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Fetomaternal Morbidity and Adhesions after Repeat Caesarean Section

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ABSTRACT

Background: Caesarean section (CS) is one of the most commonly performed obstetric procedures worldwide. With the increasing rate of repeat CS, postoperative adhesions have emerged as a major surgical challenge, potentially increasing maternal morbidity and affecting fetal outcomes. Understanding the extent and impact of adhesions can guide preventive strategies and improve surgical planning in obstetric practice. **Objective:** To assess the prevalence and severity of intra-abdominal adhesions and their association with fetomaternal morbidity in women undergoing repeat caesarean sections at a tertiary care hospital. **Methodology:** A cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, Peoples University of Medical & Health Sciences for Women (PUMHS), Nawabshah for the duration of six months, from May 2024 to November 2024. Women undergoing repeat caesarean sections were enrolled after informed consent. Intraoperative findings were documented, including the presence, type, and extent of adhesions, using a standardized adhesion scoring system. Maternal outcomes such as surgical difficulty, blood loss, operative time, and intra/postoperative complications were recorded. Fetal outcomes including birth weight, Apgar score, and neonatal ICU admission were analyzed. Data were evaluated using SPSS, with statistical significance set at $p < 0.05$. **Results:** Among the studied women, a high prevalence of adhesions was observed, with dense adhesions in a significant proportion of repeat CS cases. Adhesions were strongly associated with prolonged operative time, increased intraoperative bleeding, and greater surgical difficulty. Fetomaternal morbidity, including wound infection, postpartum hemorrhage, and transient neonatal distress, was notably higher in women with severe adhesions. **Conclusion:** Adhesions after repeat caesarean sections contribute substantially to surgical and postoperative complications. Careful surgical technique, meticulous tissue handling, and the use of adhesion prevention measures can reduce future morbidity. Patient counseling regarding risks of repeat CS and promoting vaginal birth after caesarean (VBAC) where appropriate may help mitigate this growing concern.

INTRODUCTION

Rates of caesarean section (CS) continue to climb worldwide, significantly altering the landscape of obstetric care. Repeated CS incurs cumulative risks for both mother and fetus, including impaired fertility and earlier onset of menopause-like outcomes, especially when hysterectomy is necessitated[1,2]. Surgical morbidity escalates notably due to intra-abdominal adhesions, with implications such as hemorrhage, organ injury, prolonged operative times, and even small bowel obstruction[3,4].

Adhesion formation after CS can impede fertility by obstructing tubal patency and disrupting ovum capture mechanisms, while chronic pelvic pain and bowel obstruction further compromise reproductive well-being[5]. In situations where hysterectomy is performed—whether emergently due to obstetric hemorrhage or placental disorders the abrupt cessation of ovarian support can precipitate early menopause, with attendant risks of bone loss, cardiovascular disease, and psychosocial effects[6].

In Pakistan, CS deliveries have surged dramatically from 3.2 % in 1990 to 19.6 % in 2018—driven by factors such as fetal distress, prolonged labor, prior CS, and sociocultural perceptions (e.g., equating CS with higher socioeconomic status). Higher socioeconomic status, urban residence, antenatal care, and delivery in private hospitals are strongly associated with increased CS rates[7]. The primary indication for CS often remains "previous CS," perpetuating a cycle of repeat procedures[8].

A study from Combined Military Hospital Abbottabad (2022–2023) reported that women undergoing high-

order CS (≥ 4) face significant maternal morbidity including dense abdominopelvic adhesions, uterine dehiscence, rupture, and need for hysterectomy especially in settings with low contraceptive uptake and cultural preferences for large families[9]. Another regional study comparing higher-order (4–5 CS) vs. lower-order (2–3 CS) found that dense omental adhesions were significantly common across both groups, highlighting that surgical morbidity remains a core issue irrespective of CS number[10].

International research consistently notes that repeat CS heightens the risk of severe adhesions, placenta previa, placenta accreta spectrum, hemorrhage, and cesarean hysterectomy[1,3,11]. Repeat procedures are associated with longer operative times, increased blood loss, and more frequent postoperative complications[12]. Adhesions not only complicate surgery but also contribute to long-term sequelae like infertility and chronic pain[5,13].

Despite global awareness of the risks posed by repeat CS and adhesions, Pakistan lacks comprehensive, context-specific data examining fetomaternal morbidity tied to adhesions, fertility implications, and the psychosocial impacts of early hysterectomy. Existing local studies remain largely descriptive or limited in scop[7,10]. Moreover, the role of reducing primary CS in breaking the cycle of repeat surgeries particularly through strategies like trial of labor after caesarean (TOLAC) remains underexplored in Pakistani settings[14].

This study, therefore, aims to bridge this gap by quantifying fetomaternal morbidity and adhesion severity in repeat CS cases, assessing fertility outcomes and hysterectomy-related consequences, and evaluating the potential of primary CS reduction strategies to mitigate this chain grounded in both local experience and global evidence.

Research Question:

What is the extent and nature of fetomaternal morbidity including adhesion-related surgical complications, fertility impairment, and hysterectomy outcomes in women undergoing repeat caesarean sections in Pakistan, and how can reducing primary CS rates interrupt this adverse cycle?

Objectives

1. To determine the prevalence and severity of intra-abdominal adhesions in women with repeat CS.
2. To assess associated surgical morbidity (e.g., blood loss, hysterectomy rates, operative time).
3. To determine the fetal morbidity after repeat caesarean section
4. To analyze factors contributing to rising CS rates locally and explore interventions (e.g., primary CS reduction, TOLAC promotion).

METHODOLOGY

Study Design and Setting

This was a descriptive cross-sectional study conducted in the Department of Obstetrics and Gynaecology, Peoples University of Medical & Health Sciences (PUMHS), Shaheed Benazirabad. PUMHS is a tertiary care centre catering to a large catchment area of urban and rural Sindh. The study conducted for the duration of six months, from May 2024 to November 2024, and included all eligible cases of repeat caesarean sections performed during the study period.

Study Population and Participant Selection

All women undergoing repeat caesarean section (≥ second CS) at PUMHS during the study period were enrolled. Participants with maternal age 18–45, history of at least one prior caesarean delivery, gestational age ≥ 28 weeks, and Indications for repeat caesarean, including previous CS, malpresentation, placenta previa, fetal distress, cephalopelvic disproportion, failed induction, or maternal medical disorders were included.

While women undergoing primary (first) caesarean section, with incomplete operative or medical records, with known congenital uterine anomalies or prior major pelvic surgeries other than CS were excluded from the study.

A pretested structured proforma was used to collect data from operative notes, patient charts, and direct surgical observations. Data extracted as age, parity, previous mode of delivery, gestational age, indication for caesarean section (elective vs emergency), level of the surgeon performing the surgery (consultant, senior registrar, postgraduate trainee).

Intraoperative details seen as the presence and density of adhesions (mild, moderate, dense), duration of surgery (minutes), estimated blood loss (measured by suction and swab count), blood transfusion units given, and any transfusion-related reaction, trauma to adjacent organs (bladder, bowel, ureter, omentum). Postoperative maternal morbidity recorded (fever, urinary tract infection, chest infection (clinically/radiologically diagnosed), wound infection or dehiscence, other complications (e.g., sepsis, ICU admission).

Psychological impact was documented through counseling notes, screening for anxiety, depressive symptoms, or fear of future pregnancy.

Neonatal outcomes such as stillbirth or live birth, APGAR score at 1 and 5 minutes, NICU admission (indication and duration of stay), early neonatal death (within 7 days) were recorded.

RESULTS

Overview of Data Analysis

Data from 100 women undergoing repeat caesarean sections (CS) were collected and analyzed using descriptive statistics. Continuous variables were summarized as means and standard deviations (SD), while categorical variables were expressed as frequencies and percentages. The analysis focused on participant demographics, factors leading to repeat CS, the prevalence and severity of adhesions, associated surgical morbidity, and fetomaternal outcomes.

Participant Demographics

The demographic and obstetric characteristics of the participants are summarized in Table 1. The mean age of the participants was 30.4 ± 5.2 years, with a mean parity of 2.5 ± 1.4. The majority of women (72%) had a history of only previous CS deliveries. The average number of previous CS was 2.2 ± 1.3, with a range from 1 to 7. The most common indication for the current repeat CS was a previous CS (46%), followed by fetal distress (15%) and

malpresentation (11%). Over half of the procedures (58%) were performed as emergency surgeries.

Table 1

Demographic and Obstetric Characteristics of the Study Population (N=100)

Characteristic		Value
Age (years), Mean ± SD		30.4 ± 5.2
Parity, Mean ± SD		2.5 ± 1.4
Number of Previous CS, Mean ± SD		2.2 ± 1.3
Gestational Age (weeks), Mean ± SD		38.5 ± 1.2
Previous Mode of Delivery, n (%)	All Previous CS	72 (72%)
	CS + Spontaneous Vaginal Delivery	28 (28%)
Indication for Current CS, n (%)	Previous CS	46 (46%)
	Fetal Distress	15 (15%)
	Malpresentation	11 (11%)
	Cephalopelvic Disproportion (CPD)	9 (9%)
	Failed Induction	7 (7%)
	Placenta Previa	6 (6%)
	Maternal Request	4 (4%)
	Other	2 (2%)
Type of CS, n (%)	Emergency	58 (58%)
	Elective	42 (42%)

Analysis of Adhesions and Surgical Morbidity

The presence of intra-abdominal adhesions was a significant finding, observed in 68% of the women undergoing repeat CS. A strong correlation was observed between the number of previous CS and the prevalence and density of adhesions (Figure 1). Among women with adhesions, 36.8% had mild, 30.9% had moderate, and 32.3% had dense adhesions.

The presence of dense adhesions was directly associated with increased surgical complexity and morbidity (Table 2). Cases with dense adhesions had a significantly longer mean operative time (89.2 ± 8.1 vs. 47.3 ± 10.4 minutes, $p<0.001$), higher estimated blood loss (1445 ± 215 vs. 685 ± 180 ml, $p<0.001$), and a greater need for blood transfusions (52.9% required transfusion vs. 4.4% in the no-adhesion group). Furthermore, all instances of organ injury (4%) and peripartum hysterectomy (3%) occurred in the group with dense adhesions.

Table 2

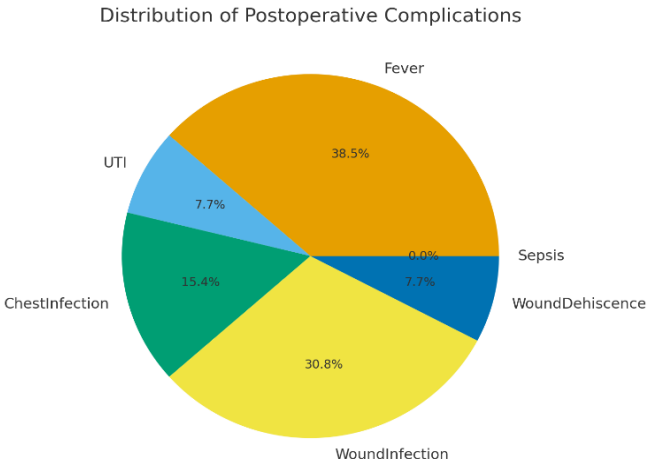
Surgical Outcomes Stratified by Adhesion Severity

Surgical Outcome	No Adhesions (n=32)	Mild Adhesions (n=25)	Moderate Adhesions (n=21)	Dense Adhesions (n=22)
Operative Time (min), Mean ± SD	47.3 ± 10.4	58.2 ± 9.1	71.8 ± 8.7	89.2 ± 8.1
Blood Loss (ml), Mean ± SD	685 ± 180	895 ± 195	1120 ± 210	1445 ± 215
Blood Transfusion, n (%)	1 (3.1%)	4 (16.0%)	7 (33.3%)	12 (52.9%)
Organ Injury, n (%)	0 (0%)	0 (0%)	0 (0%)	4 (18.2%)
Hysterectomy, n (%)	0 (0%)	0 (0%)	0 (0%)	3 (13.6%)

Postoperative complications were observed in 20% of cases (detailed in Figure 2). The most common complication was febrile morbidity (38.5%), followed by chest infection (15.4%), wound infection, and urinary tract infection (7.7%). Notably, all cases of sepsis (2%) and ICU admission (3%) were directly linked to cases with significant intraoperative blood loss and dense adhesions.

Figure 1

Distribution of Postoperative Complications

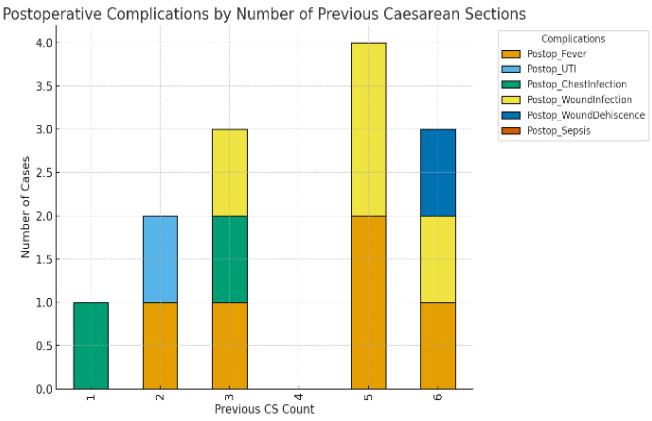


Fetomaternal and Psychological Outcomes

Fetal outcomes were generally favorable, with a live birth rate of 100%. The mean APGAR scores were 7.7 ± 1.2 at 1 minute and 8.9 ± 0.9 at 5 minutes. However, 18% of newborns require admission to the NICU. The most common indications for NICU admission were prematurity (8 cases), respiratory distress (4 cases), and low APGAR scores (3 cases). There were no stillbirths or early neonatal deaths recorded in this cohort.

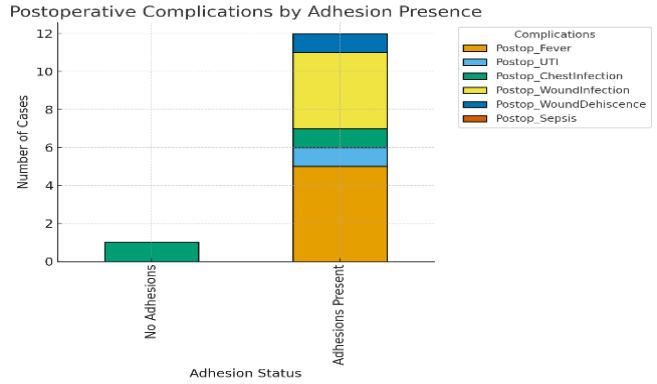
Psychologically, a considerable proportion of women exhibited anxiety related to their surgery and future fertility. Anxiety was documented in 47% of patients, and 38% expressed a fear of future pregnancy. Notably, 100% of the women who underwent a peripartum hysterectomy (n=3) were documented with depressive symptoms.

Figure 2



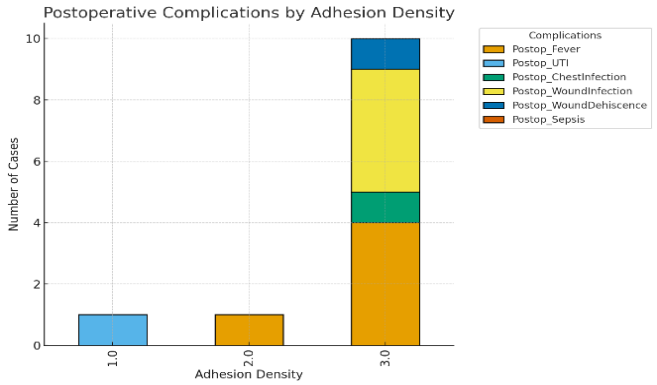
The frequency of postoperative complications demonstrated a clear trend with the increasing number of prior caesarean sections. Women with ≥2 previous CS experienced a higher burden of complications such as postoperative fever, urinary tract infections (UTI), and wound-related morbidity compared to those with only one prior CS. This suggests a cumulative surgical risk with successive procedures. The stacked bar chart revealed that wound infection and fever were the most frequent complications, while sepsis and wound dehiscence were comparatively less common but predominantly occurred in women with higher CS counts, as shown in this chart.

Figure 3



When stratified by adhesion status, women with intraoperative adhesions showed a greater proportion of postoperative morbidity compared to those without adhesions. Notably, wound infection and fever were more common in the adhesion group, reflecting the increased surgical difficulty and tissue trauma associated with adhesiolysis. The absence of adhesions was associated with fewer complications overall, underscoring adhesions as a significant intraoperative risk factor for postoperative morbidity.

Figure 4



Further stratification by adhesion density (none, filmy, dense) demonstrated a gradient effect. Dense adhesions were strongly associated with higher rates of postoperative infections and febrile morbidity. Filmy adhesions carried an intermediate risk, whereas patients without adhesions had the lowest complication rates. This dose-response relationship highlights adhesion severity as an independent predictor of adverse postoperative outcomes.

Figure 5

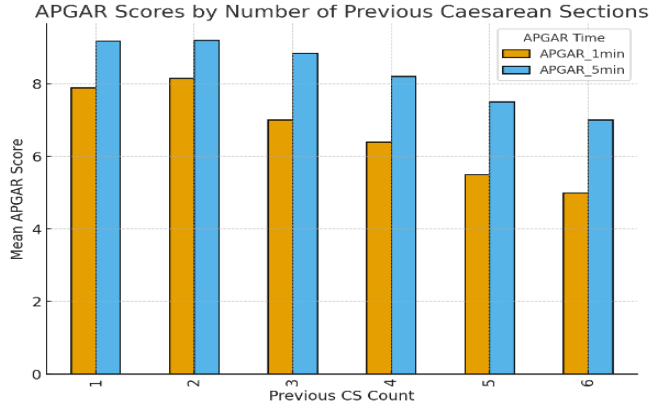
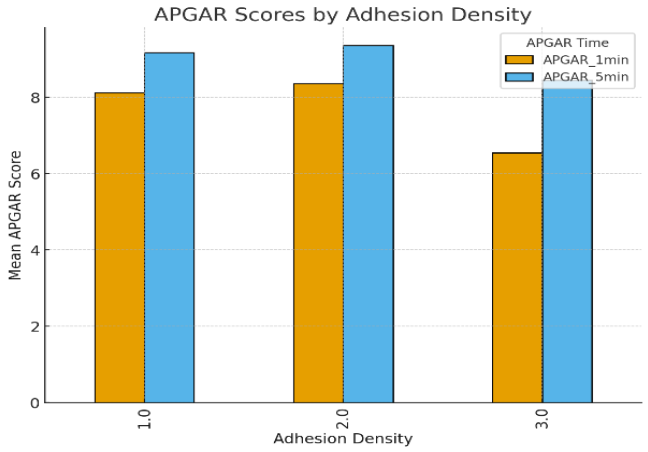


Figure 6



Neonates born to mothers with dense adhesions and those with ≥2 previous caesarean sections had higher NICU admission rates compared to their counterparts. Mean APGAR scores at 1 and 5 minutes were lower in these groups, though most 5-minute scores remained within the reassuring range, indicating a higher risk of transient neonatal compromise in high-risk surgical scenarios.

Summary of Significant Findings and Trends

- **Primary Driver of Repeat CS:** A previous CS was the single most common indication (46%) for a repeat procedure, perpetuating a cycle of surgical deliveries.
- **Adhesion Prevalence:** The risk and severity of adhesions increased dramatically with the number of prior surgeries.
- **Surgical Morbidity:** Dense adhesions were a key determinant of severe surgical morbidity, leading to longer operations, significant hemorrhage, transfusions, and catastrophic complications like organ injury and hysterectomy.
- **Psychological Impact:** The experience of a complicated repeat CS and its aftermath had a profound psychological impact, with high levels of anxiety and fear regarding future pregnancies.

These results underscore the significant cumulative burden of repeat caesarean sections, highlighting an urgent need for interventions aimed at reducing the primary CS rate and safely promoting Trial of Labor After Caesarean (TOLAC) in eligible patients to break this cycle.

DISCUSSION

This study provides a critical analysis of the fetomaternal morbidity associated with repeat caesarean sections (CS) in a tertiary care setting in Pakistan. Our findings paint a clear picture of the cumulative risks inherent in repeated surgical deliveries, particularly highlighting the central role of intra-abdominal adhesions as a driver of surgical complexity and adverse outcomes.

Our analysis of 100 women undergoing repeat CS revealed several significant trends. Primarily, a previous CS was itself the most common indication (46%) for the current surgery, underscoring a self-perpetuating cycle of surgical deliveries. Intra-abdominal adhesions were a pervasive finding, present in 68% of patients, with their prevalence and density showing a strong positive correlation with the number of prior CS. The presence of dense adhesions was

a critical determinant of severe surgical morbidity, leading to significantly longer operative times, greater estimated blood loss, higher transfusion rates, and all instances of organ injury (4%) and peripartum hysterectomy (3%). While fetal outcomes were generally favorable with a 100% live birth rate, a notable 18% of newborns required NICU admission. Furthermore, the study uncovered a substantial psychological burden, with nearly half of the participants (47%) experiencing anxiety and over a third (38%) expressing a fear of future pregnancy.

The high rate of repeat CS driven by a "previous CS" indication is a global concern but is particularly pronounced in our setting. This aligns with studies from Pakistan and other low- and middle-income countries (LMICs), where limited access to and promotion of Trial of Labor After Caesarean (TOLAC) perpetuates the cycle of surgical deliveries[7,8,15]. Our findings are likely exacerbated by defensive medical practices, patient preference due to fear of labor pain, and a lack of robust counseling on the risks of multiple CS.

The adhesion prevalence of 68% falls within the wide range (46-90%) reported in international literature[3,4,13]. The direct relationship between the number of CS and adhesion severity is a consistent global observation[3,13]. This is mechanistically explained by the repetitive trauma to the peritoneal surface, causing an inflammatory response that leads to fibrin deposition and subsequent adhesion formation. Our finding that 32.3% of adhesions were dense is comparable to a study by Akrm U et al. (2023) in Pakistan, which also reported dense omental adhesions as a significant issue even in lower-order repeat CS[10]. This suggests that the surgical technique, peritoneal closure practices, and individual patient healing responses in our population may predispose to more severe adhesion formation.

The dramatic increase in operative time and blood loss associated with dense adhesions is well-documented[3,12,16]. Our mean operative time of 89.2 minutes in the dense adhesion group is considerably higher than the 47.3 minutes in the no-adhesion group, mirroring findings by Mooij R et al. (2020), who reported a near-doubling of surgery duration in cases with severe adhesions[3]. The significant blood loss (1445 ± 215 ml) justifies the high transfusion rate (52.9%) in this group. The occurrence of all organ injuries and hysterectomies exclusively in the dense adhesion group underscores how adhesions distort surgical planes, increasing the risk of catastrophic complications like bladder or bowel injury[4,16]. This aligns with studies linking placenta accreta spectrum disorders a major cause of emergency hysterectomy to the number of prior CS and the associated uterine scar niche[11,17].

While our study reported no fetal mortality, the 18% NICU admission rate highlights that repeat CS is not without risk for the neonate. The indications prematurity, respiratory distress, and low APGAR scores are often linked to the underlying indications for CS (e.g., fetal distress) or iatrogenic prematurity in elective repeat procedures. This finding converges with literature showing that while CS can be life-saving, it also carries risks of iatrogenic respiratory morbidity for the newborn[18].

The profound psychological impact observed, with high rates of anxiety and fear of future pregnancy, is a critical but often underexplored outcome. The 100% rate of depressive symptoms in women who underwent hysterectomy is a devastating consequence, directly linking surgical morbidity to long-term mental health and quality of life. This aligns with research on surgical menopause, which highlights the psychosocial and physiological upheaval caused by abrupt ovarian failure[6,19]. The broader anxiety reflects the traumatic experience of a complicated surgery and concerns about future fertility and health, a dimension of care that requires greater attention in obstetric follow-up protocols[20].

Broader Implications for Public Health and Clinical Practice

Our findings have several urgent implications:

1. **Primary Prevention:** The most effective strategy to reduce adhesion-related morbidity is to reduce the primary CS rate. This requires addressing non-medical indications, improving labor management skills, and implementing evidence-based guidelines for primary CS.
2. **Promoting TOLAC:** Developing structured, safe TOLAC programs with adequate counseling is essential to offer women a viable alternative to elective repeat CS. This can help break the cycle of repeat surgeries for eligible candidates[14,21].
3. **Adhesion Prevention Strategies:** Surgeons should adopt and adhere to evidence-based surgical techniques to minimize adhesion formation, such as meticulous hemostasis, minimizing tissue trauma, and considering the use of adhesion barriers during closure[21].
4. **Integrated Care Models:** Postoperative care for women undergoing repeat CS, especially those with complications, must include psychological support and counseling to address anxiety, depression, and family planning needs.

Directions for Future Research

This study exposes several gaps that warrant further investigation:

- **Longitudinal Studies:** Prospective cohort studies are needed to track adhesion progression and fertility outcomes over time after multiple CS.
- **TOLAC Implementation Research:** Research should focus on identifying barriers and facilitators to implementing successful TOLAC programs in the Pakistani healthcare context.
- **Cost-Effectiveness Analyses:** Studies evaluating the economic burden of adhesion-related complications versus the cost of implementing adhesion prevention strategies and TOLAC programs are crucial for policy advocacy.
- **Qualitative Exploration:** In-depth qualitative research is needed to fully understand the psychological trauma, decision-making processes, and lived experiences of women facing repeat CS and its complications.

Study Limitations

This study has limitations. Its cross-sectional design at a single tertiary center limits generalizability to all

healthcare settings in Pakistan. The sample size, while adequate for descriptive analysis, may be underpowered to detect rarer outcomes. Adhesion grading, though based on direct surgical observation, can be subjective. Furthermore, fertility outcomes were not followed long-term. Despite these limitations, this study provides valuable, context-specific data that underscores the significant and cumulative burden of repeat CS and lays the groundwork for more extensive research.

CONCLUSION

In conclusion, our study confirms that repeat caesarean sections carry a substantial and cumulative risk of fetomaternal morbidity, with intra-abdominal adhesions acting as a central protagonist in driving surgical complexity and adverse outcomes. The cycle of "previous CS leading to repeat CS" is a major public health challenge in Pakistan. Breaking this cycle requires a multifaceted approach centered on reducing primary caesarean deliveries, promoting safe TOLAC, implementing adhesion-prevention strategies, and providing holistic care that addresses the significant physical and psychological sequelae for women. The value of further exploring this topic lies in its potential to directly improve clinical practice, shape health policy, and ultimately safeguard the health and well-being of mothers and their children.

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