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Immediate and Delayed Impact of Ovarian Cystectomy on Serum AMH Levels and Ovarian Reserve

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KEYWORDS

AMH, ovarian reserve, ovarian cystectomy, endometrioma, laparoscopy, fertility.

ABSTRACT:

Background: Ovarian cystectomy is widely performed for benign ovarian cysts in women of reproductive age. However, its impact on the ovarian reserve, particularly as reflected by serum Anti-Müllerian Hormone (AMH) levels, remains a concern. This study aimed to evaluate the immediate and delayed effects of ovarian cystectomy on AMH levels, considering the cyst type and laterality.

Methods: This observational study was conducted at the Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from February 2023 to January 2024. A total of 200 women who underwent ovarian cystectomy were enrolled in the study. Serum AMH levels were measured preoperatively and at 7 days, 1 month, and 3 months postoperatively. Data were analyzed using SPSS version 25.0, and a p-value of less than 0.05 was considered statistically significant.

Results: The Mean AMH level significantly declined from a preoperative level of 3.31 ± 1.3 ng/mL to 2.10 ± 1.1 ng/mL on day 7 (36.5% decrease, $p < 0.001$), partially recovering to 2.42 ± 1.2 ng/mL at 1 month and 2.51 ± 1.0 ng/mL at 3 months (24.2% reduction from baseline, $p < 0.001$). Endometriomas showed the most significant decline (32.7%), followed by dermoid (19.3%) and serous/mucinous cysts (13.5%). Bilateral cystectomy resulted in significantly higher AMH reduction than unilateral procedures (37.2% vs. 18.2%, $p < 0.001$).

Conclusion: Ovarian cystectomy leads to a significant but partially reversible reduction in ovarian reserve. Surgical approach and patient selection should be individualized to minimize the reproductive impact.

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Introduction

Ovarian cystectomy is a standard surgical procedure in reproductive-aged women, often performed for benign ovarian cysts such as endometriomas, dermoid cysts, and serous or mucinous cysts. While controlling symptoms is top of mind, making sure the patient does not lose her fertility and ovarian reserve has to be carefully considered. AMH, which is released by the granulosa cells in pre-antral and small antral follicles, is a strong and sensitive indicator of the number of eggs the ovaries contain [1]. Their levels are not affected by a person's cycle and provide a more precise measure of the remaining eggs than do other hormones, such as FSH or inhibin B [2].

Recent research suggests that ovarian surgery, particularly when removing endometriomas, may impact the number of eggs a woman has remaining, as indicated by a decrease in AMH levels [3, 4]. It has been suggested that losing otherwise healthy tissue during surgery, damage caused by heated tools and post-surgical blood flow restriction during ovarian hibernation may be responsible for this decline [5]. Different types of cysts, locations, sizes, and methods of surgery appear to play a role in this impact [6].

Endometriomas are worrisome because they are highly destructive and tend to recur. Many studies have found that levels of AMH drop more sharply after removing endometriomas than after removing other types of benign cysts [7, 8]. They reported that AMH levels dropped significantly after treatment for endometrioma, and the recovery was only partial over the following years [9]. According to Ding et al., performing more than one surgery on the ovaries and having larger cysts were associated with greater decreases in ovarian reserve [10].

Although the study results suggest a reduction in AMH, the extent and duration of this reduction are inconsistent. According to some studies, speech abilities can temporarily decline and then improve, mostly or entirely, over the following months; however, repeated or bilateral operations may result in permanent damage [11]. Moreover, the majority of research focuses on outcomes related to endometrioma. At the same time, less attention is given to comparing different types of cysts or tracking AMH levels after surgery over several follow-up intervals [12].

Because there are so many differences in research, it's clear that the full effect of ovarian cystectomy on ovarian reserve isn't yet understood. Specifically, we should have more data comparing different types of benign cysts, examining how the side of surgery may influence outcome, and determining when AMH levels bounce back after treatment.

The impact on reproduction of women undergoing cystectomy must be understood, as well as which specific groups may have reduced ovarian function following surgery. The purpose of this study was to examine serum AMH changes after ovarian cystectomy, differentiated by the type and laterality of the cyst, in reproductive-aged women at a tertiary center.

Objective

The objective of this study was to evaluate the immediate and delayed effects of ovarian cystectomy on serum Anti-Müllerian Hormone (AMH) levels and to assess the impact of cyst type and laterality on postoperative ovarian reserve.

Methodology & Materials

This observational study was conducted in the Department of Obstetrics and Gynaecology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from February 2023 to January 2024. A total of 200 women who underwent ovarian cystectomy were enrolled to evaluate the immediate and delayed impact of surgery on serum Anti-Müllerian Hormone (AMH) levels and ovarian reserve.

Sample Selection

Inclusion Criteria:

- Women aged 20–40 years undergoing laparoscopic ovarian cystectomy.
- Diagnosis of benign ovarian cyst confirmed by imaging and clinical evaluation.
- Baseline serum AMH level available within two weeks before surgery.
- Consent provided for participation and follow-up testing.

Exclusion Criteria:

- Women with suspected or confirmed malignant ovarian pathology.
- History of previous ovarian surgery.

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- Current use of hormonal therapies that could affect ovarian reserve.
- Diagnosis of polycystic ovary syndrome (PCOS).
- Presence of chronic systemic diseases (e.g., autoimmune or endocrine disorders).
- Incomplete follow-up data.

Data Collection Procedure: Data were collected through patient interviews, clinical examinations, imaging findings, and laboratory investigations. Baseline demographics and clinical characteristics were documented before surgery. Serum AMH levels were measured using standardized ELISA kits at four time points: preoperative, postoperative day 7, one month, and three months post-surgery. Experienced gynecologic laparoscopic surgeons performed all surgical procedures. Informed consent was secured from all participants. Patient confidentiality and data privacy were strictly maintained throughout the study.

Statistical Analysis: Data analysis was performed using SPSS version 25.0. Descriptive statistics summarized baseline characteristics and AMH levels over time. Paired sample t-tests compared preoperative and postoperative AMH values at different intervals. One-way ANOVA was used to assess differences in AMH changes among cyst types, while independent t-tests examined the effects of laterality. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Baseline Characteristics of Study Participants (N = 200)

Variable		Number of patients	Percentage (%)
Age (years), Mean ± SD		32.6 ± 3.7	
BMI (kg/m²)		23.4 ± 3.1	
Type of Cyst	Endometrioma	101	50.5
	Dermoid Cyst	60	30
	Serous/Mucinous Cyst	39	19.5
Laterality	Unilateral	129	64.5
	Bilateral	71	35.5
Mean Cyst Diameter (cm)		5.2 ± 1.4	
Preoperative AMH (ng/mL)		3.31 ± 1.3	

Table 1 presents the demographic and clinical baseline characteristics of the 200 patients who underwent ovarian cystectomy. The mean age was 32.6 ± 3.7 years, and the average body mass index (BMI) was 23.4 ± 3.1 kg/m². Regarding cyst types, 50.5% had endometriomas, 30% had dermoid cysts, and 19.5% had serous or mucinous cysts. Unilateral cysts were more common (64.5%) than bilateral (35.5%). The mean cyst diameter was 5.2 ± 1.4 cm, and the mean preoperative AMH level was 3.31 ± 1.3 ng/ml.

Table 2: Changes in Serum AMH Levels Over Time

Time Point	Mean AMH (ng/mL) ± SD	% Change from Baseline	p-value (From Baseline)
Preoperative	3.31 ± 1.3		
Post-op Day 7	2.10 ± 1.1	-36.50%	< 0.001
1 Month Post-op	2.42 ± 1.2	-26.90%	< 0.001
3 Months Post-op (n=160)	2.51 ± 1.0	-24.20%	< 0.001

Table 2 illustrates the mean serum AMH levels measured at different postoperative time points. A substantial decrease in AMH was noted by postoperative day 7 (2.10 ± 1.1 ng/mL), corresponding to a 36.5% decline from baseline ($p < 0.001$).

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At 1 month, AMH slightly recovered to 2.42 ± 1.2 ng/mL (26.9% reduction), and at 3 months (n = 160), it reached 2.51 ± 1.0 ng/mL (24.2% reduction), with all changes being statistically significant ($p < 0.001$).

Table 3: Mean AMH Changes by Cyst Type (3-Month Follow-Up)

Cyst Type	Number of patients	Pre-op AMH (ng/mL)	3-Month Post-op AMH (ng/mL)	% Reduction	p-value
Endometrioma	80	3.12 ± 1.1	2.10 ± 0.9	-32.70%	< 0.001
Dermoid Cyst	48	3.48 ± 1.2	2.81 ± 1.0	-19.30%	0.002
Serous/Mucinous	32	3.41 ± 1.0	2.95 ± 0.9	-13.50%	0.047

Table 3 compares the mean preoperative and 3-month postoperative AMH levels across different cyst types. The most significant decline in AMH was observed in patients with endometriomas, from 3.12 ± 1.1 to 2.10 ± 0.9 ng/mL, representing a 32.7% reduction ($p < 0.001$). Dermoid cysts showed a milder decline (19.3%; $p = 0.002$), while serous/mucinous cysts exhibited the least decrease (13.5%; $p = 0.047$).

Table 4: AMH Decline by Laterality of Cystectomy (3-Month Follow-Up)

Laterality	Number of patients	Pre-op AMH (ng/mL)	3-Month Post-op AMH (ng/mL)	% Decline	p-value
Unilateral	104	3.36 ± 1.2	2.75 ± 1.0	-18.20%	< 0.001
Bilateral	56	3.20 ± 1.1	2.01 ± 0.8	-37.20%	< 0.001

Table 4 analyzes AMH decline based on cyst laterality. Bilateral cystectomy was associated with a more pronounced reduction in AMH levels (from 3.20 ± 1.1 to 2.01 ± 0.8 ng/mL; 37.2% reduction; $p < 0.001$) compared to unilateral procedures (from 3.36 ± 1.2 to 2.75 ± 1.0 ng/mL; 18.2% reduction; $p < 0.001$).

Discussion

The results of this study showed that AMH levels in the serum decrease significantly after ovarian cystectomy, but they do not return to preoperative levels entirely within three months. Patients with endometriomas and those who had surgery performed on both sides experienced the most substantial decline in fertility. This research demonstrates that the effects of benign ovarian cyst surgery could potentially impact a woman's ability to have children.

AMH levels after cystectomy support earlier findings that cyst removal, along with part of the ovarian cortex, typically results in a decline in ovarian reserves [13]. As a result of our study, 36.5% lower levels of AMH were seen 7 days after surgery, and these remained 24.2% lower at the end of follow-up. Celik et al. found that AMH secretion remained reduced following laparoscopic resection of endometriomas, with limited indication of a complete recovery quickly after the operation [14].

Our outcomes show that endometriomas can harm the ovaries in two ways: one by their processes, like repeated inflammation and fibrosis, and two by the surgery necessary to remove them. AMH levels dropped by 32.7% in patients with endometriomas three months following surgery, which was significantly more pronounced than the 19.3% decrease seen in those with dermoids, as well as the 13.5% decrease in those with serous/mucinous cysts. This finding is consistent with what Sönmezer et al reported, that there is a greater risk of losing normal ovarian tissue during endometrioma removal because endometriomas have an invasive nature and are not easily divided [16].

The decline in AMH was also strongly affected by laterality. AMH levels decreased by 37.2% following bilateral cystectomy, as against 18.2% after the surgery was performed on one side. Hirokawa et al. found that bilaterality and the severity of endometriosis independently influenced lowered AMH following surgery, as did our results [17]. This study indicates that women who have undergone bilateral removal

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procedures need to be aware of challenges in getting pregnant on their own in the future.

It is still unclear how much AMH can be restored following the removal of an ovarian cyst. Urman et al. observed a moderate improvement in follicle reserve six months after surgery, suggesting that the amount in the first few months after surgery cannot accurately show the full impact on ovarian function [18]. However, even after three months, our analysis revealed that AMH levels had improved but did not return to their initial values. Although we can't be sure about the long-term effects, reduced sperm levels early on are essential for planning a family.

Choosing the right approach for surgery is essential for preserving ovarian reserve. Analyses have suggested that thermal coagulation may lead to more damage compared to using sutures or hemostatic sealants [19]. Although the surgical modality was not investigated in detail, as all procedures were conducted by expert surgeons using bipolar cautery, this may have contributed to the reduction in AMH. As a result of these findings, surgeons are urged to try fertility-saving methods and perform careful hemostasis.

Because surgery is necessary for different types of cysts, their varying influences demonstrate the need for specialised surgical procedures. Analysis by Roman et al. revealed that larger endometriomas result in greater unintentional removal of ovarian tissue due to the difficulty in managing these large or complex ovarian lesions [20]. It is therefore essential to use tailored counselling before surgery, mainly for patients having bilateral endometriomas or lower AMH or AFC levels.

In clinical practice, the results suggest that measuring AMH before and after surgery can help counsel patients about their fertility. It is essential in areas where the ability to use assisted reproductive technologies is not available. AMH testing is also beneficial after cystectomy to identify patients who might develop premature ovarian insufficiency, as pointed out by Takae et al. in their look at postsurgical ovarian insufficiency [4].

Based on our results, it could be argued that conservative treatment of some cysts is better suited for women who aren't symptomatic or focused on quick fertility. When it is unclear whether fertility will be affected or only slightly, Somigliana et al. suggest that the risks should be carefully weighed against the expected benefits [21]. As a result, a customized method for cystectomy should be used, keeping in mind the type and symptoms of the cyst as well as what the patient wishes for their reproductive future.

Overall, the results indicate that removing ovarian cysts, primarily endometriomas and those on both sides, significantly reduces AMH levels, underscoring a genuine impact on ovarian reserve. The initial recovery is observable, despite the constrained overall progress. It shows why specific surgical planning, expert fertility advice and thinking about how to preserve the ovaries are crucial for reproductive-age women.

Limitations and recommendations

This study is limited by its short follow-up and lack of long-term reproductive data. AMH was the sole ovarian reserve marker, and antral follicle count and pregnancy outcomes were not assessed. Future research should include longer follow-up and more fertility indicators. Evaluating the effects of surgical techniques and hemostatic methods on ovarian function is recommended. Counselling patients based on cyst type and laterality can help guide surgical decisions, especially for those seeking fertility.

Conclusion

This study confirms that ovarian cystectomy significantly reduces serum AMH levels, indicating a decrease in ovarian reserve. The effect is most pronounced in patients with endometriomas and those undergoing bilateral procedures. While partial recovery occurs within three months, levels remain lower than baseline. These findings underscore the importance of preoperative fertility counselling and ovarian-sparing surgical techniques. AMH should be monitored postoperatively to assess ovarian function, especially in women planning future fertility.

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