

Menstrual Disturbances Following Tubal Ligation: A Cross-Sectional Study in a Rural Setting

Khadiza Begum^{1,*}, Anasuya Ray², Ayesha Siddika³

¹Department of Obstetrics & Gynecology, Ghoragat Upzila Health Complex, Dinajpur, Bangladesh.

²Department of Obstetrics & Gynecology, Sherpur Upzila Health Complex, Bogura, Bangladesh.

³Department of Obstetrics & Gynecology, Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh.

*Address for correspondence: Dr. Khadiza Begum, Department of Obstetrics & Gynecology, Ghoragat Upzila Health complex, Dinajpur, Bangladesh. E-mail:30183@gmail.com

Abstract

Background: Tubal ligation (TL) is a widely used permanent contraceptive method in Bangladesh and globally, but its association with menstrual disturbances, often termed “post-tubal ligation syndrome,” remains controversial. Some studies report increased menorrhagia, dysmenorrhoea, and irregular bleeding after TL, while others show no significant differences compared to non-sterilized women. This study was conducted to investigate the role of uterine and ovarian changes in menstrual disturbances among Bangladeshi women following TL.

Methods: This cross-sectional study was conducted among 33 women who developed menstrual disturbances after bilateral tubal ligation. The study was conducted in Department of Obstetrics & Gynecology at Shastho-Seba Hospital, New Rogmukti Hospital, Salimullah General Hospital from July 2023 to December 2023. Data were collected through structured interviews, clinical examinations, and relevant investigations, including ultrasound, hormonal, and hematological tests. Uterine and ovarian pathologies were identified by imaging. Statistical analysis was performed using SPSS 26, with Pearson correlation and logistic regression applied to determine independent predictors of menstrual disturbances.

Results: Among 33 women studied, the most frequent symptoms were dysmenorrhoea (63.6%), menorrhagia (57.6%), and irregular bleeding (45.5%). Uterine pathology was common, with fibroids (18.2%) and adenomyosis (15.2%) strongly associated with dysmenorrhoea, while fibroids and anaemia significantly predicted menorrhagia. Logistic regression confirmed adenomyosis, fibroids, and ovarian cysts as key predictors of post-ligation menstrual disturbances.

Conclusion: Menstrual disturbances after tubal ligation are common, with dysmenorrhoea and menorrhagia most frequent. Though adenomyosis, fibroids, ovarian cysts, and anemia are the strongest predictors but tubal ligation itself is the direct casual factor in these cases.

Keywords: Tubal ligation, menstrual disturbances, adenomyosis, uterine fibroids, ovarian cysts

Introduction

Tubal ligation (TL) is one of the most widely used permanent contraceptive methods, particularly among women who have completed their desired family size.^[1] Globally, more than 220 million couples rely on sterilization, with TL representing around 30% of contraceptive use among married

women in certain regions.^[2] In 2020, among 1.9 billion women of reproductive age (15–49 years), 1.1 billion women are considered to have a need for family planning; that is, they desire to limit or delay childbearing. Of these women, 851 million are using a modern method of contraception and 85 million are using a traditional method.^[2] In Bangladesh, TL remains a cornerstone of family

planning, with national surveys showing that over 6% of married women have undergone the procedure.^[3] While TL is considered safe and highly effective, concerns have persisted for decades about a potential “post-tubal ligation syndrome” (PTLS), characterized by menstrual irregularities such as menorrhagia, dysmenorrhoea, polymenorrhoea, and irregular cycles.^[1,4] Several hospital-based studies in South Asia, including Bangladesh, report that women presenting with dysfunctional uterine bleeding after TL often require surgical intervention such as hysterectomy, underscoring the clinical significance of this issue.^[5] The proposed mechanisms include changes in ovarian blood supply, hormonal imbalance, and uterine pathology triggered or unmasked after sterilization.^[6]

Recent research presents conflicting findings. A historical cohort study in Iran reported significantly higher rates of menstrual disorders following TL, including irregular cycles (24.3% vs 10%), polymenorrhoea, and menorrhagia.^[7] Similarly, an Iraqi case-control study observed much higher rates of menorrhagia (68.5% vs 29.7%) and irregular bleeding among TL women compared with controls.^[8] Conversely, newer investigations suggest no significant effect of TL on menstrual outcomes. A comparative study from India found no significant difference in polymenorrhoea or menorrhagia between TL and non-TL women.^[9] Turkish research also showed no consistent differences in dysmenorrhoea, dyspareunia, or hormone levels after TL, though slight increases in irregular cycles were noted.^[10] These divergent findings align with earlier extensive cohort studies from Western countries, which largely failed to confirm a causal association between TL and menstrual changes.^[7] Mechanistic insights remain equally inconclusive. Some ultrasound-based studies reported that TL could alter ovarian morphology, showing polycystic-appearing ovaries and higher ovarian vascular resistance indices.^[11] A more recent analysis linked TL with reduced anti-Müllerian hormone (AMH) levels, suggesting possible diminished ovarian reserve.^[12] However, other studies failed

to show consistent hormonal or endometrial differences after TL.^[1,10]

Despite decades of research, consensus on PTLS is lacking. Contradictory epidemiological evidence, inconsistent definitions of menstrual disturbance.^[7-10] Furthermore, very few studies have explored this problem in South Asian populations, where sociocultural factors, nutritional status, and reproductive patterns differ significantly from those in Western contexts. In Bangladesh, where TL is a widely promoted permanent contraceptive option among women aged 20–45 years, systematic evidence on its long-term gynecologic effects is scarce. Given these gaps, the study aims to evaluate the prevalence and nature of menstrual disturbances following tubal ligation in Bangladeshi women, with a particular focus on underlying uterine and ovarian changes.

Methods

This cross-sectional observational study was conducted in Department of Obstetrics & Gynecology at Shastho-Seba Hospital, New Rogmukti Hospital, Salimullah General Hospital from July 2023 to December 2023. Among women who developed menstrual disturbances following bilateral tubal ligation (BLTL). A total of 33 participants were included. Data were collected through structured interviews, clinical examination, and review of relevant investigations. Baseline characteristics recorded included age, weight, haemoglobin status (anaemia), systolic and diastolic blood pressure, and the presence of medical comorbidities. Gynaecological and obstetric history was obtained, including parity, history of lower uterine caesarean section (LUCS), vaginal delivery (VD), menstrual regulation (MR), and presence of adnexal cysts. Menstrual symptoms assessed were dysmenorrhoea, menorrhagia, dyspareunia, and irregular bleeding patterns. Investigations included transvaginal sonography (TVS), abdominal ultrasonography (USG), random blood sugar (RBS), serum creatinine, thyroid-stimulating hormone (TSH),

follicle-stimulating hormone (FSH), hepatitis B surface antigen (HbsAg), urine routine examination (R/E), electrocardiogram (ECG), and complete blood count (CBC). Uterine and ovarian pathologies such as fibroids, adenomyosis, and ovarian cysts were identified through USG.

Data were compiled and analysed using standard statistical software SPSS version 26. Categorical variables were expressed as frequency and percentage distributions. Pearson correlation analysis was performed to examine linear associations between demographic, clinical, and pathological variables, with correlation coefficients (*r*) represented in a heatmap. To identify independent predictors of menstrual disturbances, binary logistic regression models were constructed. Odds ratios (OR) with 95% confidence intervals (CI) were calculated for fibroid, adenomyosis, ovarian cyst, and other relevant covariates. Variables with *P* < 0.05 were considered statistically significant.

Procedure of Tubal Ligation

In the study, tubal ligation had been performed primarily using the Yoon Silastic ring technique, a widely accepted laparoscopic method of female sterilization.^[13] In this procedure, a small loop of the fallopian tube is drawn into the applicator, and a flexible silicone (silastic) ring is applied to occlude the loop, thereby blocking the passage of ova. The method is considered safe, minimally invasive, and widely used in Bangladesh for permanent contraception.

Results

The baseline characteristics of the 33 women with menstrual disturbances following tubal ligation show that the majority were in the 31–40 age group (45.5%), with nearly equal proportions above 40 years (39.4%) and fewer under 30 years (15.2%). Weight distribution was relatively balanced, with 36.4% between 61–70 kg, 33.3% above 70 kg, and 30.3% at or below 60 kg. Anaemia was present in

about one-quarter of participants (24.2%). Most women had normal systolic (81.8%) and diastolic (78.8%) blood pressure, though 18.2% and 21.2% showed elevated values, respectively. Comorbid conditions were reported in 21.2% of the women, while the majority (78.8%) had none [Table 1].

The gynecologic and obstetric profile of the women revealed that over half had a parity of 3–4 (51.5%), while 30.3% had ≥5 children, and only 18.2% had 1–2. Most participants had a negative VIA test (90.9%), and a history of lower uterine cesarean section (LUCS) was uncommon (15.2%). Vaginal delivery was reported in 27.3% and menstrual regulation (MR) in 18.2%. Adnexal cysts and lymphadenopathy (LAP) were relatively rare, each present in 12.1% of cases. Dysmenorrhoea (63.6%) and menorrhagia (57.6%) were the most frequently reported symptoms, followed by irregular bleeding in nearly half of the women (45.5%). Dyspareunia was less common, affecting 15.2% [Table 2].

Most of the study population had a minimum interval cycle (72.7%), with bleeding lasting 4–7 days in nearly half (45.5%) of the cases. About

Table 1: Baseline characteristics of women with menstrual disturbances after tubal ligation (*n* = 33)

Variable	Category	<i>n</i>	%
Age (years)	≤30	5	15.2
	31–40	15	45.5
	>40	13	39.4
Weight (kg)	≤60	10	30.3
	61–70	12	36.4
	>70	11	33.3
Anaemia	Present	8	24.2
	Absent	25	75.8
Systolic BP	Normal (<140)	27	81.8
	High (≥140)	6	18.2
Diastolic BP	Normal (<90)	26	78.8
	High (≥90)	7	21.2
Comorbidity	Present	7	21.2
	Absent	26	78.8

Table 2: Gynecologic and obstetric history (*n* = 33)

Gynecologic and obstetric history	Category	<i>n</i>	%
Parity (Para)	1–2	6	18.2
	3–4	17	51.5
	≥5	10	30.3
VIA test	Negative	30	90.9
	Positive	3	9.1
H/O LUCS	Yes	5	15.2
	No	28	84.8
H/O VD	Yes	9	27.3
	No	24	72.7
H/O MR	Yes	6	18.2
	No	27	81.8
Adnexal cyst	Present	4	12.1
	Absent	29	87.9
LAP	Present	4	12.1
	Absent	29	87.9
Irregular bleeding	Present	15	45.5
	Absent	18	54.5

42.4% used ≤3 Pads on the heaviest day, and 39.4% used ≤10 pads overall, but menorrhagia was still reported by 57.6%. Intermenstrual bleeding (45.5%) and spotting (36.4%) were relatively common, while half reported premenstrual symptoms (51.5%). Around 1-third experienced noncyclic pelvic pain (33.3%), and nearly half reported decreased libido (48.5%). Dyspareunia was less common (15.2%) [Table 3].

The investigation's findings showed that the majority of women had normal results on transvaginal sonography (72.7%) and random blood sugar (66.7%), while 27.3% and 33.3% had abnormal or high results, respectively. Most were negative for HBsAg (93.9%), with only two cases positive. Elevated creatinine was noted in 18.2%. Abdominal ultrasonography revealed fibroids in 21.2% and ovarian cysts in 15.2%, while 63.6% were standard. Thyroid and reproductive hormone profiles showed abnormalities in 30.3% (TSH) and 39.4% (FSH). Urine R/E, ECG, and

Table 3: Menstrual cycle characteristics and symptoms in women with menstrual disturbances after bilateral tubal ligation (*n* = 33)

Menstrual cycle characteristics and symptoms	Categories	<i>n</i> (%)
Menstrual cycle interval (days)	Minimum interval	24 (72.7)
	Maximum interval	9 (27.3)
Length of bleeding (days)	≤3 days	10 (30.3)
	4–7 days	15 (45.5)
Sanitary pads on heaviest flow day	>7 days	8 (24.2)
	≤3 pads	14 (42.4)
	4–5 pads	12 (36.4)
Total sanitary pads per menstruation	≥6 pads	7 (21.2)
	≤10 pads	13 (39.4)
	11–15 pads	12 (36.4)
Intermenstrual bleeding	>15 pads	8 (24.2)
	Present	15 (45.5)
Spotting	Absent	18 (54.5)
	Present	12 (36.4)
Premenstrual symptoms	Absent	21 (63.6)
	Present	17 (51.5)
Noncyclic pelvic pain	Absent	16 (48.5)
	Present	11 (33.3)
Intercourse occurrences per week	Absent	22 (66.7)
	≤1 time	18 (54.5)
Libido	≥2 times	15 (45.5)
	Decreased	16 (48.5)
Dysmenorrhoea	Normal/Unchanged	17 (51.5)
	Present	21 (63.6)
Dyspareunia	Absent	12 (36.4)
	Present	5 (15.2)
Menorrhagia	Absent	28 (84.8)
	Present	19 (57.6%)
	Absent	14 (42.4)

CBC results were abnormal in nearly one-third of cases each (33.3%, 30.3%, and 30.3%, respectively) [Table 4].

The uterine and ovarian diagnoses indicated that nearly two-thirds of women had a normal uterus (63.6%). Among abnormal findings, fibroids

Table 4: Investigation findings of the study population ($n = 33$)

Variable	Category	<i>n</i>	%
TVS	Normal	24	72.7
	Abnormal	9	27.3
RBS	Normal	22	66.7
	High	11	33.3
HbsAg	Negative	31	93.9
	Positive	2	6.1
Creatinine	Normal	27	81.8
	High	6	18.2
USG (W/A)	Normal	21	63.6
	Fibroid	7	21.2
	Ovarian cyst	5	15.2
TSH	Normal	23	69.7
	Abnormal	10	30.3
FSH	Normal	20	60.6
	Abnormal	13	39.4
Urine R/E	Normal	22	66.7
	Abnormal	11	33.3
ECG	Normal	23	69.7
	Abnormal	10	30.3
CBC	Normal	23	69.7
	Abnormal	10	30.3

were the most common (18.2%), followed by adenomyosis (15.2%), while ovarian cysts were relatively rare (3.0%) [Table 5].

The multivariable logistic regression analysis identified adenomyosis, fibroid, and ovarian cyst as significant predictors of dysmenorrhoea in women after bilateral tubal ligation. Adenomyosis showed the strongest association (OR = 6.5, 95% CI: 1.8–23.4, $P = 0.004$), followed by ovarian cyst (OR = 5.1, 95% CI: 1.2–20.8, $P = 0.027$) and fibroid (OR = 4.2, 95% CI: 1.3–13.5, $P = 0.016$). Although younger age (≤ 30 years), high parity (≥ 5), and dyspareunia showed elevated odds ratios, their associations were not statistically significant [Table 6].

This forest plot demonstrates the independent associations of adenomyosis, fibroid, and ovarian

Table 5: Uterine and ovarian diagnoses ($n = 33$)

Diagnosis	<i>n</i>	%
Normal uterus	21	63.6
Fibroid	6	18.2
Adenomyosis	5	15.2
Ovarian cyst	1	3.0

Table 6: Multivariable logistic regression: Predictors of dysmenorrhoea in women after BLTL ($n = 33$)

Predictors	OR	95% CI	<i>P</i> -value
Age ≤ 30 years	2.1	0.6 – 7.5	0.18
Para ≥ 5	1.7	0.4 – 6.9	0.32
Adenomyosis	6.5	1.8 – 23.4	0.004
Fibroid	4.2	1.3 – 13.5	0.016
Dyspareunia	2.9	0.8 – 10.4	0.09
Ovarian cyst	5.1	1.2 – 20.8	0.027

cysts with dysmenorrhoea among women who developed menstrual disturbances after bilateral tubal ligation. All three pathologies showed statistically significant odds ratios above 1, indicating that they are strong predictors of dysmenorrhoea. Adenomyosis had the highest risk (OR 6.5; 95% CI: 1.8–23.4), followed by ovarian cysts (OR 5.1; 95% CI: 1.2–20.8) and fibroids (OR 4.2; 95% CI: 1.3–13.5). These findings highlight the important role of underlying uterine and ovarian pathology in the genesis of post-ligation menstrual disturbances [Figure 1].

This forest plot illustrates the independent predictors of menorrhagia in women with menstrual disturbances following tubal ligation. Both fibroid (OR 4.5; 95% CI: 1.1–18.9; $P = 0.03$) and anaemia (OR 5.4; 95% CI: 1.2–23.4; $P = 0.02$) emerged as statistically significant predictors, while adenomyosis showed a positive but non-significant trend. Age > 40 years and higher parity (≥ 3) were not significant predictors. These findings emphasize that fibroid pathology and anaemia are key contributors to post-ligation menorrhagia, reflecting the interplay between

structural uterine changes and systemic factors [Figure 2].

This heatmap illustrates the Pearson correlation coefficients (r) between demographic factors, menstrual disturbances, and uterine ovarian pathologies. Strong positive correlations were observed between adenomyosis and dysmenorrhoea ($r = 0.65$) and between fibroid and menorrhagia ($r = 0.58$), indicating consistent associations between uterine structural abnormalities and symptom patterns. A moderate correlation was also noted between ovarian cysts and irregular bleeding ($r = 0.45$), suggesting that ovarian pathology may contribute to cycle irregularities. Age and blood pressure variables showed only weak correlations with menstrual symptoms. These findings reinforce the central role of uterine and ovarian changes in post-ligation menstrual disturbances [Figure 3].

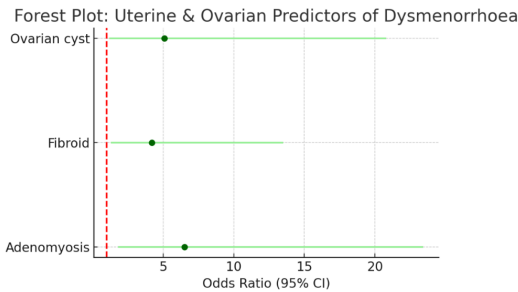


Figure 1: Forest plot of uterine and ovarian predictors of dysmenorrhoea in women following bilateral tubal ligation.

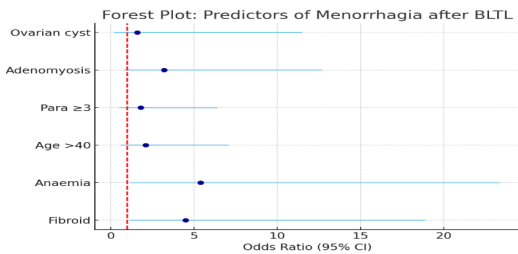


Figure 2: Forest plot of predictors of menorrhagia in women following bilateral tubal ligation.

This Sankey diagram illustrates the relationship between uterine/ovarian pathologies and post-ligation menstrual disturbances. Fibroids showed predominant connections to menorrhagia and dysmenorrhoea, indicating their strong role in heavy and painful menstrual bleeding. Adenomyosis was most strongly linked to dysmenorrhoea, reflecting its impact on painful menstruation, while also contributing to menorrhagia. Ovarian cysts were mainly associated with irregular bleeding, with smaller contributions to menorrhagia and dysmenorrhoea [Figure 4].

Discussion

We noted a very high prevalence of dysmenorrhoea (63.6%), menorrhagia (57.6%), and

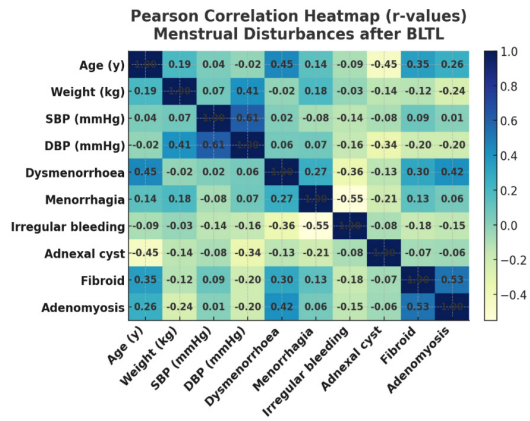


Figure 3: Pearson correlation heatmap of menstrual disturbances and uterine-ovarian changes in women after bilateral tubal ligation.

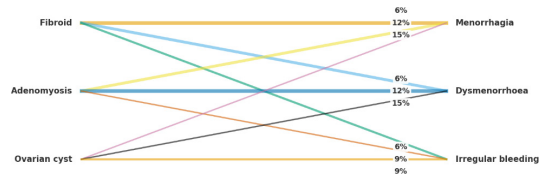


Figure 4: Flow of uterine and ovarian pathologies to menstrual disturbances in women after bilateral tubal ligation.

irregular bleeding (45.5%) in this cross-sectional survey of 33 Bangladeshi women with menstrual disorders after bilateral tubal ligation (BTL). These findings are consistent with a series of studies in the Middle East and South Asia that consistently report an increased burden of menstrual abnormality following sterilization. Sadatmahalleh et al. demonstrated a significantly greater incidence of abnormal cycles and menorrhagia in post-ligation women compared with controls,^[7] while Lafta et al. and Shaikh et al. also observed more frequent or heavier bleeding in 47–68% of the sterilized cases.^[8,14] Abbas et al. and Yasmeen et al. also experienced an increased risk of polymenorrhoea and metrorrhagia in post-ligation women compared to non-ligated women.^[15,16] These consistent results imply that menstrual dysfunction is not random but a biological response provoked by the procedure of ligation in itself. Our research identified adenomyosis, fibroids, and ovarian cysts as significant correlates for dysmenorrhoea and menorrhagia. Rather than assuming such lesions in themselves to be the etiology, the findings indicate tubal ligation as a causal factor leading to or accelerating uterine and ovarian changes leading to symptomatic menstrual disorders. Post-occlusive disruption of the utero-ovarian circulation, disruption of the local hormonal gradients, and inflammatory mechanisms associated with the tubes have the potential to initiate endometrial hyperplasia, adenomyotic transformation, or cystic ovarian reorganization. These secondary morphological alterations subsequently perpetuate chronic menorrhagia and dysmenorrhoea. Under these conditions, uterine and ovarian pathologies are secondary sequelae of the primary insult, occlusion of the tubes, and not free-standing comorbidities. The statement that tubal ligation acts as an immediate causal determinant is supported by a number of physiologic and histopathologic studies. Doppler examinations have shown alteration in uterine and ovarian blood-flow indices after sterilization,^[17] and low anti-Müllerian hormone levels after ligation imply reduced ovarian reserve.^[12] Khokhar et al. and Rulin et al. suggested that

tubal constriction alters ovarian venous and lymphatic drainage, resulting in pelvic venous congestion, hormonal imbalance during the luteal phase, and endometrial instability.^[6,18] The pathophysiologic consequences account for the predominance of heavy, prolonged, and painful bleeding among women after ligation, despite no pre-existing gynecologic disease. Besides, the higher frequencies of fibroids and adenomyosis after sterilization in a few South Asian series may be an expression of chronic ischemic and inflammatory stress to the uterus and not incidental pathology.^[14,5] The findings of this study thus contradict the early perception that post-ligation menstrual symptoms arise mainly due to incidental uterine or ovarian pathology. Instead, the process itself tends to induce a cascade of endocrine and microvascular alterations that manifest as erratic bleeding, menorrhagia, and dysmenorrhoea. The strong correlations between fibroid, adenomyosis, and ovarian cysts in our logistic models are likely to represent pathologic intermediates, not confounders. The intimate correlation between menorrhagia and fibroids (OR 4.5) and dysmenorrhoea and adenomyosis (OR 6.5) points out the tubal ligation's contribution to lesion development or increase in size. The explanation is consistent with the concept of a “post-ligation uterine remodeling” effect, where sustained alterations in uterine perfusion and sensitivity to hormones are the dynamic forces that determine the emergence of secondary pathology. Clinically, the results support the observation that menorrhoea after sterilization is not due to chance or psychogenicity. Instead, they represent an anticipated biological response in a subgroup of women susceptible to post-ligation vascular or hormonal alterations. Pre-operative counseling thus must include reference to possible menstrual and endocrine effects, and careful early post-ligation follow-up must be encouraged. Management strategies must combine symptomatic management (hormonal therapy, NSAIDs) and secondary pathology assessment, appreciating that both share a common cause in the process of tubal occlusion. The findings in this study validate that menstrual

problems have a direct causal connection with tubal ligation and are generally associated with secondary uterine or ovarian changes such as fibroid growth, adenomyosis, or cystic degeneration. Identification of such a cause-and-effect relationship is required to attain patient counseling in balance, individualized surgical decision-making, and timely treatment of post-ligation menstrual disturbances.

Limitations of the Study

The small sample size and lack of a non-sterilized control group limit the generalizability of the findings. By including only symptomatic women, we may have overestimated the frequency of post-TL disturbances (selection bias). Recall bias about pre-ligation cycles is possible, and not all women underwent uniform hormonal or imaging assessments. The cross-sectional design precludes establishing causality between TL and menstrual changes.

Conclusion

Menstrual disturbances after bilateral tubal ligation are common, with dysmenorrhoea and menorrhagia being the most frequent complaints. Though adenomyosis, fibroids, ovarian cysts, and anemia are the strongest predictors but tubal ligation itself is the direct casual factor in these cases. Careful evaluation and management of these pathologies are essential to address post-ligation menstrual problems effectively.

Recommendations

Women undergoing tubal ligation should receive thorough preoperative counseling regarding the possibility of menstrual changes, with emphasis that such disturbances are usually related to underlying gynecological conditions rather than the procedure itself. A structured pre-sterilization evaluation, including pelvic ultrasound and hemoglobin assessment, is advised to

detect fibroids, adenomyosis, ovarian cysts, or anemia, allowing early management and informed decision-making. Post-ligation complaints such as heavy, painful, or irregular bleeding should prompt a comprehensive gynaecological assessment rather than being attributed solely to sterilisation, and treatment should be directed toward the identified pathology through medical or surgical therapy as appropriate. Finally, larger prospective controlled studies are recommended to clarify relationships, compare different sterilisation techniques, and guide evidence-based counselling and management of women in similar populations.

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