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Original Research Article

Maternal and neonatal morbidity associated with higher-order of four or more repeat cesarean sections: a retrospective cohort analysis in Dubai

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ABSTRACT

Background: Cesarean delivery rates have surged globally over the past few decades, with an increasing trend of repeat cesarean sections (CS), raising significant maternal and neonatal health concerns. The risks associated with higher-order (four or more) repeat cesarean deliveries are underexplored, especially concerning outcomes like maternal hemorrhage, uterine rupture, placenta accreta spectrum (PAS), and neonatal morbidity. This study aimed to analyze maternal and neonatal morbidity in women undergoing higher-order repeat cesarean sections, comparing these with outcomes in lower-order (three or fewer) CS deliveries, to provide insights for risk mitigation and informed decision-making.
Methods: A retrospective cohort study was conducted on patients who underwent repeat cesarean deliveries from January 2018 to December 2023. Data were gathered from electronic health records, focusing on key outcomes including maternal complications (e.g., blood transfusions, adhesions, ICU admissions) and neonatal complications (e.g., NICU admissions, respiratory distress). Statistical analysis was used to assess correlations and compare morbidity outcomes between groups.
Results: Findings indicated significantly higher morbidity in the higher-order CS group. Elevated risks of hemorrhage, peripartum hysterectomy, organ injuries, and neonatal NICU admissions were observed. These findings highlight the need for enhanced clinical strategies and informed counselling for women with multiple prior cesarean sections.
Conclusions: This study underscored the increased maternal and neonatal risks associated with four or more repeat cesarean sections. These results support the importance of careful prenatal monitoring, informed patient counselling, and targeted interventions to mitigate risks for high-order repeat cesarean deliveries.

Keywords: Dubai hospital, Maternal morbidity, Neonatal morbidity, NICU admissions, Peripartum hysterectomy, Placenta accreta spectrum, Repeat cesarean section, Retrospective cohort study, Uterine rupture

INTRODUCTION

In the last few decades, the rate of cesarean section (CS) has increased significantly worldwide, changing the nature of childbirth practices.

What was once considered a lifesaving intervention for high-risk pregnancies and complicated deliveries is now a mode of delivery for about 21% of all births globally, with some regions reporting even higher rates due to factors such as increasing maternal age, preference for elective deliveries, and cultural norms.[1] Elective cesarean sections have gained immense popularity in the United Arab Emirates (UAE) and throughout the middle east.[2] The incidence in Dubai is particularly characteristic of the risks primarily where four or more interventions are involved in the scenario of higher-order repeat cesareans.[3]

The higher the CS rates, the more maternity and neonatal complications are at risk, especially when there are multiple previous cesareans.[4] Risks include adhesions, bands of scar tissue connecting organs within the abdominal cavity which pose problems during subsequent operations. Adhesions not only prolong the time of surgical interventions but also increase intraoperative hemorrhage and complicate subsequent operations, especially in emergency conditions.[5] Tarney et al showed that with each subsequent cesarean delivery, the risk of bladder injury increases, which indicates the significant technical and anatomical difficulties that surgeons face with every intervention.[6] The presence of adhesions and scarring changes the surgical environment.

There is also a risk with multiple cesarean deliveries-the placenta accreta spectrum- where the depth of placental implantation into the uterine wall is abnormal, sometimes invading the adjacent organs.[7] This is associated with a grave threat to life and significant risk of hemorrhage at the time of delivery and often requires peripartum hysterectomy. Studies have also shown that with every cesarean, the risk of PAS increases as previous uterine incisions and scarring create a perfect environment for improper placental attachment. According to research by Liu et al, incidence of PAS among women who have had three or more cesareans was five times higher than women who had not had any history of cesareans.[8] This higher risk requires greater antenatal surveillance and preoperative preparation in women with multiple cesarean deliveries.

The neonatal outcomes of multiple cesarean sections are also worrisome, especially in terms of respiratory distress syndrome (RDS), which is highly prevalent in newborns delivered by repeat cesareans.[9] Elective repeat cesarean sections are typically scheduled prior to labor to reduce the risk of uterine rupture in those with a history of uterine scars. Early delivery, most often before 39 weeks of gestation, means that babies are born before their lungs are fully developed and thus at greater risk for respiratory issues. Research has shown that babies delivered by higher-order repeat cesareans are often admitted to the NICU for disorders such as RDS. Yadav et al reported that, in addition to increased respiratory distress, these neonates had lower Apgar scores, showing the direct effects of maternal surgical risks on neonatal health.[10]

Besides the short-term maternal and neonatal outcome, cumulative effects of multiple caesarean deliveries result in lasting consequences. Repeated cesareans put a lot of physical strain on the mother. Furthermore, in regions where large family sizes are prevalent, such as the middle east, the urge for more children can force women into having multiple cesareans despite the risks involved. This gives a unique socio-cultural dimension to the health implications of multiple cesareans. A higher risk of PAS and rupture of the uterus can lead to hysterectomy at delivery, which, in effect, abruptly ends a woman's reproductive capacity and heavily impacts her psychological well-being and family dynamics.[11]

Maternal health implications of multiple repeat cesareans are important beyond the immediate outcome in terms of physical health consequences.

Compounding risks factors of higher order cesarean delivery include such pre-existing medical conditions as diabetes, obesity, and hypertension, which are commonly prevalent among pregnancy populations worldwide especially in urban regions where lifestyle associated health issues are growing more common. For example, maternal obesity has been associated with increased risks for postoperative complications, including infections and delayed wound healing.[12] Few studies have successfully controlled these health factors in examining the risks of higher-order cesarean deliveries. Teefey et al noted that both obese and multiparous women who have had multiple cesareans are at higher risk for surgical complications and that such factors must be taken into consideration in the preoperative preparation and counseling of patients.[13] In addition, diseases like diabetes and hypertension increase the risks for both the mother and the baby, which increases the chances of complications like preeclampsia, preterm delivery, and neonatal hypoglycemia. Thus, studies that include these factors can offer a more in-depth assessment of risk and help in developing comprehensive care plans.

The existing literature on repeat cesarean sections lacks strength in methodology and heterogeneity of study populations. Most of the studies have been conducted in single-center settings with homogenous populations, hence limiting the generalizability of the findings to more extensive and heterogeneous populations. For example in Dubai, its multicultural demographic characterized by varied socio-cultural standards regarding family size and birth preferences requires studies that capture these different dynamics. One notable deficiency is the lack of widely applicable data on higher-order repeat cesarean sections within multicultural contexts, and also the limited investigation of the cultural, social, and economic determinants that might influence women's decisions on cesarean deliveries. This deficiency is especially pertinent in Dubai, where high rates of cesarean births coincide with cultural tendencies towards larger family units, generating intricate healthcare challenges and a need for data that is relevant to the local environment.

Aim

The aim of this study was to bridge the identified gaps by researching maternal and neonatal morbidity among women undergoing higher-order repeat CS in Dubai. This study, conducted as a retrospective cohort study, has examined maternal complications, which include ICU admissions, transfusion requirements, organ injuries, and recovery after surgery, and neonatal complications, including NICU admissions and low Apgar scores. The study had a comparative approach, comparing the results for women who have had four or more prior cesareans with those who have had fewer. This will clearly illustrate how risks build with each surgery.

Furthermore, demographic variables, such as maternal age, parity, and pre-existing health conditions, were taken into account in the study to gain a wide view of what factors influence outcomes in higher-order cesareans.

The research is of both clinical and policy significance. Clinically, such findings will enable healthcare providers to formulate detailed prenatal and perinatal care plans for women with multiple prior cesareans to reduce the likelihood of complications related to higher-risk pregnancies. Enhanced prenatal counselling for women with multiple cesareans would better patient outcomes through ensuring that mothers are well informed of the risks and the need for careful monitoring. On the policy-making level, the findings could serve as possible inputs in formulating health strategies on safe reproductive choice and to support initiatives aimed at limiting elective cesareans based on unclear medical indications. Where rising cesarean rates are seen as a public health problem, these policies help in effectively setting resources and detailing how the challenges of repeat cesareans should be approached.

In summary, while cesarean deliveries are inevitable in modern obstetrics, an increasing incidence of higher-order repeat cesarean sections raises maternal and neonatal health concerns. It is essential that the cumulative effects of multiple cesareans on short-term and long-term outcomes drive targeted research for the guidance of clinical practice and policy. The main objectives of this study were to deepen the knowledge related to complications in higher-order repeat caesarean deliveries within the culturally diverse background of Dubai. This is toward promoting safer obstetric practices, more effective counselling of patients, and evidence-based policy-making.

Focusing on maternal and neonatal outcomes, this study looks forward to joining the greater discourse on cesarean sections while providing concrete suggestions for the safety and care of mothers and their newborns across the world.

METHODS

Study design and setting

This was a retrospective cohort study conducted at Dubai Hospital, using data retrieved from the SALAMA electronic health records system. The study period extended from January 2018 to December 2023.

Participants

A total of 388 women were included in each group. Women with four or more previous cesarean sections were classified into the higher-order cesarean group, while those with three or fewer previous cesarean sections comprised the comparison group.

Procedures and outcomes

Maternal outcomes assessed included intensive care unit admission, transfusion requirements, and perioperative complications. Neonatal outcomes included neonatal intensive care unit admission, Apgar scores, and immediate perinatal morbidity. Data were extracted, verified, and categorized systematically to ensure uniformity across groups.

Ethical approval

Ethical clearance for the study was obtained from the institutional review board of Dubai Hospital, and patient confidentiality was strictly maintained.

Statistical analysis

Statistical analysis was performed using SPSS software, version 20.0 (IBM Corp., Armon k, NY, USA). Descriptive statistics were used to summarize baseline characteristics. Regression and correlation analyses were applied to evaluate associations between cesarean order and maternal or neonatal outcomes. Results were expressed as p-values, odds ratios, and 95% confidence intervals, with adjustments for potential confounding variables.

This retrospective cohort study analysed a total of 388 females in each group. Data from electronic health records by (SALAMA), covering the period from January 2018 to December 2023 was collected. Women with four or more prior cesarean sections will be included in the higher-order CS group, while those with three or fewer comprised the comparison group.

Key outcomes to be assessed include maternal factors (e.g., ICU admissions, transfusion requirements) and neonatal factors (e.g., NICU admissions, Apgar scores). Statistical analyses, including regression and correlation tests, will be applied to establish the significance of observed differences while controlling for potential confounding variables.

Expected outcomes and implications

This study anticipated demonstrating that higher-order repeat cesarean sections carry increased risks for both mothers and neonates compared to lower-order procedures.

The findings could underscore the importance of patient counselling and the development of individualized care plans for women considering additional pregnancies after multiple cesareans.

Ultimately, this research aimed to contribute to safer obstetric practices and improve maternal and neonatal health outcomes in the context of repeat cesarean deliveries.

RESULTS

Demographic and obstetric characteristics

The study included 776 women (388 in each group). Women in the multiple CS group were older (36.2±4.2 years) compared with controls (34.5±3.8 years, p<0.01; Table 3). Mean parity was significantly higher (4.96±1.2 versus 2.1±0.7, p<0.001). As expected, the number of prior cesarean deliveries was substantially greater (4.36±1.1 versus 0.6±0.5, p<0.001).

Intraoperative outcomes

Severe adhesions were observed in 25.8% of multiple CS cases compared with 7% of controls (p<0.001; Table 2). Estimated blood loss was significantly higher (770±420 mL versus 450±160 mL, p<0.001), with 18% of women in the multiple CS group experiencing blood loss >1000 ml. Operative duration was prolonged in the multiple CS group (60.5±14.2 minutes versus 40.0±9.1 minutes, p<0.001).

Table 1: Hemodynamic changes and maternal health.

Maternal hemodynamic changes	Control group (n=X)	Multiple c-section group (n=Y)	Remarks
Mean intraoperative blood pressure (mmHg)	85 (Range: 70-95)	92 (Range: 75-110)	Increased stress and blood loss in multiple c-sections elevate heart rate
Vasopressor use (%)	110/70 (Range: 90/60-120/80)	115/75 (Range: 100/65-130/90)	Slightly higher BP in multiple c-sections
Uterine and placental abnormalities	5	12	More frequent use due to hemodynamic instability in multiple c-sections
Uterine rupture (%)			
Placenta previa	0	3.8	Significant risk of rupture in multiple c-sections due to scar thinning
Placenta accreta spectrum	0.5	9.6	Higher prevalence due to abnormal implantation
Postoperative complications	0	5.4	Abnormal placentation seen more frequently in multiple c-sections
Postoperative fever (%)			
Wound Infection	4	10	More infections due to prolonged surgeries and adhesions
Need for blood transfusion	2	8	Higher rates in multiple c-sections due to poor tissue healing
Neonatal complications	3	14	Greater transfusion requirement due to blood loss
Respiratory distress syndrome (RDS) (%)			
Neonatal sepsis	2	7	Higher incidence likely due to prematurity
	1	3	Increased risk due to prolonged surgeries or compromised environments
Birth trauma	0.5	1.2	Marginally higher trauma in multiple c-sections due to difficult deliveries
Anesthetic considerations (%)			
Regional anesthesia used	95	89	Slightly lower usage due to more complex surgical scenarios
General anesthesia used	5	11	Higher rate due to complications or emergencies
Anesthesia-related complications	1	4	Increased complications
Uterine scar characteristics			
Scar thickness (mm)	Mean: 4.5 (Range: 4-5)	Mean: 3.2 (Range: 2-4)	Thinner uterine scars increase risk of rupture
Scar dehiscence (%)	0	6	Higher rates due to cumulative stress on uterine tissue
Intraoperative uterine tear (%)	0.5	5	More common due to adhesions and scar weakening
Fetal outcomes			
Prematurity (%)	7%	18%	Increased rates due to complications requiring early delivery
Birth weight (kg)	Mean: 3.1 (Range: 2.5-4.2)	Mean: 2.8 (Range: 1.8-3.5)	Lower birth weights observed in multiple c-sections

Continued.

Maternal hemodynamic changes	Control group (n=X)	Multiple c-section group (n=Y)	Remarks
Stillbirth (%)	0.2	1.5	Slight increase due to higher-risk pregnancies
Postpartum recovery and morbidity			
Postpartum hemorrhage (%)	3	12	Higher incidence due to uterine atony or placental issues
Postoperative pain score (VAS)	Mean: 3.5	4.2 (Range: 3-6)	6.8 (Range: 5-9)
Return to normal activity (weeks)	Mean: 3.5 (Range: 3-5)	Mean: 5.2 (Range: 4-8)	Longer recovery times due to complications
Chronic pelvic pain (%)	1	6	Adhesions and scar complications contribute to increased pelvic pain
Future fertility issues (%)	0.5	8	Higher rates due to uterine damage
Psychological stress/anxiety (%)	2	10	Elevated stress due to surgical trauma or neonatal complications
Perioperative infections			
Endometritis (%)	1.2	5.6	Higher incidence of uterine infections
Urinary tract infections (UTIs) (%)	2	7	More common due to catheter use and prolonged hospital stay
Surgical site infections (%)	1.5	6	Increased rates influenced by longer operation times and adhesions

Table 2: Comparative analysis.

Parameters	Control group	Multiple C-section group	Remarks
Age (years)	Mean: 34.5 (Range: 22-45)	Mean: 36.2 (Range: 23-46)	Comparable age range; slight increase in the multiple C-section group due to cumulative pregnancies
Parity	Mean: 2.1 (Range: 1-4)	Mean: 4.96 (Range: 2-9)	Significantly higher parity in the multiple c-section group, reflecting obstetric complexity
Previous c-sections	Mean: 0.6 (Range: 0-2)	Mean: 4.36 (Range: 4-9)	Control group includes cases with no or minimal prior surgeries
Adhesions (%)	Mild: 5	Mild: 33.9	Adhesions more frequent and severe in the multiple C- section group, complicating surgeries
	Moderate: 2	Moderate: 26.1	
	Severe: 0	Severe: 25.8	
	None: 93	None: 14.2	
Estimated blood loss (EBL)	mean: 450 ml (200-800 ml)	mean: 770 ml (200-5500 ml)	Greater blood loss in multiple c-sections due to adhesions, uterine rupture, or abnormal placentation
Operation duration	Mean: 40 minutes (25-60 minutes)	Mean: 60.5 minutes (40-120 minutes)	Prolonged surgeries in the multiple c-section group due to increased surgical complexity
NICU admissions	7.5%	23.2%	Higher neonatal morbidity in the multiple c-section group, likely due to prematurity and complications
ICU admissions	0.5%	1.3%	Comparable ICU rates; effective perioperative management in both groups
Hospital stay (days)	Mean: 3.2 (2-5)	Mean: 5.26 (3-8)	Longer hospital stay in multiple c-section group due to complications and recovery needs
Surgery type	Elective: 60%	Elective: 72.4%	Higher elective surgeries in multiple c-sections due to pre-planned care
	Emergency: 40%	Emergency: 27.6%	Emergency cases still constitute a significant proportion in both groups
Neonatal outcomes (Apgar)	Mean: 9.8 (Range: 8-10)	Mean: 9.75 (Range: 7-10)	Favorable neonatal outcomes in both groups, despite challenges in multiple c-sections

Table 3: Demographic characteristics of the study population (n=388).

Variables	Values	95% CI
Age (years)	Mean: 36.0	35.59-36.41
Nationality	Local: 284 (73.2%) Expatriate: 104 (26.8%)	Local: 68.8-77.6% Expatriate: 22.4-31.2%

Hemodynamic and maternal health parameters

Mean intraoperative systolic blood pressure was higher in the multiple CS group (92±10 mmHg versus 85±8 mmHg, p<0.05; Table 1). Vasopressor use was also more common (12% versus 5%, p<0.01). Placental complications were disproportionately higher: placenta accreta spectrum (9.6% versus 0.5%, p<0.001), placenta previa (3.8% versus 0%, p<0.01), and uterine rupture (5% versus 0%, p<0.01).

Postoperative morbidity

Multiple CS patients had higher complication rates. Postpartum hemorrhage occurred in 12% versus 3% (p<0.001). Wound infections were also elevated (10% versus 4%, p<0.05), as were febrile morbidities (5.4% versus 0%, p<0.01). The mean hospital stay was significantly longer (5.26±1.1 versus 3.2±0.8 days, p<0.001).

Anesthetic considerations and scar status

General anesthesia use was higher in multiple CS (11% versus 5%, p<0.05), and anesthesia-related complications occurred in 4% versus 1% (p<0.05; Table 1). Mean scar thickness was reduced (3.2±0.6 mm versus 4.5 ± 0.7 mm, p<0.001). Scar dehiscence (6% versus 0%, p<0.001) and intraoperative uterine tears (5% versus 0.5%, p<0.01) were more frequent in the multiple CS group.

Neonatal outcomes

Prematurity was significantly more common in multiple CS (18% versus 7%, p<0.001). Mean neonatal birth weight was lower (2.8±0.4 kg versus 3.1±0.5 kg, p<0.001). NICU admissions were markedly higher (23.2% versus 7.5%, p<0.001; Table 2). Neonatal morbidities included respiratory distress (14% versus 3%, p<0.001), sepsis (7% versus 2%, p<0.05), and birth trauma (1.2% versus 0.5%, ns). Stillbirths occurred more frequently (1.5% versus 0.2%, p<0.05).

Statistical insights

Confidence intervals for key metrics (age, parity, gestational age) provide a robust understanding of the population's characteristics.

The chi-square test confirms that the distribution of surgery types is not random, with type 2 surgeries being predominant.

DISCUSSION

In this cohort, women with multiple cesarean sections had significantly greater blood loss, longer operative times, and a much higher incidence of moderate-to-severe adhesions than controls. Neonatal outcomes were also affected, with more NICU admissions and higher prematurity rates. These results highlight the cumulative surgical and neonatal risks of repeat cesarean deliveries and are consistent with published international data

Key findings of this study include a markedly higher rate of severe adhesions (25.8% versus 7%), increased estimated blood loss (mean 770 ml versus 450 ml), longer operative time (60.5 minutes versus 40 minutes), and higher placenta accreta spectrum (9.6% versus 0.5%) in women with multiple cesarean sections compared with controls. Post-operative complications such as postpartum hemorrhage (12% versus 3%) and wound infection (10% versus 4%) were significantly more frequent, while neonatal outcomes showed greater prematurity (18% versus 7%) and NICU admission (23% versus 7%).

Our findings indicate that there are indeed significant differences between the two groups. The average age of women in the multiple C-section cohort was marginally elevated at 36.2 years compared to that of the control group, which was 34.5 years (Table 2). This finding is consistent with worldwide trends indicating that an advanced maternal age is becoming more prevalent, especially in high-risk obstetric scenarios. Advanced maternal age has been linked with increased obstetric complexity, and the reasons are attributed to delayed childbearing and increased chances of complications requiring cesarean deliveries.[14] The mean parity in the multiple c-section group was 4.96 compared with 2.1 in the control group, indicating that the cumulative effects of repeated pregnancies had detrimental effects on the health of mothers. The findings of the current study are in accordance with the observations of Dimitrova et al, who stated that having three or more prior deliveries significantly increases the risk of complete uterine rupture (CUR). Their findings showed that women with higher parity were nearly four times more likely to experience CUR compared to those with fewer pregnancies (Table 2).[15]

Our group of multiple cesarean sections showed a surprisingly high incidence and severity of adhesions. Adhesions of severe intensity were observed in 25.8% of cases. There were no such events in the control group. This points to the additive effect of multiple surgeries on pelvic anatomy and the complexity of surgery. A study by

Awonuga et al discuss the pathophysiology of adhesions post-cesarean delivery (CD), noting that while adhesions are less frequent than after gynecological surgeries, they still pose significant risks.[16] Our findings corroborate this, as the multiple c-section group in our study showed higher rates of moderate to severe adhesions, leading to increased surgical complexity and operation time. This highlights the importance of managing adhesions in women with multiple c-sections to reduce potential complications (Table 2).

A prospective Egyptian cohort study (Aboshama et al, 2023) recorded moderate-severe adhesions in 62% of women with history of repeat cesarean sections, highly significantly related to increased hospital stay as well as operative duration.[17] An observational Indian study by Jain et al, also identified adhesions in 35% of repeat cesarean operations, with dense adhesions corresponding to a mean operative time of 60.6±8.5 minutes, decrease of hemoglobin by 1.10±0.25 mg/dl, and transfusion in 66.7% of dense-adhesion cases.[18]

Hassanabad et al in his study highlighted that post-operative adhesions, common across various surgical fields, arise from complex, multifactorial mechanisms, yet no single dominant cause has been identified thus these studies have indicated that adhesions correlate with the number of abdominal surgeries.[19] Adhesions can distort pelvic anatomy, making subsequent surgeries more difficult, prolonging operative time, and increasing the risk of intraoperative injuries to adjacent organs. The high incidence of severe adhesions in our population underlines the need to initiate preventive measures for adhesions, especially adhesion barriers and judicious surgical techniques in those cases that are perceived to be at more risk.

A comparative study from Turkey by Uyanikoglu et al evaluated 120 women undergoing cesarean sections, dividing them into two groups: those with ≤3 prior cesareans (n=62, 51.7%) and those with ≥4 prior cesareans (n=58, 48.3%). The study reported a significantly higher incidence of intra-abdominal adhesions in the multiple CS group, whereas rates of peripartum hemorrhage, blood transfusion, uterine rupture, placenta previa with invasion anomalies, bladder, and bowel injuries did not differ significantly between groups.[20]

These findings are partially consistent with our data, where moderate to severe adhesions occurred in 52% of women with multiple c-sections, contributing to increased operative times (mean 60.5±12.3 minutes) and blood loss (mean 770±650 ml), highlighting that while adhesions consistently increase with repeat surgeries, the overall risk of severe maternal complications may vary with population and surgical expertise. A very large study out of the US saw an increased incidence of adhesions from 24.4% on second c-section to 42.8% on third, with delivery time also increasing from 7.7±0.3 minutes on the first cesarean to 10.4±0.1 minutes on ≥4th cesarean AJOG. This mirrors our data exactly, showing increased operative times, and supports the cumulative risk of successive cesarean sections.[21]

Our findings also show that the EBL was appreciably increased in the group of women who had multiple cesareans, with a mean recorded at 770 ml in comparison to 450 ml reported in the control group. This finding resonates with the findings presented by Alshehri et al showing that multiple cesarean deliveries are associated with hemorrhagic complications resulting from amongst others, uterine rupture, abnormal placentation and injuries during the course of the surgical process.[22] Our data showed a range of EBL from 200 to 5500 ml in the multiple c-section group, indicating potential catastrophic hemorrhage. This should be a premise for preoperative planning, blood product availability, advanced surgical skill, and strict adherence to evidence-based protocols on hemorrhage management (Table 2). Our findings are also in accordance with a retrospective study by Zhou et al, which reported that women with three or more prior cesarean sections had a significantly higher rate of perioperative blood transfusions compared to women with one or two cesarean deliveries (transfusion rate 8.1% versus 2.9%, $p<0.05$).[23]

An interesting finding of our study was that the operating time was prolonged; the average duration for the cohort of multiple cesarean deliveries was 60.5 minutes, whereas the control group took 40 minutes. Prolonged surgical times in subsequent cesarean deliveries are a widely reported phenomenon and are mainly due to the issues related to adhesions, altered pelvic anatomy, and increased demands of dissection. Operative time has also been reported by Zia et al to be highly increased with the number of previous cesareans, more so in cases of severe adhesions or abnormal placentation.[24] Thus, the implication is that operative duration and resultant complications can only be minimized through surgical expertise and preoperative planning (Table 2).

Neonatal outcomes for our study indicate a higher NICU admission rate in the multiple c-section group at 23.2% compared to the control group at 7.5%. This finding agrees with the findings of Yeganegi et al, which cited prematurity, respiratory distress, and delivery-related trauma as some of the frequent causes of neonatal morbidity in multiple cesarean sections.[25] Even though there were higher rates of NICU admissions, the Apgar scores remained positive for both groups with a mean of 9.75 for the multiple c-section group and 9.8 for the control group. This depicts proper intrapartum care and neonatal resuscitation practices in our population, even in at-risk conditions (Table 2).

The multiple c-section group had a longer hospital stay; the mean number of days spent in the hospital was 5.26, compared with that for the control group at 3.2. Similar trends have been noted by Gelaw et al, with evidence that extended periods of inpatient care are commonly

associated with postoperative complications such as wound infections, long stays in recovery, and additional treatments.[26] The more than average length of hospital stay for patients in this study underscores the cost and psychosocial factors associated with having more than one cesarean, thus increasing the need to design targeted interventions for enhanced recovery with decreased hospitalization (Table 2).

It is important to note that the repeated c-section group represented a greater proportion of planned surgical procedures at 72.4% compared to the control group at 60%. This is indicative of a strong preference for scheduled medical interventions for high-risk pregnancies to eliminate last-minute emergency conditions and to ensure proper preparation of surgical equipment. Emergency surgeries still accounted for 27.6% of cases in the multiple c-section group, and this shows the unpredictable nature of complications arising with pregnancy. The results obtained concur with the observations made by Johnson et al, who observed that although elective surgical procedures are favored in instances categorized as high-risk, emergency interventions persist as an indispensable component of obstetric care (Table 2).[27]

The retrospective nature and single-center design of this study may restrict its applicability to other obstetric contexts. Despite the large sample size, selection bias cannot be completely ruled out, and results may have been impacted by unmeasured confounders like surgeon experience and the length of the interpregnancy period. Minor intraoperative details might have gone unreported because we relied on electronic records and operative notes. Lastly, conclusions are limited to the perinatal period because long-term maternal and neonatal sequelae were not evaluated.

CONCLUSION

In summary, our research emphasizes the substantial effect of repeated cesarean deliveries on maternal, surgical, and neonatal outcomes. Women with recurrent c-sections are at greater risk of serious adhesions, longer operative times, excessive blood loss, and longer hospital stays, highlighting the importance of these surgeries. Neonatal outcomes also indicate increased NICU admissions, emphasizing the difficulties for newborns in such high-risk births. While improvements in surgical skill and intrapartum care have reduced some risks, our results emphasize preventive measures, careful preoperative planning, and individualized interventions to optimize outcomes. These findings support the necessity of an even-handed approach in managing cesarean deliveries to provide better care for both mothers and their infants.

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