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Original Article

Association of Previous Surgical Miscarriage with Risk of Preterm Subsequent Pregnancy in Females Presenting in a Tertiary Care Hospital

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ABSTRACT

Surgical miscarriages are a common obstetric issue with potential long-term effects on subsequent pregnancies. **Objective:** To evaluate the association between previous surgical miscarriages and the risk of preterm birth in later pregnancies. **Methods:** This descriptive cross-sectional study was conducted at the Department of Obstetrics & Gynaecology, Mekran Medical College (MMC), Turbat, from November 2023 to April 2024. Data collected included age at second pregnancy, BMI, socioeconomic status, smoking status, and medical conditions such as hypertension and diabetes. Collected data were processed and analyzed using IBM SPSS, version 27.0. **Results:** The study included 230 patients with a history of miscarriage. Participants with ≥ 3 previous miscarriages had significantly higher odds of all-cause preterm birth (OR = 8.19, p = 0.050), spontaneous preterm birth (OR = 6.38, p = 0.005), and induced preterm birth (OR = 4.64, p < 0.001) compared to those with 1 previous miscarriage. After adjustment, those with ≥ 3 previous miscarriages had higher odds of all-cause (OR = 4.92, p < 0.001) and spontaneous preterm birth (OR = 5.79, p = 0.005), but not induced preterm birth (OR = 5.63, p = 0.050). **Conclusions:** Our study results revealed a significant association between a history of previous surgical miscarriages and the probability of preterm births in subsequent pregnancies. These findings underscore the need for clinical monitoring and interventions for women with a history of surgical miscarriages.

INTRODUCTION

Abortion is a common and emotionally distressing event that affects various females in the global society as it refers to the spontaneous pregnancy failure before the foetus is capable of standing on its own without the additional support offered by the womb. Surgical miscarriage, particularly accomplished through procedures including dilatation and curettage (D and C), is employed to remove foetal tissue from the uterus once miscarriage has occurred [1, 2]. Surgeries are sometimes necessary for various clinical reasons, but their impact on future pregnancies has raised concern and controversy. The association between prior surgical miscarriage and the risk of later preterm birth remains a significant area of focus for concern and research among clinicians [3]. Preterm birth, defined as delivery before 37 weeks of pregnancy, is associated with significant infant morbidity, mortality, and long-term health complications. It also puts lots of pressure on families and health organizations making it a big financial burden [4]. It is understood that preterm birth has polyetiologic factor with a genetic and environmental as well as medical aspect. Out of these factors, the past history of obstetric events, namely miscarriages, and the

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ways that have been used to treat them, have been deemed the most important predictors for timing of birth in any subsequent pregnancy [5]. The idea of the usage of prior surgical miscarriage as an influential factor in increasing the risk factor for preterm delivery is anchored on several biology and mechanics of a pregnant woman's body. Hysterectomy can lead to surgery complications, for example, Dilation and Curettage (D and C) may cause injury to the endometrium and cervical tissue [6]. This traumatic event can sometimes make the cervical structure weak, which translates to mean that the lady is at high risk of having preterm labour. However, it may lead to other complications such as the creation of intrauterine adhesions typically termed Asherman's syndrome. These can result in various complications such as placenta abruption that undermines the ability of the organ to stick to the lining of the uterus hence leading to premature delivery. The obvious risks associated with such complications may vary depending on how often surgeries are performed, the skills of the surgeon, and the body's ability to handle the presence of the injured uterus [7, 8]. An underlying mechanism that could elucidate the correlation between prior miscarriage and the likelihood of preterm birth is the probable debilitation of the cervix due to surgical interventions performed during miscarriage care. This mechanism has been hypothesised to elucidate the correlation between prior therapeutic pregnancy termination and heightened susceptibility to premature birth. Notably, there have been modifications in the techniques utilised for therapeutic pregnancy termination during the past 30-40 years. These changes have coincided with a decrease in the relationship between previous pregnancy termination and the likelihood of giving birth prematurely [9, 10].

In order to develop evidence-based procedures for future professionals and offer the best recommendations when addressing patients, it is crucial to form a clear understanding of the possible risks connected with surgical miscarriage. Women who have an abnormality that requires surgical intervention to evacuate the uterus are well informed about the implications of such an occurrence on future pregnancies. Possessing this information also enable people to exercise their rights by deciding on ways to regulate their fertility in case they are willing to. Furthermore, the group of women who might be in high risk of delivering preterm after surgical miscarriage might help with close follow up and monitoring in the subsequent pregnancies to eliminate adverse outcomes.

METHODS

This descriptive cross-sectional study was conducted at Department of Obstetrics and Gynaecology Mekran Medical College (MMC), Turbat from November 2023 to April 2024. The study was approved by the Institutional Review Board (MMC/ERC/107/2023) of the hospital and informed consent was obtained from all participants. The sample size for this study was calculated using the WHO calculator (available at www.openepi.com, version 3). A total of 230 patients were determined to be necessary based on a 95% confidence level, a 5% margin of error, and an assumed miscarriage rate of 54.3% in females [11]. The study used a convenience sampling technique. Demographic data involved the age at the time of the second pregnancy, BMI, smoking status, and medical issues including hypertension, and diabetes. The obsteric history included the number and type of prior miscarriages, whether surgical or medical; the gestational age when miscarriages occurred; number of full-term pregnancies; and the number of preterm births. The present pregnancy issues include number of pregnancies/ gestational weeks at delivery, mode of delivery; whether vaginal or caesarean section, presence of pregnancy complications like gestational diabetes, preeclampsia, neonatal result in terms of birth weight and Apgar scores. The main variable was a previous history of surgical miscarriage which was self-reported at the first antenatal visit and defined as the spontaneous loss of a non-registerable foetus (defined as <28 weeks and <24 weeks thereafter). Preterm birth which was classified as delivery before 37 completed weeks of pregnancy. The questionnaire used for data collection was developed based on a comprehensive review of the literature and validated through expert review to ensure clarity and reliability. Bias was controlled through exclusion criteria. The collected data were processed and analyzed using IBM SPSS, version 27.0. Descriptive statistics were computed, presenting means and standard deviations for continuous variables such as age and height, and frequencies and percentages for categorical variables including smoking status, alcohol status, marital status, socio-economic deprivation (insufficient financial and material resources), therapeutic pregnancy termination history, and preterm birth outcomes. Unadjusted odds ratios assessed the association between previous miscarriages and the likelihood of preterm delivery. The significance level was set at $p < 0.05$.

RESULTS

A total of 230 patients with a previous history of miscarriage were included in the study. Table 1 presented the descriptive characteristics and outcomes of the study participants. The majority of participants (n=181, 78.7%) belonged to the age group of 20-29 years, followed by 30-39 years (n=46, 20%). The mean age of the participants was 26.83 ± 5.16 years, with a mean height of 162.08 ± 7.09 cm. Most participants were non-smokers (n=132, 57.4%), non-alcoholic (n=217, 94.3%), and married (n=201, 87.4%). The

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socio-economic deprivation status varied among the participants, with the majority falling into categories 4 (n=57, 24.8%) and 5 (n=36, 15.7%). Additionally, 36 (15.7%) participants had a history of therapeutic pregnancy termination. Regarding preterm birth outcomes, 34 (14.8%) participants experienced preterm birth, 22 (9.6%) had spontaneous preterm birth, and 12 (5.2%) had induced preterm birth.

Table 1: Descriptive Characteristics and Outcomes of Study Participants

Variables	N (%) / Mean ± SD
Age Groups (Years)	
20-29	181 (78.7%)
30-39	46 (20.05)
More than 40	3 (1.3%)
Age (Years)	26.83 ± 5.16
Height (cm)	162.08 ± 7.09
Smoking Status	
Smoker	73 (31.7%)
Non-Smoker	132 (57.4%)
Ex-Smoker	25 (10.9%)
Alcohol Status	
Alcoholic	13 (5.7%)
Non-Alcoholic	217 (94.3%)
Marital Status	
Married	201 (87.4%)
Divorced	29 (12.6%)
Socio-Economic Deprivation Status	
Least Deprived, 1	14 (6.1%)
2	31 (13.5%)
3	46 (20.0%)
4	57 (24.8%)
5	36 (15.7%)
6	26 (11.3%)
Most Deprived, 7	20 (8.7%)
Therapeutic Pregnancy Termination	
History of Therapeutic Termination	36 (15.7%)
None	194 (84.3%)
Preterm Birth (PTB) Outcomes	
All-Cause PTB	34 (14.8%)
Spontaneous PTB	22 (9.6%)
Induced PTB	12 (5.2%)

The maternal characteristics and outcomes were tabulated by number of previous miscarriages Participants were categorized based on the number of previous miscarriages (1, 2, or ≥ 3). Significant differences were observed in the mean age of participants across the three categories (p = 0.003), with those in the ≥ 3 miscarriages group having a higher mean age (33.66 years). No significant differences were found in height, smoking status, alcohol status, marital status, or socio-economic deprivation status across the three categories (p > 0.05). However, a significant association was observed between the number of previous miscarriages and the history of therapeutic pregnancy termination (p = 0.001) and preterm birth outcomes (all-cause PTB, p < 0.001; spontaneous PTB, p = 0.011; induced PTB, p = 0.038)(Table 2).

Table 2: Descriptive Characteristics and Outcomes In Relation To Number of Previous Miscarriages

Variables	Number of Previous Miscarriages			p-Value
	1	2	≥ 3	
	N (%) / Mean ± SD	N (%) / Mean ± SD	N (%) / Mean ± SD	
Number of Patients	189 (82.2%)	30 (13.0%)	11 (4.8%)	-
Age (Years)	26.24 ± 4.43	28.17 ± 7.00	33.66 ± 6.28	0.003
Height (cm)	162.19 ± 7.10	161.23 ± 7.44	162.45 ± 6.23	0.778
Smoking Status				
Smoker	59 (31.2%)	10 (33.3%)	4 (36.4%)	0.988
Non-Smoker	109 (57.7%)	17 (56.7%)	6 (54.5%)	
Ex-Smoker	21 (11.1%)	3 (10.0%)	1 (9.1%)	
Alcohol Status				
Alcoholic	10 (5.3%)	2 (6.7%)	1 (9.1%)	0.568
Non-Alcoholic	179 (94.7%)	28 (93.3%)	10 (90.9%)	
Marital Status				
Married	169 (89.4%)	24 (0.0%)	(72.7%)	0.216
Divorced	20 (10.6%)	6 (20.0%)	(27.3%)	
Socio-Economic Deprivation Status				
Least Deprived, 1	10 (5.3%)	1 (3.3%)	3 (27.3%)	0.791
2	26 (13.8%)	4 (13.3%)	1 (9.1%)	
3	38 (20.1%)	6 (20.0%)	2 (18.2%)	
4	47 (24.9%)	7 (23.3%)	3 (27.3%)	
5	29 (15.3%)	5 (16.7%)	2 (18.2%)	
6	22 (11.6%)	4 (13.3%)	0 (0.0%)	
Most Deprived, 7	17 (9.0%)	3 (10.0%)	0 (0.0%)	
Therapeutic Pregnancy Termination				
History of Therapeutic Termination	23 (12.2%)	12 (40.0%)	1 (9.1%)	0.001
None	166 (87.8%)	18 (60.0%)	10 (90.9%)	
Preterm Birth (PTB) Outcomes				
All-Cause PTB	21 (11.1%)	7 (23.3%)	6 (54.5%)	<0.001
Spontaneous PTB	14 (7.4%)	4 (13.35)	4 (36.4%)	0.011
Induced PTB	7 (3.7%)	3 (10.0%)	2 (18.2%)	0.038

Table 3 presented the unadjusted Odds Ratios (ORs) for the association between previous miscarriages and the risk of preterm birth outcomes. Participants with ≥ 3 previous miscarriages had significantly higher odds of experiencing all-cause preterm birth (OR = 8.19, p = 0.050), spontaneous preterm birth (OR = 6.38, p = 0.005) and induced preterm birth (OR = 4.64, p < 0.001) compared to those with 1 previous miscarriage.

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Table 3: Unadjusted Odds Ratios Were Calculated To Assess the Association between Previous Miscarriages and the Likelihood of Experiencing Preterm Delivery

Outcome	Unadjusted Odd Ratio (95% CI)			p-Value
	Number of Previous Miscarriages			
	1	2	≥ 3	
All-Cause PTB	0.27 (0.12-0.60)	1.95 (0.76-4.98)	8.19 (2.34-28.61)	0.050
Spontaneous PTB	0.33 (0.13-0.85)	1.56 (0.49-4.96)	6.38 (1.70-23.88)	0.005
Induced PTB	0.28 (0.08-0.92)	2.36 (0.60-9.26)	4.64 (0.8824.39)	<0.001

The associations persisted after controlling for potential confounding factors, including maternal age, maternal height, smoking Status, alcohol status, marital status, deprivation status and history of pregnancy termination. After adjustment, participants with ≥ 3 previous miscarriages remained at significantly higher odds of experiencing all-cause preterm birth (OR = 4.92, p < 0.001) and spontaneous preterm birth (OR = 5.79, p = 0.005), but not induced preterm birth (OR = 5.63, p = 0.050), compared to those with 1 previous miscarriage (Table 4).

Table 4: Adjusted Odd Ratios for Past Miscarriages and All-Cause and Subtype Preterm Birth Risk

Outcome	Adjusted odd ratio (95% CI) *			p-Value
	Number of Previous Miscarriages			
	1	2	≥ 3	
All-Cause PTB	0.16 (0.04-0.60)	5.01 (1.04-24.05)	4.92 (0.77-31.31)	<0.001
Spontaneous PTB	0.19 (0.05-0.72)	6.24 (1.01-38.64)	5.79 (0.75-44.79)	0.005
Induced PTB	0.18 (0.02-1.58)	3.07 (0.39-24.43)	5.63 (0.10-29.33)	0.050

*Adjusted for maternal age, maternal height, smoking Status, alcohol status, marital status, deprivation status and history of pregnancy termination.

DISCUSSION

Miscarriage, the loss of pregnancy before viability, often necessitates surgical intervention such as Dilation and Curettage (D and C) or Dilation and Evacuation (D and E), especially for complications in the second trimester. Although these procedures are generally safe and effective, concerns exist about their impact on future pregnancies, with increased risks of preterm delivery and higher neonatal morbidity and mortality rates reported [12, 13]. The mean age of the patients was 26. 83 ± 5. 16 years. Mitrogiannis I *et al.*, Mitrogiannis I *et al.*, reported an umbrella review of meta-analyses identifying risk factors for preterm birth, highlighting multiple observational study findings. [14]. In our study, 78.7% of participants were aged 20-29 years, with approximately 17% having a history of previous miscarriages. We observed a statistically significant positive association between previous miscarriages and preterm birth (p < 0.001). Conversely, Iqbal Z *et al.*, in 2021 found a mean age of 31.08 ± 5.10 years among women and reported that a history of miscarriage was significantly associated with an increased risk of subsequent miscarriages (AOR = 2.91; p = 0.003) [15]. Our study's findings align with Brown JS *et al.*, in 2008, which also identified a significant association between previous miscarriages and preterm birth (p < 0.001), they noted that each subsequent abortion increased the risk of low birth weight and preterm birth, with odds ratios ranging from 2.93 to 3.67 [16]. Parker W *et al.*, reported a revised Markov model assessing the benefits of oophorectomy during hysterectomy for benign conditions, particularly revisiting the age threshold of 65 years [17]. According to our research conclusions, level of three or more previous miscarriages increased all-cause preterm birth: OR 4.92 (95% CI, p < 0. 001, and spontaneous preterm birth: OR 5.79 (95% CI), p = 0. 005 as compared to the level of one previous miscarriage. Rush SK and Rose SL addressed considerations for patients aged 65 years and older. [18]. Another study examined the long-term reproductive outcomes in women who had experienced multiple miscarriages and reported a significantly higher risk of preterm birth in subsequent pregnancies. Their study found that women with a history of multiple miscarriages had an increased odds ratio for preterm delivery, similar to our finding that multiple previous miscarriages are associated with a higher risk of preterm birth. Wen T *et al.*, analyzed trends and outcomes related to deliveries with hypertensive disorders of pregnancy from 2000 to 2018, while Gascoigne EL *et al.*, investigated accelerated epigenetic clock aging in maternal peripheral blood and its association with preterm birth. [19, 20]. This study is limited by its single-center design, which may not be generalizable to broader populations. The cross-sectional nature of the study restricts causal inferences and temporal relationships between surgical miscarriage and preterm birth. Lastly, the study does not account for variations in surgical procedures or healthcare access, which might affect the generalizability of the results.

CONCLUSIONS

Our study results revealed a significant association between a history of previous surgical miscarriages and the probability of preterm births in subsequent pregnancies. Therefore, women with surgical miscarriages should be closely monitored and have management plans developed to reduce risks in future pregnancies.

Authors Contribution

Conceptualization: YG
Methodology: AY, RA, RB, BS
Formal analysis: SK
Writing, review and editing: RB, SK, BS

All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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