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Original Research Article

Fetomaternal outcome in gestational diabetes mellitus: a retrospective study

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a common pregnancy complication that can adversely affect both maternal and neonatal outcomes. This study aimed to retrospectively evaluate fetomaternal outcomes in GDM by comparing lower segment caesarean section (LSCS) and normal vaginal delivery groups.
Methods: A retrospective review of medical records from January 2018 to December 2020 was conducted at a tertiary care hospital. Fifty-one patients with GDM were included, with 29 undergoing LSCS and 22 having normal vaginal deliveries. Demographic, maternal, neonatal, lifestyle, and postpartum parameters were extracted and statistically analyzed using t-tests and Chi-square tests, with a significance threshold of $p<0.05$.
Results: No significant differences were observed in maternal age, height, weight, body mass index (BMI), or gestational age at diagnosis between groups. However, birth weight values showed significant variation ($p=0.039$), though data discrepancies were noted. Maternal complications were significantly higher in the LSCS group ($p=0.024$), particularly due to previous caesarean sections and complex comorbidities. Neonatal outcomes also differed, with the LSCS group requiring more specialized care (IDM care, NICU admissions) and showing lower Apgar scores ($p=0.015$). Lifestyle factors and postpartum recovery were comparable between groups.
Conclusions: The study highlighted that while baseline maternal characteristics were similar, significant differences in maternal complications and neonatal outcomes exist between LSCS and vaginal deliveries in GDM pregnancies. These findings underscore the need for individualized management and vigilant monitoring to optimize both maternal and neonatal health.

Keywords: GDM, LSCS, Neonatal outcomes, Maternal complications, Retrospective study

INTRODUCTION

Gestational diabetes mellitus (GDM) represents a significant and growing public health concern worldwide, marked by the onset of glucose intolerance during pregnancy and associated with a myriad of adverse fetomaternal outcomes.[1] Over the past few decades, the prevalence of GDM has increased considerably due to rising trends in obesity, sedentary lifestyles, and advanced maternal age, factors that not only predispose women to the condition but also complicate its management.[2] GDM is characterized by a state of insulin resistance and relative insulin deficiency that emerges during pregnancy, primarily as a consequence of placental hormones such as human placental lactogen, estrogen, and progesterone, which interfere with maternal insulin signalling.[3] This hormonal milieu, coupled with genetic and environmental factors, leads to hyperglycemia that, if uncontrolled, has profound implications for both maternal and neonatal health. For the mother, GDM increases the risk of hypertensive disorders, preeclampsia, and a higher likelihood of requiring caesarean delivery, while also predisposing her to future metabolic disorders such as type 2 diabetes mellitus.[4] Neonates, on the other hand, face the risk of complications including macrosomia, neonatal hypoglycemia, respiratory distress syndrome, and a greater

propensity for obesity and metabolic syndrome later in life.[5]

Screening for GDM typically occurs during the second trimester through standardized tests such as the glucose challenge test (GCT) followed by the oral glucose tolerance test (OGTT) when indicated, allowing for early diagnosis and intervention.[6] Timely management is essential to mitigate the short- and long-term risks associated with the condition. Management strategies primarily focus on dietary modifications and physical activity, with insulin therapy being the mainstay of treatment when lifestyle modifications fail to achieve adequate glycemic control.[7] Recently, the use of oral hypoglycemic agents, particularly metformin, has been explored as an alternative to insulin, although their long-term effects on both mother and neonate remain a subject of ongoing research.[8] The dual challenge of achieving euglycemia while minimizing the risk of adverse outcomes underscores the complexity of managing GDM and highlights the need for robust clinical data to guide therapeutic decisions.

Retrospective studies play a crucial role in this context by analyzing historical patient data to uncover patterns and associations that may not be evident in prospective studies. Such studies enable researchers to evaluate the effectiveness of current management protocols and identify risk factors that may contribute to adverse outcomes. In the context of GDM, retrospective analyses can provide valuable insights into the impact of maternal characteristics—such as age, body mass index (BMI), and gravidity—on delivery outcomes, including the rates of caesarean section versus normal vaginal delivery.[9] For instance, previous research has indicated that women with GDM are more likely to undergo caesarean delivery, a trend that has been attributed to factors such as fetal macrosomia and the presence of obstetric complications like preeclampsia.[10] Moreover, the choice of delivery mode may itself influence postpartum recovery and the incidence of complications such as postpartum hemorrhage or wound infections.

In addition to maternal outcomes, neonatal outcomes warrant significant attention. Infants born to mothers with GDM are at an elevated risk for conditions such as hypoglycemia, which results from the abrupt cessation of the maternal glucose supply after birth, and may require intensive care support immediately postpartum.[11] Other neonatal complications include respiratory distress and an increased likelihood of requiring admission to a neonatal intensive care unit (NICU), both of which can have lasting effects on the infant's long-term health and development.[12] Furthermore, the interplay of maternal lifestyle factors, such as smoking and alcohol consumption, may exacerbate these risks. Although these factors are less frequently studied in the context of GDM, emerging evidence suggests that they could potentially compound the adverse effects on both maternal and neonatal outcomes.[13]

Given the substantial burden of GDM on healthcare systems and its potential to affect the long-term health of both mothers and their offspring, there is a pressing need to thoroughly examine the fetomaternal outcomes associated with this condition. This study seeks to retrospectively analyze these outcomes by comparing maternal and neonatal parameters between women who underwent caesarean delivery and those who delivered vaginally. By exploring variables such as maternal age, BMI, gravidity, associated complications, as well as neonatal factors including birth weight, Apgar scores, and the need for NICU admission, our research aims to elucidate critical determinants of adverse outcomes in GDM pregnancies.[14] The insights derived from this study are expected to not only enhance our understanding of the pathophysiology and clinical manifestations of GDM but also to inform future clinical guidelines and improve the overall management of the condition. Ultimately, a deeper understanding of these associations will contribute to better targeted interventions, reducing the incidence of complications and improving the quality of life for both mothers and their children.[15]

METHODS

Study type

A retrospective study design was employed to review and analyze the medical records of pregnant women diagnosed with GDM.

Study setting

The study was conducted in Sri Devaraj URS Medical College and Research Centre which is a referral center for high-risk obstetric cases. This setting was chosen because it provided a large and diverse patient population with documented cases of GDM. The hospital was well-equipped with an electronic medical records system, which ensured that accurate and comprehensive data were available for analysis. All procedures, including patient management and data documentation, were carried out as part of the hospital's routine clinical practice during the study period.

Study duration

Data for this study were collected retrospectively over a period of three years, from January 2018 to December 2020.

Participants – inclusion and exclusion criteria

Participants were selected based on the following criteria.

Inclusion criteria

Pregnant women who had been diagnosed with GDM based on standard diagnostic criteria, women who had delivered at the study hospital during the defined study

period, and cases with complete medical records including maternal demographic details, mode of delivery, and neonatal outcomes were included.

Exclusion criteria

Women with pre-existing diabetes mellitus prior to pregnancy, patients with incomplete or missing data in critical sections of their medical records, women who had delivered outside the study hospital, and cases with concurrent severe systemic illnesses that could confound the interpretation of fetomaternal outcomes were excluded.

Study sampling

A consecutive sampling method was utilized to select cases from the hospital's database. All patients meeting the inclusion criteria were included in the study until the desired sample size was reached. This method was chosen to minimize selection bias and to ensure that the sample was representative of the general population of women with GDM treated at the facility. The data were extracted from the hospital's electronic records, and each eligible case was reviewed to ensure that it met the predefined criteria.

Study sample size

The study sample size was determined based on the number of cases available in the hospital records during the study period that met the inclusion criteria. A total of 51 patients were identified, comprising 29 cases that resulted in lower segment caesarean section (LSCS) and 22 cases that resulted in normal vaginal delivery. This sample size was considered adequate to perform statistical comparisons between the two groups and to identify significant differences in maternal and neonatal outcomes.

Study groups

The participants were divided into two distinct groups based on the mode of delivery. The first group consisted of patients who underwent LSCS, while the second group comprised those who delivered via normal vaginal delivery. This division allowed for a comparative analysis of fetomaternal outcomes between the two delivery methods. Group allocation was based solely on the mode of delivery as documented in the medical records, and the groups were analyzed separately to identify any statistically significant differences in key clinical parameters.

Study parameters

A wide range of study parameters was identified and analyzed to provide a comprehensive overview of fetomaternal outcomes in GDM. Maternal parameters included age, height, weight, BMI, gravidity, and the presence of complications such as preeclampsia, hypothyroidism, and previous caesarean sections. Neonatal parameters were also assessed and included birth weight, Apgar scores at 1 and 5 minutes, the incidence of neonatal hypoglycemia, and the requirement for neonatal intensive care unit (NICU) admission. In addition, lifestyle factors such as smoking and alcohol use were evaluated to determine their impact on both maternal and neonatal outcomes.

Study procedure

The study procedure involved several key steps. First, the research team obtained permission from the hospital administration to access the electronic medical records. Once permission was granted, a list of patients with a diagnosis of GDM was generated using the hospital's database. Each case was then reviewed individually, and relevant data were extracted using a standardized data extraction form. This form included sections for demographic information, clinical characteristics, mode of delivery, treatment modalities, and both maternal and neonatal outcomes. All data were verified for accuracy by cross-referencing with the original patient files, and any discrepancies were resolved through consultation with the hospital's medical records department.

Study data collection

Data collection was performed by a trained team of researchers who were experienced in medical record abstraction. The team systematically reviewed all relevant sections of the patient records, including admission notes, laboratory results, operative reports, and discharge summaries. Information was recorded on predesigned data sheets and later entered into a secure database for analysis. The data collection process was standardized to minimize errors and ensure consistency across all cases. Each data point was carefully checked to maintain the integrity of the study, and any missing or ambiguous information was addressed by reviewing supplementary documentation when available.

Data analysis

Data analysis was conducted using statistical software that was appropriate for retrospective clinical studies. Descriptive statistics were calculated to summarize the demographic and clinical characteristics of the study population. Continuous variables were presented as means with standard deviations, while categorical variables were expressed as frequencies and percentages. Comparative analyses between the LSCS and normal vaginal delivery groups were performed using independent t-tests for continuous variables and chi-square tests for categorical variables. A p value of less than 0.05 was considered statistically significant. The analysis allowed the research team to identify significant differences in maternal and neonatal outcomes between the two groups, thereby providing insights into the impact of mode of delivery on fetomaternal outcomes in GDM cases.

RESULTS

Demographic profile of the respondents

Interpretation

Maternal age, height, weight, BMI, and gestational age at diagnosis were similar between LSCS and vaginal delivery groups (p>0.05). However, birth weight differed significantly (p=0.039), although the LSCS group's large standard deviation suggested potential unit discrepancies that require further clarification and review (Table 1 and Figure 1).

Maternal factors and mode of delivery

Interpretation

Maternal factors showed comparable gravida distribution (p=0.465) and diagnosis types (p=0.693) between LSCS and vaginal delivery groups. Complications were significantly higher in LSCS patients (p=0.024), with increased occurrences of prior LSCS and preeclampsia. Treatment modalities did not differ significantly (p=0.485), reinforcing consistent management practices. Overall, maternal outcomes influenced delivery decisions (Table 2 and Figure 2).

Neonatal factors and mode of delivery

Interpretation

Neonatal factors showed no significant difference in gender distribution between LSCS and vaginal delivery groups (p=0.313). Birth outcomes differed significantly (p=0.047), with increased IDM care and NICU admissions in the LSCS group. Apgar scores also varied significantly (p=0.015), while hypoglycemia incidence was comparable. Overall, neonatal outcomes required careful clinical monitoring (Table 3 and Figure 3).

Table 1: Demographic profile of the respondents.

Variables	Mode of delivery	N	Mean	Standard deviation	P value
Age	LSCS	29	29.45	4.281	0.064
	Normal vaginal delivery	22	28.86	5.064	
Birth weight	LSCS	29	73.0362	375.60908	0.039
	Normal vaginal delivery	22	2.7968	0.68572	
Height	LSCS	29	150.48	5.194	0.243
	Normal vaginal delivery	22	150.45	4.339	
Weight	LSCS	29	84.17	8.186	0.614
	Normal vaginal delivery	22	86.27	6.401	
BMI	LSCS	29	37.010	3.6430	0.382
	Normal vaginal delivery	22	38.073	2.6671	
Presenting complaint	LSCS	29	37.72	1.066	0.929
	Normal vaginal delivery	22	37.95	1.090	

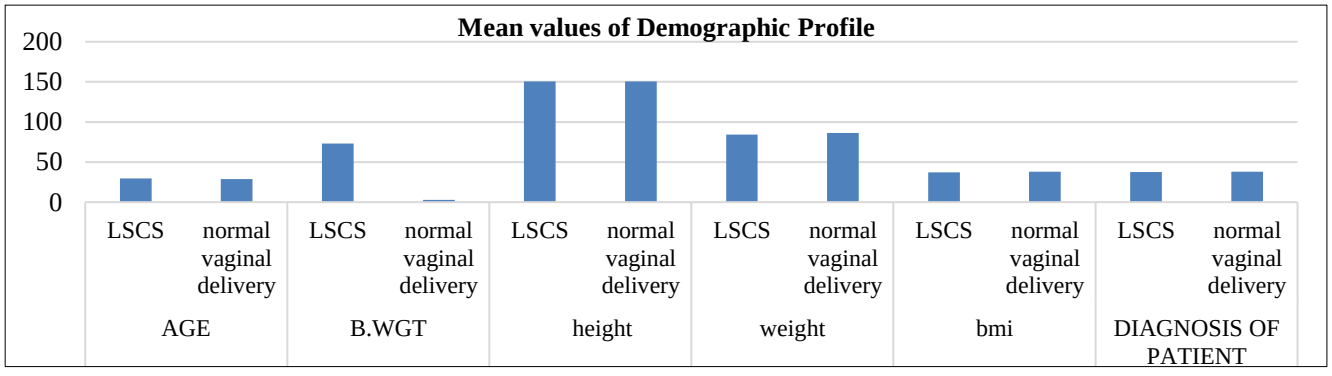

Figure 1: Mean values of demographic profile.

Table 2: Maternal factors and mode of delivery.

Variables	LSCS (n=29)	Normal vaginal delivery (n=22)	Total (n=51)	P value
Gravida				
Multigravida	20	13	33	0.465
Primigravida	9	9	18	
Presenting complaints				0.693

Continued.

Variables	LSCS (n=29)	Normal vaginal delivery (n=22)	Total (n=51)	P value
Latent	21	17	38	
PROM	8	5	13	
Complications				
GDM only	4	5	9	0.024
GDM and preeclampsia	1	3	4	
GDM and previous LSCS	3	0	3	
GDM and hypothyroidism	1	1	2	
GDM and obesity	1	0	1	
GDM, PPROM, hypothyroid	0	1	1	
Other combinations	18	12	30	
Treatment				
Diet with exercise	2	2	4	0.485
DIET	4	7	11	
Insulin	12	6	18	
OHA	10	7	17	

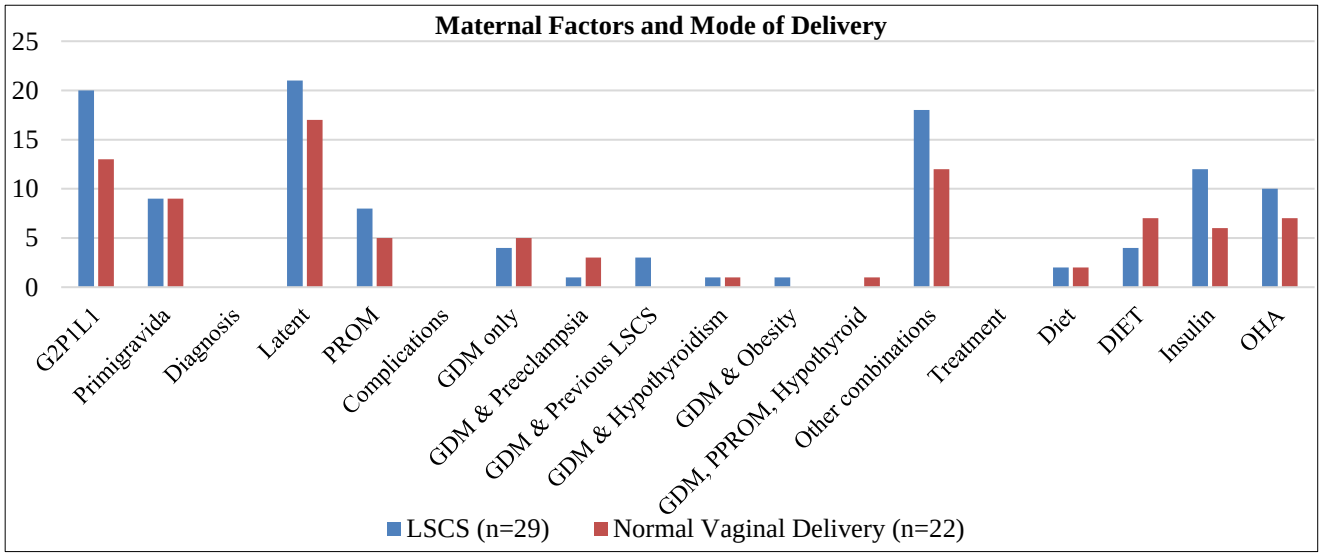

Figure 2: Maternal factors and mode of delivery.

Table 3: Neonatal factors and mode of delivery.

Variables	LSCS (n=29)	Normal vaginal delivery (n=22)	Total (n=51)	P value
Gender				
Male	16	9	25	0.313
Female	13	13	26	
Birth outcomes (baby status)				
IDM care	12	6	18	0.047
Respiratory distress	4	4	8	
NICU i/v/o LBW	5	6	11	
Mother side	5	0	5	
Observation	1	1	2	
Apgar score				
1’6/10, 5’8/10	3	6	9	0.015
1’7/10, 5’8/10	1	0	1	
1’7/10, 5’9/10	25	16	41	
Neonatal hypoglycemia				
Yes	6	4	10	
No	23	18	41	

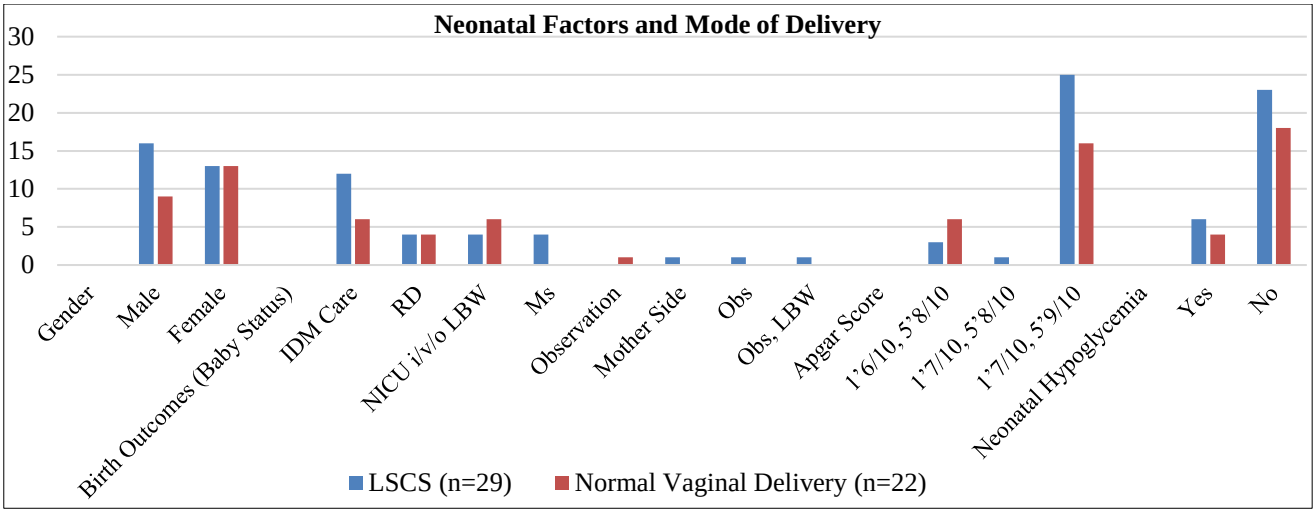

Figure 3: Neonatal factors and mode of delivery.

Lifestyle factors and mode of delivery

Interpretation

Lifestyle factors indicated no significant differences in smoking (p=0.444) or alcohol use (p=0.726) between LSCS and vaginal delivery groups. Most participants did not smoke or consume alcohol, confirming minimal lifestyle impact on delivery mode. Both groups exhibited similar lifestyle profiles without statistical significance. These findings clearly underscored consistent lifestyle behaviors (Figure 4).

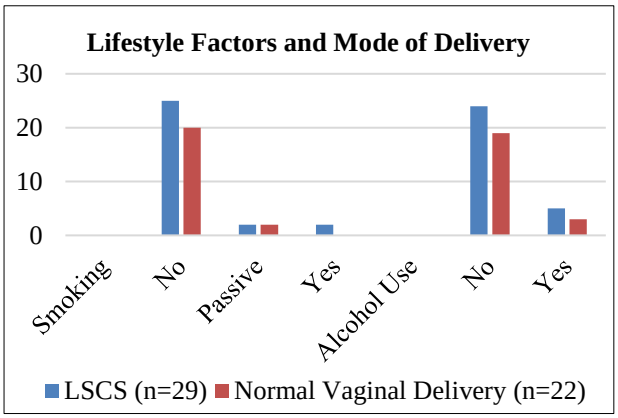

Figure 4: Maternal lifestyle factors and mode of delivery.

Postpartum outcomes and mode of delivery

Interpretation

Postpartum outcomes were similar between LSCS and vaginal delivery groups. Most patients did not experience complications (p=0.807). Minor complications included postpartum hemorrhage and wound gap occurrences, with no significant differences observed. Overall, postpartum recovery was comparable, reflecting consistent management practices across both delivery methods. These results confirmed effective postoperative care (Figure 5).

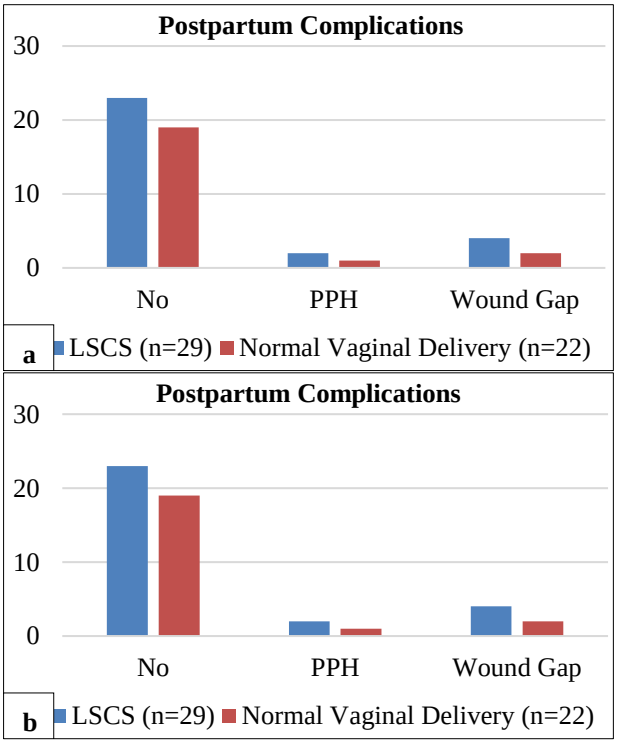

Figure 5 (a and b): Postpartum outcomes and mode of delivery.

DISCUSSION

The present retrospective study evaluated fetomaternal outcomes in women with GDM by comparing those who underwent LSCS with those who delivered via normal vaginal delivery.[16] The demographic profile revealed that the mean age in the LSCS group was 29.45±4.28 years compared to 28.86±5.06 years in the vaginal delivery group (p=0.064), indicating no significant age difference

between the groups. Maternal height (150.48±5.19 cm versus 150.45±4.34 cm, p=0.243), weight (84.17±8.19 kg versus 86.27±6.40 kg, p=0.614), and BMI (37.01±3.64 versus 38.07±2.67, p=0.382) were also similar, suggesting that basic anthropometric characteristics did not significantly differ. However, birth weight showed a significant difference (p=0.039) with the LSCS group having a mean of 73.04 (±375.61) compared to 2.80 (±0.69) in the vaginal delivery group; this large discrepancy in numeric values suggests a potential unit or data entry error, necessitating further investigation to ensure measurement consistency. Gestational age at diagnosis was comparable between LSCS (37.72±1.07 weeks) and vaginal delivery (37.95±1.09 weeks) groups (p=0.929), confirming that both groups were diagnosed at a similar stage of pregnancy.

Maternal factors such as parity were examined next. The distribution of gravida status showed that 20 women in the LSCS group were G2P1L1 compared to 13 in the vaginal delivery group, while primigravida numbers were equal at 9 in each group (p=0.465). This finding implied that parity did not significantly influence the mode of delivery. Additionally, the clinical diagnosis concerning the onset of labor—categorized as latent phase versus premature rupture of membranes (PROM)—was similar between groups (latent: 21 in LSCS versus 17 in vaginal delivery; PROM: 8 versus 5, p=0.693), further reinforcing that labor onset conditions were evenly distributed and likely did not drive the decision for a specific mode of delivery.

The study also revealed significant differences in maternal complications (p=0.024). Specifically, while cases of "GDM only" were 4 in the LSCS group versus 5 in the vaginal group, complications such as GDM with preeclampsia occurred in 1 LSCS patient compared to 3 in the vaginal group. Notably, the LSCS group had 3 cases of GDM with a previous LSCS, with none reported in the vaginal delivery group; similarly, GDM with hypothyroidism and GDM with obesity were observed in 1 case each in the LSCS group, with the latter absent in vaginal deliveries. Additionally, one case of GDM, PPROM, and hypothyroidism was noted in the vaginal delivery group, and "other combinations" of complications were more frequent in LSCS (18 cases) than in vaginal deliveries (12 cases). These findings suggest that the LSCS group bore a higher burden of complex maternal conditions, which may have contributed to the decision to perform a caesarean section. In terms of treatment modalities, no significant differences were observed (p=0.485); dietary management was implemented in 2 cases in both groups, a modified diet regimen (DIET) was used in 4 LSCS cases versus 7 vaginal deliveries, insulin therapy was applied in 12 LSCS cases compared to 6 vaginal deliveries, and oral hypoglycemic agents (OHA) were given to 10 LSCS cases versus 7 vaginal deliveries. These results indicate that treatment approaches for GDM were uniformly applied across both groups.

Neonatal outcomes provided further insights into the impact of delivery mode.[17] Gender distribution did not significantly differ between the two groups (p=0.313), with 16 males and 13 females in the LSCS group compared to 9 males and 13 females in the vaginal delivery group, suggesting that sex distribution was random with respect to delivery method. However, the overall birth outcomes were significantly different (p=0.047). In the LSCS group, 12 neonates required IDM care compared to 6 in the vaginal group, 4 neonates in each group experienced respiratory distress (RD), and NICU admissions were 4 in the LSCS group versus 6 in the vaginal group. Notably, 4 neonates in the LSCS group were classified under the "mother side" category a complication not observed in the vaginal delivery group and minor categories such as observation, mother side, and LBW were recorded with very low frequency. Apgar scores also differed significantly (p=0.015); in the LSCS group, 3 neonates had scores of 1'6/10 and 5'8/10, 1 had scores of 1'7/10 and 5'8/10, and 25 neonates had scores of 1'7/10 and 5'9/10, whereas in the vaginal group, 6 neonates had scores of 1'6/10 and 5'8/10 and 16 had scores of 1'7/10 and 5'9/10. This variation may reflect subtle differences in neonatal adaptation immediately post-delivery. Neonatal hypoglycemia was observed in 6 cases within the LSCS group and 4 cases in the vaginal delivery group, although statistical significance was not reported for this parameter; still, it underlines the importance of early and vigilant neonatal monitoring in pregnancies complicated by GDM.

Lifestyle factors such as smoking and alcohol consumption were evaluated and found not to significantly influence outcomes. Smoking habits were similar across groups (p=0.444), with 25 LSCS patients and 20 vaginal delivery patients reporting no smoking, 2 patients in each group indicating passive exposure, and 2 active smokers reported only in the LSCS group. Alcohol consumption was also comparable (p=0.726), with 24 LSCS patients and 19 vaginal delivery patients reporting no alcohol use, while 5 LSCS and 3 vaginal delivery patients reported alcohol consumption. These results suggest that lifestyle factors did not have a notable impact on the mode of delivery or associated outcomes in this cohort.[18]

Postpartum outcomes were generally favourable and did not differ significantly between the two groups (p = 0.807). The majority of patients in the LSCS group (23 cases) and the vaginal delivery group (19 cases) did not experience any postpartum complications. Minor complications, such as postpartum hemorrhage (PPH), were observed in 2 LSCS cases compared to 1 vaginal delivery case, while wound gap complications occurred in 4 LSCS patients versus 2 in the vaginal group. These findings indicate that despite the higher complexity of some cases in the LSCS group, overall postpartum recovery was comparable between both delivery methods.

In summary, this study provided a comprehensive evaluation of fetomaternal outcomes in GDM by comparing LSCS and vaginal delivery groups. The

demographic characteristics were largely similar between groups except for the notable discrepancy in reported birth weight values, which may indicate data inconsistencies that require further scrutiny. Maternal factors, including parity and clinical diagnosis at labor onset, did not significantly differ; however, the LSCS group had a higher incidence of maternal complications, notably in cases involving previous caesarean sections and complex comorbid conditions. Treatment strategies remained consistent across both groups, reflecting adherence to standardized GDM management protocols. Neonatal outcomes, particularly the need for IDM care and differences in Apgar scores, were significantly associated with the mode of delivery, suggesting that LSCS may be linked with more challenging neonatal adaptation in this population. Although lifestyle factors such as smoking and alcohol use were similar between groups, they reinforced the notion that these behaviours did not substantially affect the observed clinical outcomes. Finally, the comparable postpartum outcomes between LSCS and vaginal delivery groups, despite a higher complexity of maternal complications in the LSCS group, suggest that effective perioperative and postoperative care can mitigate potential adverse outcomes. Collectively, these findings underscore the importance of individualized management and careful monitoring in pregnancies complicated by GDM, as well as the need for further research to address discrepancies in data recording and to optimize both maternal and neonatal care.

In previous studies, past history of GDM was present in 39.81% of cases, 68.34% of cases required insulin for glycemic control, 63.34% cases required delivery by caesarean section, maternal complications like preeclampsia in 20 cases, polyhydroamnious in 44 cases, uteroplacental insufficiency in 10 cases, macrosomia, sudden IUFD in 7 cases and operative delivery were common outcome. 12 neonates developed respiratory distress syndrome, 17 developed hypoglycemia and 26 neonates required NICU admission, 12 neonates underwent perinatal mortality. Several other studies which conducted on GDM concluded that early detection of gestational diabetes mellitus, timely referral, frequent antenatal visits, and management of the identified cases at tertiary care centers can lead to decreased maternal and feral morbidity and mortality.[19]

Limitations

Prevalence of the GDM is less in the present study because limited number of patients have been referred to our hospital from the peripheral health centres due to lack of awareness of GDM and its complications, limited duration of study period, no regular visits of the non-compliant patients and due to social stigma.

CONCLUSION

The study concluded that while demographic characteristics between the LSCS and vaginal delivery groups were largely similar, significant differences in neonatal outcomes and maternal complications were observed. Specifically, neonates in the LSCS group required more specialized care and exhibited lower Apgar scores, while maternal complications such as previous caesarean sections and comorbidities were more prevalent in the LSCS group. Despite these differences, treatment modalities and postpartum recovery remained comparable between both groups. These findings underscore the importance of individualized clinical management and vigilant monitoring of both maternal and neonatal health in pregnancies complicated by GDM, and they highlight the need for further research to resolve data inconsistencies and optimize care protocols.

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