%	29	56.86%	31	57.41%
Total	54	100%	51	100%	51	100%	54	100%

Chi-square = 1.009 with 1 degree of freedom, P = 0.315

Table 2: Parity-related association comparing women with and without tubal ligation

Age	Case (Post-tubal ligated)				Control (non-tubal ligated)			
	AUB		Without AUB		AUB		Without AUB	
	N	%	N	%	N	%	N	%
P1	1	1.85%	2	3.92%	1	1.96%	0	0.00%
P2	1	1.85%	2	3.92%	1	1.96%	6	11.11%
P3	1	1.85%	3	5.88%	2	3.92%	6	11.11%
P4	2	3.70%	2	3.92%	1	1.96%	12	22.22%
P5	27	50.00%	31	60.78%	26	50.98%	28	51.85%
P6	11	20.37%	11	21.57%	11	21.57%	2	3.70%
P7	11	20.37%	0	0.00%	9	17.65%	0	0.00%
TOTAL	54	100%	51	100%	51	100%	54	100%

Table 3: Association of menstrual irregularities between women with and without tubal ligation

Menstrual disorders	Case with AUB (post-tubal ligated)		Control with AUB (non-tubal ligated)	
	N	%	N	%
Menometrorrhagia	11	20.37%	8	15.69%
Menorrhagia	16	29.63%	16	31.37%
Oligomenorrhea	6	11.11%	7	13.73%
Polymenorrhea	21	38.89%	20	39.22%
Total	54	100%	51	100%

Chi-square = 0.285, Degrees of Freedom = 3, P = 1.000

Table 4: Association of endometrial lining thickness between women with and without tubal ligation

Endometrial thickness	Cases with AUB(post-tubal ligated)		Controls with AUB (non-tubal ligated)	
	N	%	N	%
≥8 mm	26	48.15%	22	43.14%
≤8 mm	28	51.85%	29	56.86%
Total	54	100%	51	100%

Chi-square = 0.049, Degrees of Freedom = 1, P = 0.825

Table 5: Histopathological alterations in the endometrium comparing women with and without tubal ligation

Endometrial Biopsy	Case with AUB (post-tubal ligated)		Control with AUB (non-tubal ligated)	
	NO	%	NO	%
Proliferative	23	42.59%	21	41.18%
Secretory	17	31.48%	16	31.37%
Mixed	12	22.22%	13	25.49%
Endometrial Hyperplasia	2	3.70%	1	1.96%
Total	54	100%	51	100%

Chi-square = 0.588, Degrees of Freedom = 3, P = 1.000

Table 6: Distribution of participants based on intervals since tubal ligation and presence of abnormal uterine bleeding

Tubal ligation time	AUB		Without AUB	
	NO	%	NO	%
Interval	20	37.04%	26	50.98%
Post MTP	14	25.93%	13	25.49%
Postpartum	20	37.04%	12	23.53%
Total	54	100.00%	51	100.00%

Chi-square = 3.224, Degrees of Freedom = 2, P = 0.200

Proliferative endometrium was the most common histopathological finding in both groups, observed in 42.59% of cases and 41.18% of controls. Secretory endometrium was found in 31.48% of cases and 31.37% of controls. Mixed endometrium was seen in 22.22% of cases and 25.49% of controls. Endometrial hyperplasia was the least common, observed in 3.70% of cases and 1.96% of controls. No significant difference was observed in histopathological findings between the two groups (p = 1.000).

Among post-tubal ligated women with AUB, interval tubal ligation and postpartum tubal ligation each accounted for 37.04% of cases, while post-MTP tubal ligation accounted for 25.93%. Among those without AUB, interval tubal ligation was the most common (50.98%), followed by post-MTP (25.49%) and postpartum (23.53%). The association was not statistically significant (p = 0.200).

DISCUSSION

Tubal sterilization represents a permanent contraceptive method. Ongoing concern exists regarding whether tubal ligation elevates the likelihood of menstrual dysfunction. Several potential explanations have been proposed to account for such changes, including disruptions in ovarian function or compromise of the tubo-ovarian blood supply.

In the present study, 210 women were enrolled, comprising 105 post-tubal ligated cases and 105 non-ligated controls. Women who were on oral contraceptives or using intrauterineintraventions at the time of sterilization were not included, thereby minimizing any confounding effect from prior contraceptive methods.

When comparing age distribution between study groups, most cases were aged 30–40 years, whereas most controls were aged 41–50 years. These findings are consistent with those of Babbar et al. [14], who reported that most cases were between 30 and 39 years and most controls between 40 and 45 years. In contrast, Al-Assadi et al. [15] found most of both cases and controls in the 30–35-year age group, while Hasan [16] reported most participants aged 35–46 years in both groups.

Analysis of parity revealed that parity 5 was the most frequent in both groups. The findings of the present study align with those of Babbar et al. [14], who observed that 50% of cases belonged to parity 5–7 and 40% of controls to the same range, and with Hasan [16], who reported parity 5 in 80% of both cases and controls. However, Al-Assadi et al. [15] found parity 2 in 52.9% of cases and parity 3 in 35.9% of controls, a difference that may be attributed to variations in socio-economic status across study populations.

The prevalence of menstrual abnormalities was comparable between the two observed groups, with no statistically significant difference. This observation is consistent with Babbar et al. [14], who reported menstrual abnormalities in 50.8% of cases and 49.6% of controls, and with Al-Assadi et al. [15], who found abnormalities in 46.05% of tubal ligated women and 48.16% of non-ligated women. These results also correlate with the findings of Abbas et al. [17] and Peterson et al. [8]. Similarly, Brown et al. [18] demonstrated no increase in the prevalence of abnormal menstrual function following tubal sterilization. Westhoff et al. [19] affirmed that tubal sterilization is highly effective and safe. Although sterilization has been hypothesized to adversely affect ovarian function, laboratory studies comparing women before and after the procedure have found no consistent evidence of ovarian dysfunction.

When specific menstrual disorder types were examined, polymenorrhea was the most common abnormality in both groups. These findings are comparable to those of Babbar et al.[14], who reported polymenorrhea in both cases and controls and menorrhagia in 30% of both groups. However, the present results differ from those of Al-Assadi et al. [15], who observed polymenorrhea in 32% of tubectomized women and menorrhagia in 25% of non-tubectomized women, as well as from Shobeiri et al.[11] and Pweleza[22], who reported menorrhagia as the most common abnormality (47% and 45.6%, respectively). These discrepancies may be related to differences in study variables and population characteristics.

Histopathological examination of pre-menstrual endometrial biopsies demonstrated that proliferative endometrium was the predominant histological finding in both groups. This is consistent with Babbar et al.[14], who reported proliferative endometrium as the predominant finding, with an ovulatory endometrium in 31.6% of cases and 28.7% of controls. Similar findings were reported by Hasan[16], who observed proliferative endometrium in 44% of cases and 24% of controls, and secretory endometrium in 37% and 24%, respectively. Pweleza[22] also reported proliferative endometrium as the most common histological finding (34.45%). Sadatmahalleh et al.[23] found proliferative endometrium in 45% of cases and 31% of controls, and secretory endometrium in 31% and 30%, respectively.

Controversial findings exist in literature. Pang et al.[20] and Hasan [16]reported significant differences in menstrual disturbances between tubal-ligated and non-ligated women. Similarly, Verma et al. [24] found that women who had undergone tubal ligation had higher frequencies of polymenorrhea (9.3% vs. 1.4%, $p = 0.006$), hypermenorrhea (12.1% vs. 2.1%, $p = 0.002$), menorrhagia (62.9% vs. 22.1%, $p < 0.0001$), and menometrorrhagia (15.7% vs. 3.6%, $p = 0.001$) compared to those without tubal ligation. The absence of a significant association in the present study may be explained by the relatively limited sample size. The best available evidence, including data from the Collaborative Review of Sterilization (CREST), suggests that when confounding variables are adequately controlled, no considerable change in the menstrual cycle is observed following tubal sterilization [21].

CONCLUSION

This study demonstrates that the incidence of menstrual disorders does not differ significantly between post-tubal ligated women and non-ligated women. Polymenorrhea was the most common menstrual abnormality observed in both groups, followed by menorrhagia. Endometrial histopathology showed similar findings between cases and controls, with proliferative endometrium being the predominant pattern. The frequency of abnormal uterine bleeding was comparable between the two groups, and no statistically significant differences were found in any of the measured parameters.

Women who express concern regarding the effects of tubal ligation on their future menstrual patterns should be counseled that the procedure has no adverse impact on menstrual function or endometrial histopathology. These findings may assist family physicians in educating patients about tubal ligation as a safe contraceptive option without long-term menstrual consequences.

Further large-scale, multi-center studies with extended follow-up periods are recommended to confirm these findings and to detect any subtle differences that may not have been captured in the present study.

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