RESEARCH PAPER

Maternal and Neonatal Outcomes in Pregnancies Complicated by Uterine Fibroids: A Retrospective Longitudinal Observational Cohort Study.

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ABSTRACT

Background: Uterine fibroids are among the most common benign tumors affecting women of reproductive age, with potential implications for pregnancy outcomes. While some studies suggest that fibroids may contribute to obstetric complications, there is a need for further evidence regarding their specific impact on maternal and neonatal health. This study aimed to evaluate pregnancy-related complications, mode of delivery, and neonatal outcomes in women with fibroid-complicated pregnancies compared to those with normal pregnancies.

Methods: This retrospective longitudinal observational cohort study was conducted at the Department of Obstetrics and Gynecology, Saveetha Medical College and Hospital, utilizing electronic health records. The study population consisted of pregnant women who delivered at the institution over a defined period. Participants were classified into two groups: those with documented uterine fibroids confirmed by obstetric ultrasound and those with no evidence of fibroids during pregnancy. The study included a total of 348 women, with 174 in each group, based on a predetermined sample size calculation considering preterm birth as the primary outcome measure.

Maternal characteristics, including age and body mass index, were analyzed along with obstetric and neonatal outcomes such as hypertensive disorders of pregnancy, mode of delivery, neonatal birth weight, and neonatal intensive care unit admissions. Statistical analysis included repeated measures analysis of variance (RM-ANOVA) to assess longitudinal changes in maternal and neonatal parameters. Mauchly's test of sphericity was applied to evaluate variance assumptions, and where violations occurred, the Greenhouse-Geisser correction was used. Post-hoc pairwise comparisons were conducted using Tukey's Honestly Significant Difference (HSD) test to determine significant differences between groups. Subgroup analyses were performed using Generalized Estimating Equations (GEE) to evaluate the influence of body mass index and baseline insulin resistance on maternal and neonatal outcomes.

Results: The findings revealed that maternal age and body mass index were comparable between the two groups, with no statistically significant differences. However, pregnancies complicated by fibroids were associated with a significantly higher incidence of preterm birth, affecting 20.0% of cases compared to 6.3% in the normal pregnancy group. Neonatal birth weight was lower in fibroid-complicated pregnancies, with an average birth weight of 2981.35 ± 520.32 grams compared to 3236.51 ± 458.93 grams in the normal pregnancy group.

Cesarean section was the predominant mode of delivery among women with fibroids, with 64.9% of them undergoing surgical delivery compared to 25.3% in the normal pregnancy group. The study also observed a higher prevalence of hypertensive disorders in the fibroid-complicated pregnancy group, with 16.7% of women affected compared to 10.9% in the normal pregnancy group. Neonatal intensive care unit admissions were more frequent in pregnancies complicated by fibroids, occurring in 10.0% of cases compared to 6.3% in normal pregnancies.

Hospital stay duration was significantly longer in fibroid-complicated pregnancies, with an average stay of 5.08 ± 1.10 days compared to 3.52 ± 0.82 days in the normal pregnancy group. The need for maternal intensive care unit admission was also notably higher in the fibroid group, affecting 5.3% of cases compared to 1.1% in normal pregnancies. In contrast, postpartum hemorrhage rates did not differ significantly between the two groups, suggesting that fibroids may not substantially increase the risk of excessive postpartum bleeding.

Conclusion: The presence of fibroids during pregnancy was associated with an increased risk of adverse obstetric and neonatal outcomes, including higher rates of preterm birth, hypertensive disorders, and cesarean deliveries. Women with fibroid-complicated pregnancies also required longer hospital stays and were more likely to need intensive care, indicating a higher burden of maternal morbidity. These findings underscore the need for close antenatal monitoring and individualized obstetric management for women with fibroids to optimize maternal and neonatal outcomes. Further prospective studies are warranted to explore the underlying mechanisms and develop targeted interventions for this high-risk population.

Keywords: Uterine fibroids, Pregnancy complications, Neonatal outcomes, Retrospective cohort study, Maternal health.

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INTRODUCTION

Uterine fibroids, or leiomyomas, are benign smooth muscle tumors of the uterus and are among the most common

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gynecological conditions affecting women of reproductive age. While often asymptomatic, fibroids during pregnancy have been associated with a range of complications that may adversely affect both maternal and fetal outcomes. Their presence can lead to altered uterine contractility, compromised placental function, and mechanical obstruction during labor, all of which contribute to an increased risk of obstetric complications such as preterm birth, hypertensive disorders, and cesarean delivery (1,2). The prevalence of uterine fibroids among pregnant women in India varies widely across studies, largely due to differences in study design, diagnostic criteria, and population characteristics. Reported prevalence rates range from **0.1% to 12.5%**, while another study has documented an incidence rate of **0.5%** among pregnant women (3,4). These figures underscore the significance of fibroids as a potential contributor to maternal and neonatal morbidity. However, the precise extent to which fibroids complicate pregnancy remains a subject of ongoing research, particularly in diverse populations.

Existing evidence suggests that fibroids may influence pregnancy outcomes through several mechanisms. They have been linked to an increased risk of hypertensive disorders of pregnancy, possibly due to their rapid growth in early gestation and their impact on uterine blood flow (1,5). Preterm birth has also been associated with fibroid-complicated pregnancies, likely as a result of uterine overdistension, placental abnormalities, or inflammation within the uterine environment (5,6). Additionally, women with fibroids are more likely to undergo cesarean delivery, which may be attributed to factors such as malpresentation, obstructed labor, or fetal distress (2,5). Regarding neonatal outcomes, fibroids have been linked to low birth weight and increased rates of NICU admission, although the severity of these outcomes may vary depending on the size, number, and location of the fibroids (7).

Despite these associations, the precise influence of fibroids on pregnancy remains inconsistent across studies. Some research suggests a clear increase in adverse obstetric outcomes, while others highlight that these risks may be influenced by multiple factors, including maternal demographics and fibroid characteristics. Given these variations, further research is needed to refine clinical management strategies and to establish standardized guidelines for the care of pregnant women with fibroids.

Objectives

The wide range of reported prevalence and incidence rates underscores the need for standardized diagnostic criteria and comprehensive population-based studies to accurately quantify the burden of fibroids in pregnancy. This study aims to address this gap by evaluating the impact of uterine fibroids on maternal and neonatal outcomes through a comparative analysis of fibroid-complicated pregnancies and normal pregnancies.

Specifically, this study seeks to:

Assess differences in maternal characteristics, including age and body mass index, and evaluate the association of fibroids with pregnancy complications such as hypertensive disorders, mode of delivery, and postpartum hemorrhage.

Examine neonatal outcomes, with a focus on birth weight and NICU admission rates, to determine whether fibroids contribute to increased perinatal risks.

Hypothesis

It is hypothesized that pregnancies complicated by uterine fibroids will have a higher incidence of adverse maternal and neonatal outcomes compared to normal pregnancies. This includes an increased likelihood of cesarean delivery, preterm birth, hypertensive disorders, and low birth weight, reflecting the potential impact of fibroids on pregnancy progression and neonatal well-being.

Significance of the Study

Understanding the effects of fibroids on pregnancy is crucial for optimizing antenatal care and delivery planning. The findings from this study aim to provide critical insights into the obstetric risks posed by fibroids, thereby contributing to improved risk stratification, prenatal surveillance, and delivery management. By offering evidence-based data on the maternal and neonatal complications associated with fibroid-complicated pregnancies, this study will help refine clinical decision-making strategies and guide future research on effective management protocols for pregnant women diagnosed with fibroids.

Materials and Methods

Study Design and Setting

This study was designed as a retrospective longitudinal observational cohort study conducted in the Department of Obstetrics and Gynecology at Saveetha Medical College and Hospital using electronic health records (EHR). As per IEC norms such studies don't require ethics approval since no real interaction with participant is required. The study aimed to evaluate maternal and neonatal outcomes in pregnancies complicated by fibroids compared to normal pregnancies.

Study Population and Eligibility Criteria

The study population consisted of pregnant women who delivered at Saveetha Medical College and Hospital over a defined period. Participants were classified into two cohorts:

Normal Pregnancy Group – Women with no documented fibroids during pregnancy.

Fibroid-Complicated Pregnancy Group – Women diagnosed with uterine fibroids during pregnancy, confirmed via ultrasound or clinical assessment.

Inclusion Criteria:

Singleton pregnancies.

Women with complete medical records, including maternal age, BMI, delivery details, and neonatal outcomes.

Fibroid presence confirmed through obstetric ultrasound in the fibroid-complicated group.

Exclusion Criteria:

Multiple gestations.

Pregnancies with major fetal anomalies.

Women with pre-existing chronic conditions affecting pregnancy outcomes (e.g., pre-existing hypertension, diabetes mellitus).
Incomplete or missing medical records.

Sample Size Calculation

The sample size was determined based on preterm birth rates, a primary outcome of interest. According to existing literature, the assumed preterm birth rate was 8% in normal pregnancies and 18% in fibroid-complicated pregnancies. Using a 5% significance level ($\alpha = 0.05$) and 80% power ($1-\beta = 0.80$), the required sample size was calculated as 174 per group (total: 348 women) to detect a statistically significant difference in preterm birth rates between the groups.

Data Collection

Data were extracted from hospital records, including:
Maternal Demographics: Age, BMI.
Pregnancy Complications: Gestational hypertension, preeclampsia, eclampsia.
Delivery Details: Mode of delivery (vaginal vs. cesarean section).
Neonatal Outcomes: Birth weight, NICU admission.
Maternal Outcomes: Postpartum hemorrhage (PPH), hospital stay duration, maternal intensive care unit (MICU) admission.
All data were anonymized before analysis to maintain patient confidentiality.

Outcome Measures

The primary outcome measure was preterm birth (<37 weeks of gestation). Secondary outcome measures included hypertensive disorders of pregnancy, mode of delivery, postpartum hemorrhage, neonatal birth weight, NICU admissions, hospital stay duration, and MICU admission rates.

Statistical Analysis

Descriptive statistics were used to summarize baseline characteristics. Continuous variables (e.g., maternal age, BMI, birth weight, hospital stay duration) were reported as mean ± standard deviation (SD) and compared using Student's t-test. Categorical variables (e.g., mode of delivery, hypertensive disorders, NICU/MICU admissions) were presented as frequencies (%) and compared using the chi-square test or Fisher's exact test, where appropriate.

Longitudinal Data Analysis

Repeated Measures Analysis of Variance (RM-ANOVA):
Used to assess longitudinal changes over time in **maternal and neonatal outcomes** (e.g., hospital stay, hypertensive disorders, NICU/MICU admissions).
Mauchly's Test of Sphericity was applied to evaluate variance assumptions. If the assumptions were violated, the **Greenhouse-Geisser correction** was applied.
Post-hoc pairwise comparisons were conducted using **Tukey's Honestly Significant Difference (HSD) test** to determine significant changes between time points.
Subgroup Analysis Using Generalized Estimating Equations (GEE):
GEE models were used to evaluate the impact of **BMI and baseline insulin resistance** on maternal and neonatal outcomes.
This allowed for the assessment of treatment response and its variation across different BMI groups.
A p-value < 0.05 was considered statistically significant.

Results

The baseline characteristics and maternal outcomes of the study population, stratified by pregnancy type, are summarized in Table 1. The mean maternal age was comparable between groups, with 28.97 ± 5.69 years in the normal pregnancy group and 29.78 ± 5.74 years in the fibroid-complicated pregnancy group ($p = 0.186$). Similarly, the mean BMI did not significantly differ between the two groups (24.05 ± 3.43 vs. 23.91 ± 3.51, $p = 0.717$), indicating that maternal age and BMI are not distinguishing factors between normal and fibroid-complicated pregnancies (Figure 1, Figure 2).

Table 1: Baseline Maternal Characteristics and Neonatal Outcomes in Normal and Fibroid-Complicated Pregnancies

Parameters	Normal Pregnancy	Fibroid Complicated Pregnancy	p-value
Maternal Age	28.97 (5.69)	29.78 (5.74)	0.186
BMI	24.05 (3.43)	23.91 (3.51)	0.717
Birth Weight (g)	3236.51 (458.93)	2981.35 (520.32)	<0.001
Hospital Stay (days)	3.52 (0.82)	5.08 (1.10)	<0.001

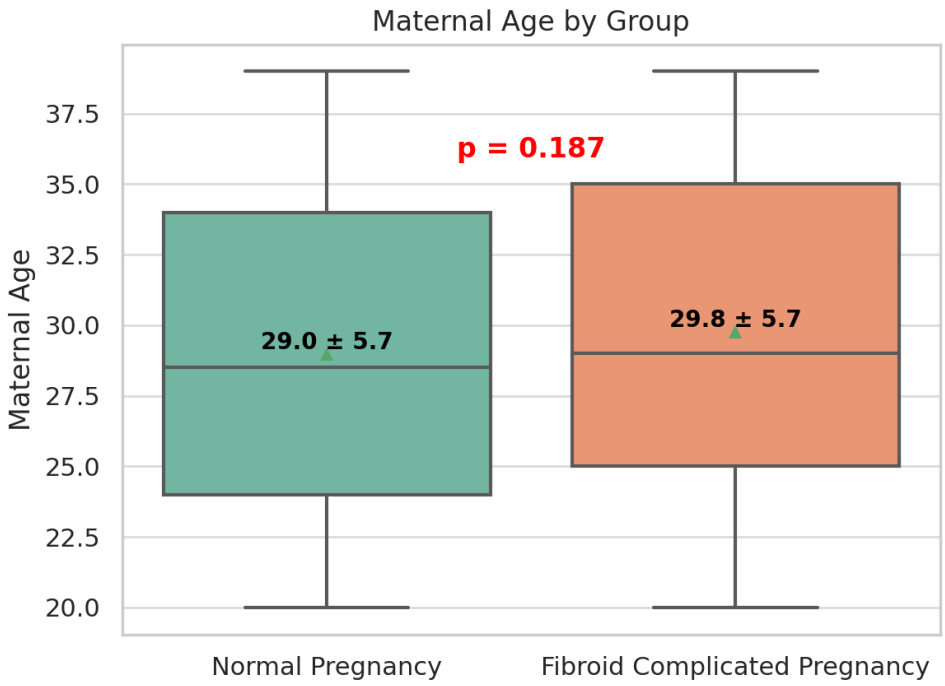

Figure 1

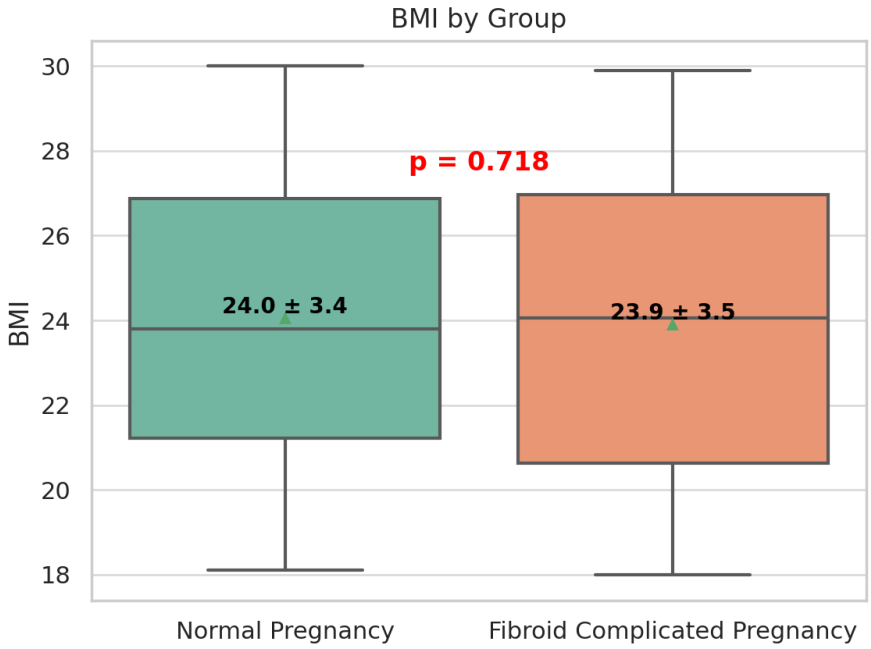

Figure 2

A significant difference was observed in neonatal birth weight between the groups (Figure 3). Infants born to mothers with fibroid-complicated pregnancies had a significantly lower mean birth weight (2981.35 ± 520.32 g) compared to those in the normal pregnancy group (3236.51 ± 458.93 g, $p < 0.001$). This suggests that fibroids during pregnancy may adversely impact fetal growth.

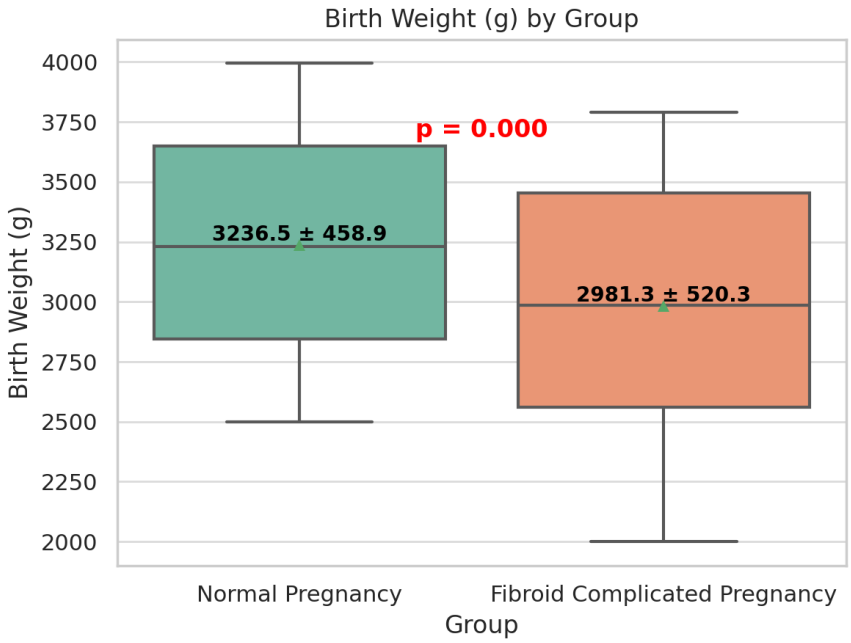

Figure 3

Additionally, NICU admissions were more frequent in pregnancies complicated by fibroids (10.0% vs. 6.3%, p = 0.028), highlighting an increased risk of neonatal complications in this group (Figure 4).

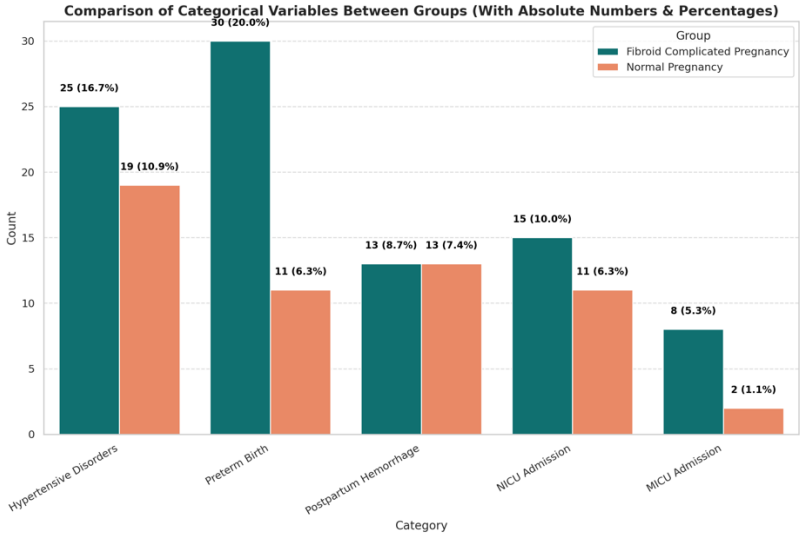

Figure 4

The mean hospital stay duration was significantly longer in the fibroid-complicated pregnancy group (5.08 ± 1.10 days) compared to the normal pregnancy group (3.52 ± 0.82 days, $p < 0.001$) (Figure 5). This suggests that pregnancies complicated by fibroids require extended medical care, likely due to increased obstetric interventions and associated complications.

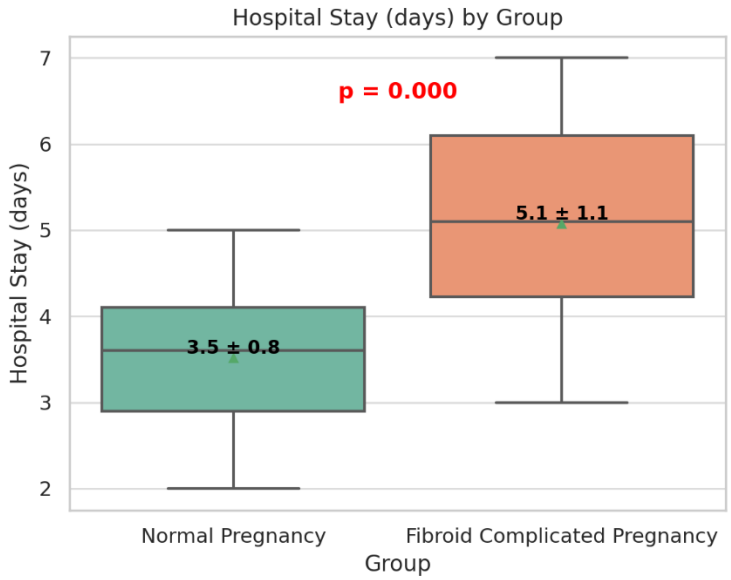

Figure 5

Furthermore, MICU admissions were significantly more common in fibroid-complicated pregnancies (5.3% vs. 1.1%, p = 0.009), indicating a higher risk of severe maternal complications necessitating intensive care (Figure 4).

A significantly higher proportion of women with fibroid-complicated pregnancies underwent cesarean section (C-section) (113 [64.9%] vs. 44 [25.3%], p < 0.001), while vaginal delivery was more common in the normal pregnancy group (130 [74.7%] vs. 61 [35.1%]) (Figure 6). This suggests that fibroid-related obstetric risks, such as malpresentation, obstructed labor, and fetal distress, may contribute to the increased likelihood of C-section in affected pregnancies.

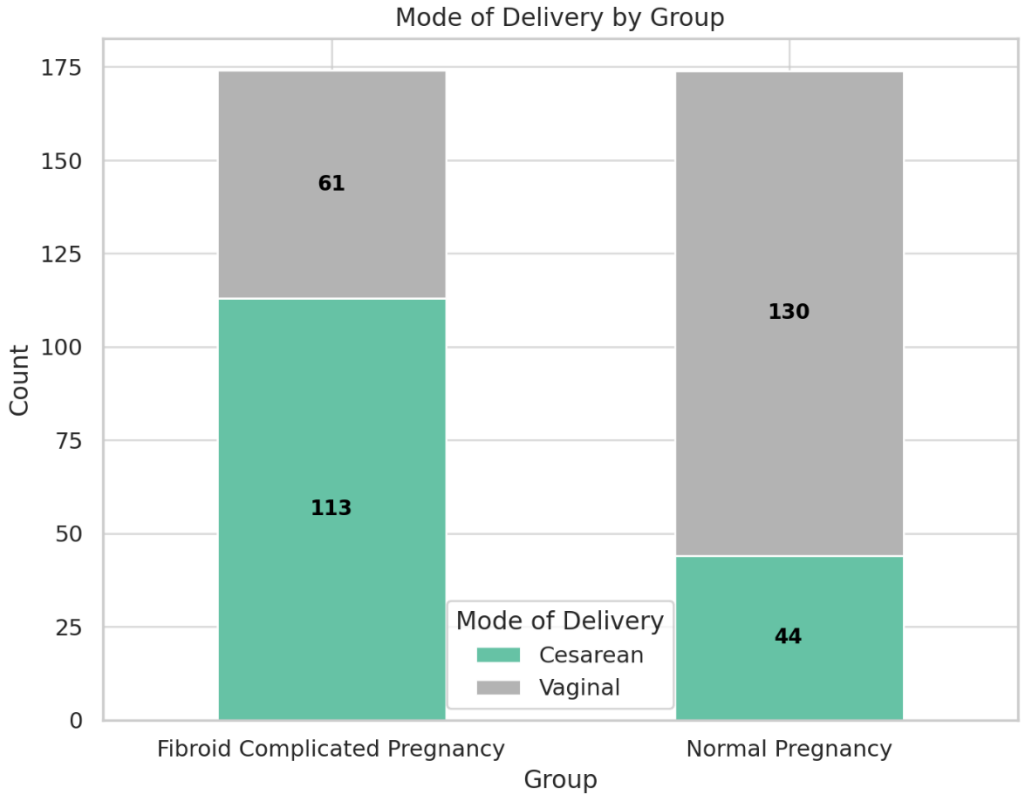

Figure 6

A higher prevalence of hypertensive disorders of pregnancy was noted among fibroid-complicated pregnancies (16.7% vs. 10.9%, p = 0.045), indicating a statistically significant increase in pregnancy-induced hypertension, preeclampsia, or eclampsia in this group (Figure 4). The incidence of preterm birth (<37 weeks) was also significantly greater in pregnancies complicated by fibroids, affecting 20.0% of

cases compared to 6.3% in the normal pregnancy group ($p < 0.001$) (Figure 4). This highlights the increased risk of early delivery and its associated neonatal morbidities in women with fibroid-related pregnancy complications. In contrast, postpartum hemorrhage (PPH) did not show a statistically significant difference between the two groups (8.7% vs. 7.4%, $p = 0.612$), suggesting that fibroids may not substantially impact the risk of excessive postpartum bleeding (Figure 4).

DISCUSSION

This study assessed the impact of uterine fibroids on maternal and neonatal outcomes by comparing pregnancies complicated by fibroids with those in women without fibroid involvement. The findings demonstrated that the presence of fibroids was associated with a higher incidence of adverse obstetric outcomes, including preterm birth, hypertensive disorders, and cesarean delivery. Neonatal complications, such as lower birth weight and increased rates of NICU admissions, were also observed in pregnancies complicated by fibroids.

A significantly higher prevalence of preterm birth was noted among women with fibroid-complicated pregnancies, aligning with prior studies that suggest mechanisms such as uterine overdistension, inflammatory responses, and uteroplacental insufficiency as potential contributing factors (2,8). A meta-analysis further supports this finding, highlighting that fibroid size, particularly those measuring ≥5 cm, significantly increases the risk of preterm birth (8). The likelihood of cesarean delivery was considerably higher in the fibroid group, predominantly due to complications such as malpresentation, fetal distress, and obstructed labor. This finding is consistent with previous research, which has demonstrated that larger fibroids or those located in the lower uterine segment pose a greater risk for cesarean birth (2,9,10).

Increased hypertensive disorders of pregnancy, including gestational hypertension and preeclampsia, were also observed in women with fibroids. These findings are in agreement with studies suggesting that fibroids may disrupt placental function, leading to altered vascular responses and increased maternal blood pressure (8,11).

Regarding neonatal outcomes, neonates born to mothers with fibroids had lower mean birth weights and a higher incidence of NICU admissions. One possible explanation for these findings is the presence of fibroids near the placenta, which may impair nutrient and oxygen exchange, leading to fetal growth restriction However, inconsistencies exist in the literature, with some studies reporting no significant differences in birth weight when fibroids are smaller than 5 cm (12).

While the association between fibroids and postpartum hemorrhage (PPH) remains controversial, this study did not find a significant difference in PPH rates between the two groups. Some studies have suggested that large intramural fibroids contribute to increased blood loss due to uterine atony, but these findings remain variable across different study populations (2).The findings of this study align with previous research highlighting the increased obstetric risks associated with fibroids. A prospective study reported higher rates of preterm labor (26.3%), cesarean delivery (55.3%), and NICU admissions (23.7%) in pregnancies complicated by fibroids (11).

Similarly, a meta-analysis involving 237,509 participants confirmed that fibroids increase the risk of preterm birth, cesarean delivery, breech presentation, and PPH, particularly in women with multiple or larger fibroids (8) . Retrospective analyses have further emphasized the role of fibroid size and location in influencing pregnancy outcomes, with lower uterine segment fibroids being more strongly associated with delivery complications (2,9). However, discrepancies exist regarding PPH rates and neonatal weight outcomes, with some studies reporting conflicting findings. These variations may be attributed to differences in sample sizes, study populations, and institutional management protocols.

The results of this study are likely generalizable to obstetric populations treated in tertiary care settings, where diverse patient demographics and pregnancy complications are routinely managed. However, variations in healthcare access, prenatal care quality, and obstetric management protocols across different regions may influence the applicability of these findings (10). Further research involving multicenter studies with larger population samples would strengthen the external validity of these results.

Future Directions

To address existing knowledge gaps and enhance the understanding of how uterine fibroids influence pregnancy outcomes, future studies should consider the following approaches:

Multicenter Cohort Studies: Conducting large-scale, multicenter studies would improve the generalizability of findings and provide a more comprehensive representation of diverse populations.

Detailed Imaging Assessments: Prospective studies incorporating high-resolution ultrasound and MRI-based imaging could offer precise insights into how fibroid size, number, and location impact pregnancy.

Biochemical and Placental Markers: Investigating placental function biomarkers could provide a deeper understanding of the underlying mechanisms contributing to hypertensive disorders and fetal growth restriction in fibroid-complicated pregnancies.

Long-Term Neonatal Follow-Up: Extending research beyond the immediate postpartum period to evaluate long-term developmental and health outcomes in neonates born to mothers with fibroids would offer crucial insights into potential lifelong implications.

By integrating these strategies, future research can further refine evidence-based management strategies for pregnant women with fibroids, ensuring improved maternal and neonatal health outcomes.

LIMITATIONS

While this study benefits from a well-defined cohort and the use of electronic health records for comprehensive data collection, several limitations must be acknowledged. The retrospective study design poses an inherent risk of selection bias and missing data, which may influence the findings. Although efforts were made to ensure complete medical records, retrospective data collection could lead to underreporting of certain pregnancy complications.

A key limitation is the lack of detailed fibroid characteristics, such as size, number, and location, which are known to affect pregnancy outcomes. Future studies incorporating imaging-based assessments would provide a more precise evaluation of fibroid-related risks.

Confounding factors, including maternal comorbidities, socioeconomic status, and variations in antenatal care, were not fully accounted for, despite statistical adjustments. Future research utilizing propensity score matching or multivariable regression models could help address these confounding effects and enhance the robustness of findings.

Conclusion

This study provides evidence that uterine fibroids are associated with a higher risk of preterm birth, hypertensive disorders, cesarean delivery, and neonatal morbidity, underscoring the importance of early identification and close monitoring of affected pregnancies. Given the increased maternal and neonatal risks, clinicians should consider individualized obstetric management strategies for women with fibroid-complicated pregnancies, including enhanced fetal surveillance, timely intervention for hypertensive disorders, and judicious decision-making regarding the mode of delivery. Further research is warranted to explore fibroid characteristics and their specific contributions to pregnancy complications, as well as to assess the long-term neonatal outcomes associated with fibroid-complicated pregnancies..

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