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Original article

Mode of Delivery and Early Neonatal Outcomes among Preterm Births in Three Hospitals in Western Libya: A Hospital-Based Observational Study

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Keywords.
Preterm Birth, Cesarean Section, Vaginal Delivery, Neonatal Outcome, Prematurity, Libya.

ABSTRACT

Preterm birth remains a major cause of neonatal morbidity and mortality. The choice between vaginal delivery and cesarean section is influenced by gestational age, maternal health, fetal condition, placental complications, and available neonatal care. This study examined differences between vaginal/natural and cesarean delivery among preterm births in three hospitals in Western Libya, with respect to maternal age, diabetes status, gestational age, recorded indications, and early neonatal outcome. A hospital-based observational study was conducted on 45 women who delivered before 37 weeks of gestation at Msellata Central Hospital, Al-Khoms Almotaalem Hospital, and Souq Al-Khamees General Hospital between October 20 and November 29, 2024. Descriptive statistics (frequencies and percentages) were used. Of 45 preterm births, 21 (46.7%) were vaginal/natural, and 24 (53.3%) were cesarean. Diabetes was identified in three cases (6.7%). Women aged 26–<31 years predominated in the vaginal group; women aged 15–<23 and 23–<26 years predominated in the cesarean group. The modal gestational age was 31 weeks for vaginal births and 34 weeks for cesarean births. Placental abruption was the most common overall indication. Urinary tract infection was the most common indication for vaginal birth; cesarean births showed a wider range of indications. Four neonates (8.9%) died after birth, with two deaths in each delivery group. Cesarean delivery was slightly more frequent than vaginal delivery among the observed preterm births. Findings should be interpreted cautiously because delivery mode may not independently affect outcomes; rather, outcomes are likely related to underlying clinical indications and case complexity.

Introduction

One of the biggest challenges in contemporary maternity and infant care is preterm birth, defined as delivery before 37 completed weeks of gestation. Beyond curtailing the duration of pregnancy, preterm birth interrupts a tightly regulated developmental sequence that prepares the fetus for extrauterine life. Consequently, premature infants may present with immature respiratory, digestive, immune, endocrine, renal, hepatic, and thermoregulatory systems [1]. This biological immaturity underlies the strong associations between preterm birth and respiratory distress, metabolic instability, feeding difficulties, infections, necrotizing enterocolitis, intraventricular hemorrhage, chronic lung disease, and longer-term neurodevelopmental vulnerability [2-5].

The sequelae of preterm birth extend well beyond the neonatal period. Evidence links preterm birth to later cognitive, behavioral, educational, and developmental difficulties, particularly among infants born at very early gestational ages or with very low birth weight [6-9]. Bronchopulmonary dysplasia and other prematurity-related morbidities may also affect health and academic performance during childhood and adolescence [10]. Preterm birth is therefore both a clinical outcome and a significant public health indicator, especially in health systems where neonatal intensive care, prenatal risk stratification, and structured follow-up vary across institutions.

Preterm birth is more usefully conceptualized as a syndrome with multiple causal pathways than as a single condition. Spontaneous preterm labor, preterm premature rupture of membranes, and medically indicated early delivery can each result from distinct biological and clinical trajectories [11,12]. Infection and inflammation have been repeatedly implicated in cervical ripening, membrane rupture, uterotonic activity, and early delivery [13-16]. Newer research also shows that molecular fingerprints in the cervix and inflammatory processes between the mother and child may be signs of risk [17].

Additional pathways include uteroplacental ischemia, antepartum hemorrhage, hypertensive disorders, placental abruption, maternal medical disease, uterine overdistension, short interpregnancy interval, and fetal growth restriction [18-21]. Both fetal growth restriction and placental failure are clinically important because they can change the delivery decision from expectant management to medically indicated preterm birth when continuing the pregnancy is dangerous for both mother and baby [22,23]. According to experimental and epidemiological research, adverse intrauterine conditions may also affect cardiac development and later cardiovascular risk, making prevention and treatment of prematurity even more important [24-28].

In this complex clinical context, the choice of delivery route constitutes a critical decision. Vaginal delivery may be appropriate when labor is established, the fetal condition is reassuring, and there are no contraindications [29-31]. There

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needs to be careful attention to labor progress, cervical dilation, fetal monitoring, and augmentation decisions, especially at early gestational ages with limited neonatal reserve [32-35].

Cesarean section, on the other hand, may be life-saving when faced with fetal distress, malpresentation, placenta previa, severe antepartum bleeding, placental abruption, labor dystocia, prior uterine scar with risk factors, or maternal illness requiring urgent delivery [19,36-38]. Vaginal delivery also carries risk from difficult labor, pelvic floor injury, perineal trauma, or postpartum hemorrhage [39-41]. Cesarean delivery, in turn, introduces surgical, anesthetic, infectious, and future-pregnancy risks as well as the possibility of neonatal respiratory problems if performed before physiological readiness [42-45]. Classification systems and quality-improvement tools are increasingly used to distinguish medically necessary from potentially avoidable cesarean deliveries [46-48].

Locally derived hospital data are valuable because they reveal how clinical concepts translate into practice. Publicly available data on mode of delivery and early neonatal outcomes among preterm births in Libyan hospitals remain limited. Describing these patterns can inform documentation improvement, future audits, and identification of variables warranting routine collection. This study therefore examined vaginal/natural versus cesarean delivery among preterm births in three hospitals in Western Libya, taking into account maternal age, diabetes status, gestational age, recorded indications, neonatal mortality after birth, and neonatal nursery/incubator care.

Materials and Methods

Study Design and Reporting Orientation

A hospital-based observational study was conducted comparing preterm births by mode of delivery. The study aimed to describe the frequency of vaginal/natural and cesarean preterm deliveries and to examine how recorded maternal, obstetric, and early neonatal variables differed between the two groups. A descriptive and comparative design was used; findings are interpreted as trends observed in the participating hospitals rather than as causal effects of the delivery route.

Study Setting and Period

The study was conducted at three hospitals in Western Libya: Msellata Central Hospital (Msellata), Al-Khoms Almotaalem Hospital (Al-Khoms), and Souq Al-Khamees General Hospital (Al-Khoms). All three facilities provide obstetric and neonatal care for women presenting with preterm labor, antepartum hemorrhage, medical conditions, or fetal indications for early delivery. Data were collected from October 20 to November 29, 2024.

Study Population and Sample

The study population comprised women who delivered before 37 completed weeks of gestation at one of the participating hospitals during the study period. A total of 45 preterm birth cases were reviewed: 21 vaginal/natural preterm deliveries and 24 cesarean preterm deliveries. The delivery episode, rather than the individual mother over time, served as the unit of analysis.

Eligibility Criteria

Women were eligible if they delivered before 37 completed weeks at a participating hospital during the study period and if delivery mode and early neonatal outcome were documented. Cases were excluded if delivery occurred at or after 37 weeks, if critical information on delivery mode or neonatal outcome was missing, if duplicate records were identified, or if the case did not meet the standard hospital viability threshold.

Study Variables and Definitions

The primary grouping variable was mode of delivery (vaginal/natural birth or cesarean section). Maternal variables included age group and diabetes status. Obstetric variables included gestational age at delivery and the recorded cause or indication for preterm birth. Early neonatal outcome variables included documented death after birth and neonatal nursery/incubator care category as recorded in the hospital data. Birth weight, Apgar score, fetal presentation, parity, antenatal corticosteroid administration, hypertensive disorder subtype, emergency versus elective cesarean status, maternal complications, and neonatal diagnoses were not available in the dataset.

Data Handling and Statistical Analysis

Data were summarized using frequencies and percentages. Denominators were set to 21 for vaginal/natural deliveries, 24 for cesarean deliveries, and 45 for overall percentages. Given the small sample size and limited cell counts across strata, no p-values, regression models, odds ratios, or confidence intervals were computed. Interpretations are descriptive and deliberately avoid causal language.

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Ethical Considerations

The study used multi-hospital data presented exclusively in aggregate categorical form. No patient names, record numbers, addresses, photographs, or other direct personal identifiers were included. This approach preserves patient privacy and prevents identification of individual mothers or neonates.

Results

A total of 45 preterm birth cases were reviewed. There were 21 vaginal/natural deliveries (46.7%) and 24 cesarean deliveries (53.3%), indicating a slightly higher proportion of cesarean deliveries in the observed sample. This difference is purely descriptive; it should not be interpreted as indicative of superiority or inferiority of either delivery mode, as the study did not account for indication, fetal status, or gestational age in a comparative analytic framework.

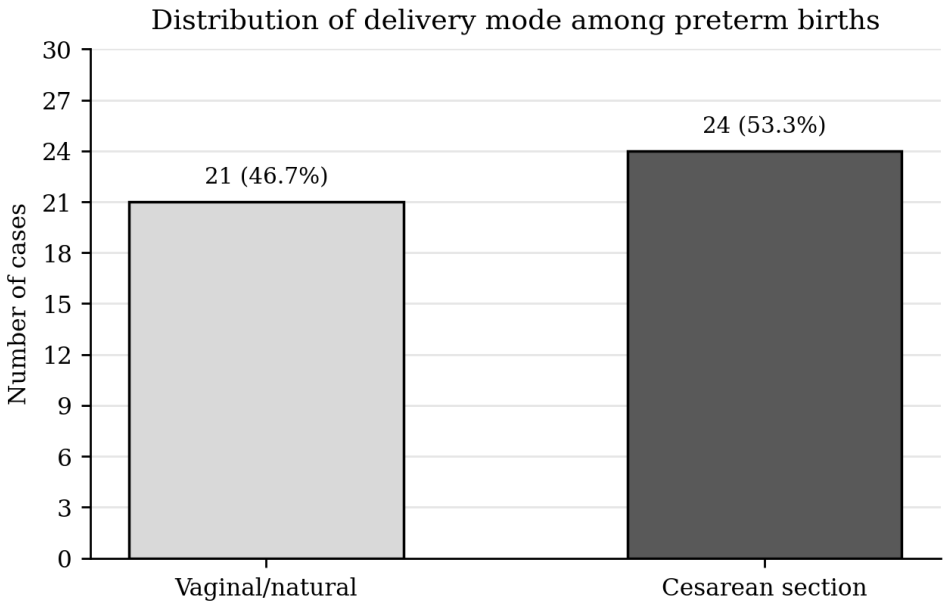

Figure 1. Distribution of delivery mode among preterm births.

Maternal Characteristics

Maternal age distribution differed by delivery mode. The most common age group for vaginal/natural delivery was 26 to <31 years (7/21 cases; 33.3%), followed by 31–41 years (6/21; 28.6%). For cesarean delivery, the 15 to <23-year and 23 to <26-year age groups each accounted for seven of 24 cases (29.2% each), the highest proportions within the cesarean group. Diabetes was identified in three cases overall (6.7%): one vaginal/natural birth and two cesarean deliveries.

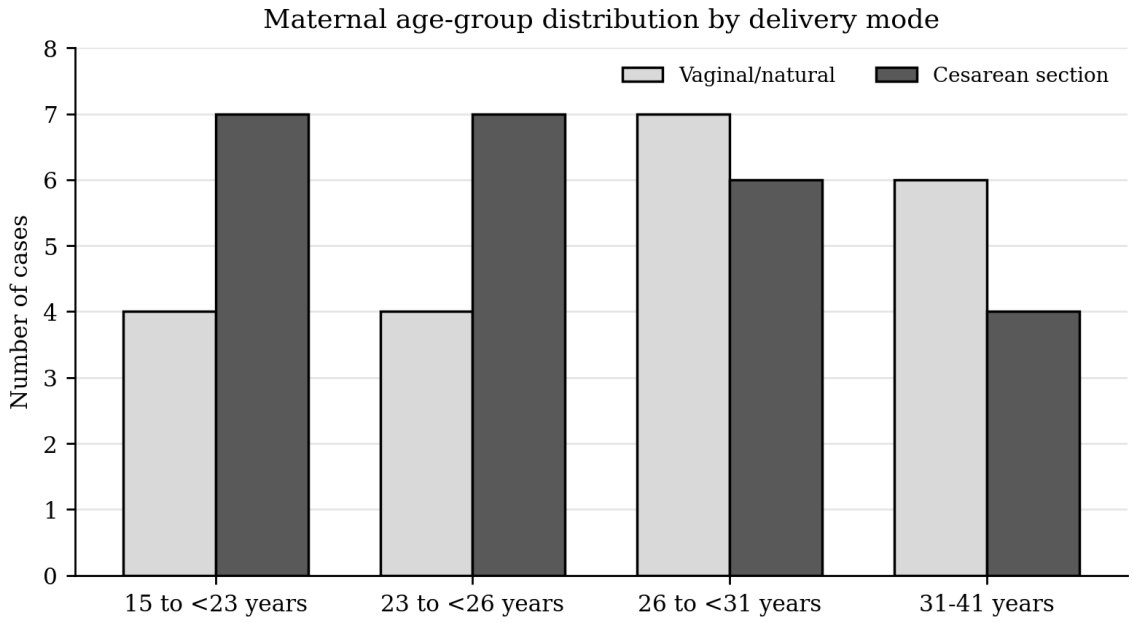

Figure 2. Maternal age-group distribution by delivery mode.

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Table 1. Maternal characteristics of preterm births by delivery mode

Variable	Vaginal/Natural n (%)	Cesarean n (%)	Total n (%)
Age: 15 to <23 years	4 (19.0)	7 (29.2)	11 (24.4)
Age: 23 to <26 years	4 (19.0)	7 (29.2)	11 (24.4)
Age: 26 to <31 years	7 (33.3)	6 (25.0)	13 (28.9)
Age: 31–41 years	6 (28.6)	4 (16.7)	10 (22.2)
Diabetes: No	20 (95.2)	22 (91.7)	42 (93.3)
Diabetes: Yes	1 (4.8)	2 (8.3)	3 (6.7)

Note. Percentages are calculated within each delivery-mode group and for the total sample.

3.2 Gestational Age Distribution

Gestational age distributions differed between delivery groups. The modal gestational age for vaginal/natural preterm births was 31 weeks (6/21; 28.6%), whereas for cesarean preterm births the modal gestational age was 34 weeks (6/24; 25.0%). Preterm deliveries occurred across a wide gestational age range of 26–36 weeks in both groups.

Figure 3. Gestational age distribution by delivery mode.

Table 2. Gestational age distribution among preterm births by delivery mode

Gestational Age	Vaginal/Natural n (%)	Cesarean n (%)	Total n (%)
26 weeks	0 (0.0)	1 (4.2)	1 (2.2)
27 weeks	0 (0.0)	1 (4.2)	1 (2.2)
28 weeks	0 (0.0)	2 (8.3)	2 (4.4)
29 weeks	2 (9.5)	4 (16.7)	6 (13.3)
30 weeks	2 (9.5)	0 (0.0)	2 (4.4)
31 weeks	6 (28.6)	2 (8.3)	8 (17.8)
32 weeks	0 (0.0)	3 (12.5)	3 (6.7)
33 weeks	4 (19.0)	3 (12.5)	7 (15.6)
34 weeks	2 (9.5)	6 (25.0)	8 (17.8)

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Gestational Age	Vaginal/Natural n (%)	Cesarean n (%)	Total n (%)
35 weeks	2 (9.5)	1 (4.2)	3 (6.7)
36 weeks	3 (14.3)	1 (4.2)	4 (8.9)

Note. Percentages are calculated within each delivery-mode group and for the total sample.

Recorded Causes or Indications of Preterm Birth

Clinically important differences were observed across the recorded indications by delivery group. Overall, placental abruption was the most common single indication, occurring in 10 cases (22.2%), with four vaginal and six cesarean deliveries. Urinary tract infection was the most common indication for vaginal/natural births (6/21; 28.6%), followed by placenta previa (5/21; 23.8%). For cesarean deliveries, placental abruption was the most common single recorded indication, while other recorded indications accounted for half of cesarean cases (12/24; 50.0%).

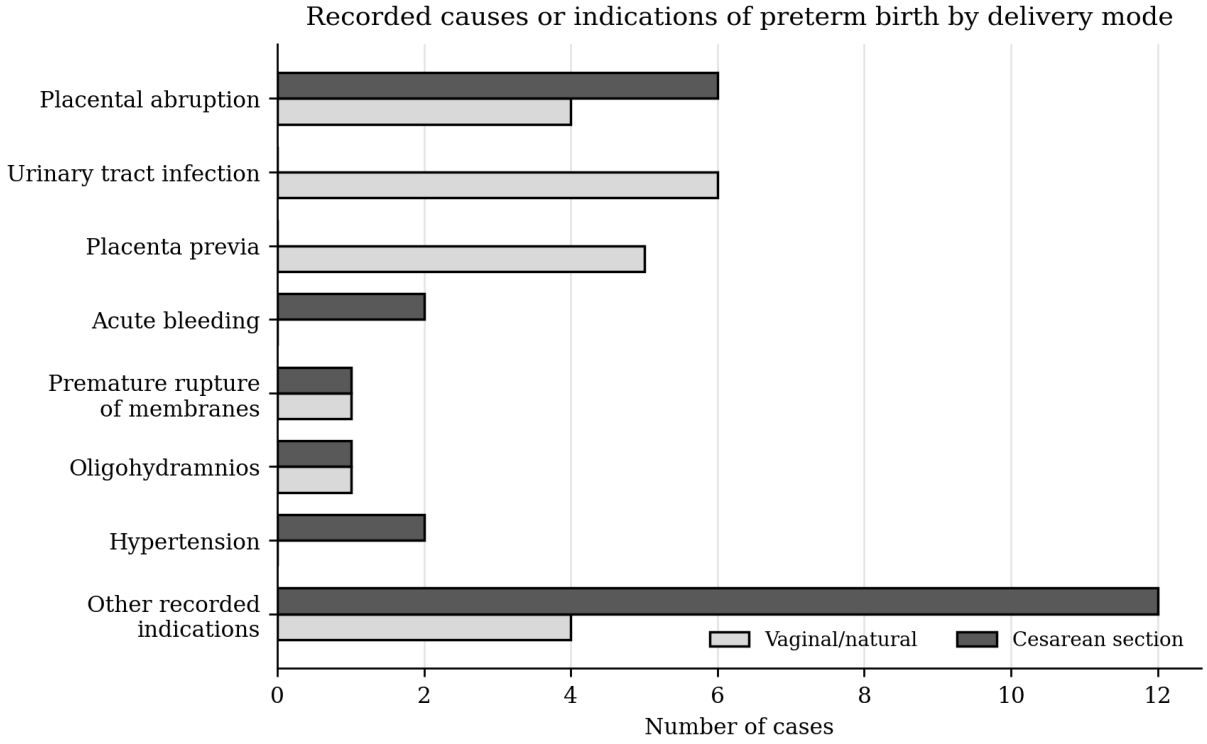

Figure 4. Recorded causes or indications of preterm birth by delivery mode.

Table 3. Recorded causes or indications of preterm birth by delivery mode

Cause or Indication	Vaginal/Natural n (%)	Cesarean n (%)	Total n (%)
Placental abruption	4 (19.0)	6 (25.0)	10 (22.2)
Urinary tract infection	6 (28.6)	0 (0.0)	6 (13.3)
Placenta previa	5 (23.8)	0 (0.0)	5 (11.1)
Acute bleeding	0 (0.0)	2 (8.3)	2 (4.4)
Premature rupture of membranes	1 (4.8)	1 (4.2)	2 (4.4)
Oligohydramnios	1 (4.8)	1 (4.2)	2 (4.4)
Hypertension	0 (0.0)	2 (8.3)	2 (4.4)
Other recorded indications	4 (19.0)	12 (50.0)	16 (35.6)

Note. Other recorded indications were grouped to avoid over-fragmentation of single-occurrence categories.

Early Neonatal Outcomes

Death after birth was recorded in four neonates (8.9% overall), with two deaths in each delivery group. Neonatal nursery or incubator admission was not recorded in 22 cases (48.9%). Among those admitted, stay categories ranged from 3–13 days,

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14–30 days, to 120–125 days, reflecting wide variation in neonatal care utilization from no admission at all to prolonged nursing care in a small number of cases.

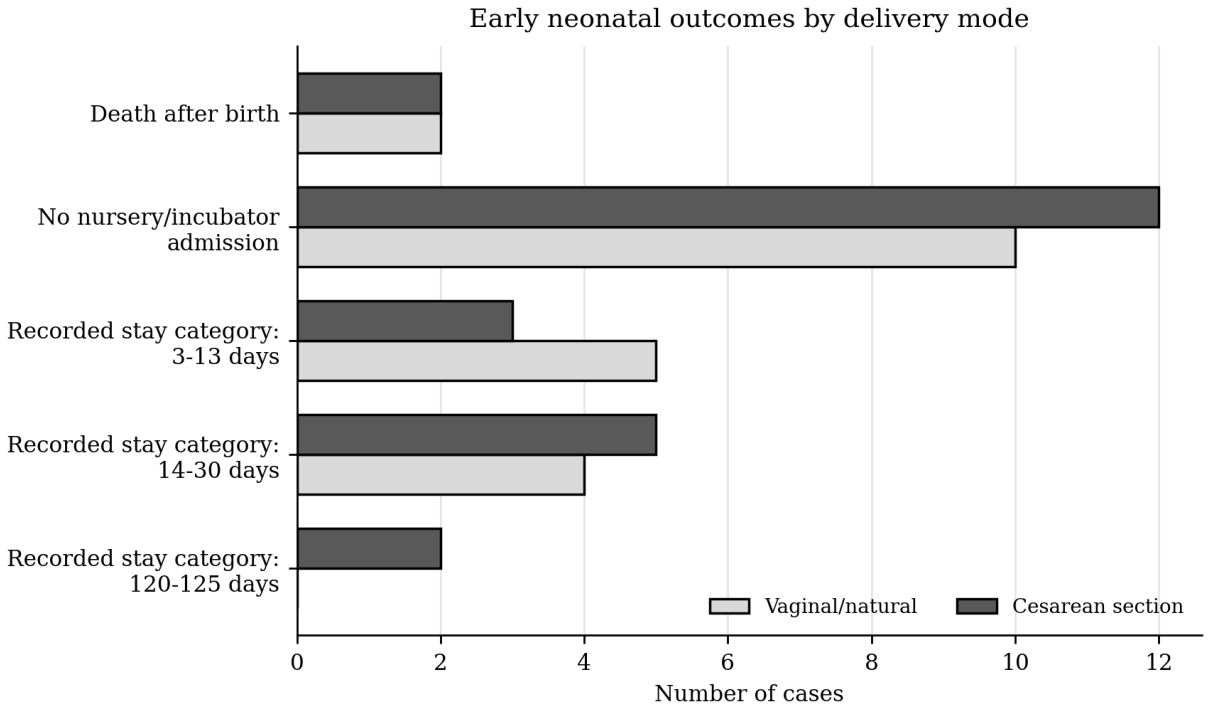

Figure 5. Early neonatal outcomes by delivery mode.

Table 4. Neonatal outcome after birth and nursery/incubator care by delivery mode

Outcome / Category	Vaginal/Natural n (%)	Cesarean n (%)	Total n (%)
Death after birth	2 (9.5)	2 (8.3)	4 (8.9)
No neonatal nursery/incubator admission	10 (47.6)	12 (50.0)	22 (48.9)
Recorded stay: 3–13 days	5 (23.8)	3 (12.5)	8 (17.8)
Recorded stay: 14–30 days	4 (19.0)	5 (20.8)	9 (20.0)
Recorded stay: 120–125 days	0 (0.0)	2 (8.3)	2 (4.4)

Note. Death after birth and neonatal nursery/incubator stay are reported as recorded in the hospital data.

Discussion

This study describes delivery mode and early neonatal outcomes among preterm births in three hospitals in Western Libya. The principal finding was that cesarean delivery accounted for 53.3% of observed preterm births, a slightly higher proportion than vaginal/natural delivery. Differences were also noted in maternal age distribution, gestational age at birth, recorded indications, and neonatal nursery/incubator care categories. Neonatal mortality was observed in both groups at equal absolute frequency.

The higher proportion of cesarean deliveries should not be construed as a direct comparison of outcomes. Cesarean section is frequently chosen for preterm birth because of the underlying clinical condition precipitating early delivery, including placental abruption, fetal bradycardia, antepartum hemorrhage, hypertensive disease, malpresentation, abnormal placentation, and maternal or fetal compromise [19,43]. Mode of delivery in preterm births should therefore be examined both as an exposure variable and as a possible proxy for clinical severity. It would be methodologically inappropriate to attribute better or worse neonatal outcomes to delivery mode without adjusting for indication, gestational age, birth weight, fetal condition, and emergency status.

The reported indications support this interpretation. Placental abruption was proportionally more common among cesarean deliveries, a finding consistent with the clinical imperative for expedited delivery in the setting of hemorrhage, maternal instability, or fetal compromise [18,49,50]. Other cesarean indications — acute bleeding, abnormal placentation, and hypertension — further suggest that the cesarean group included a higher proportion of clinically urgent or complex cases.

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For vaginal/natural preterm births, urinary tract infection was the most commonly recorded indication. The role of infection and inflammation in triggering spontaneous preterm labor and membrane rupture is well established [13,14,16]. Inflammatory pathways in the genital tract and amniotic compartment may activate prostaglandin synthesis, cytokine release, and myometrial contractility. This finding underscores the importance of prenatal infection screening, prompt treatment, and standardized documentation of infection-related preterm births.

The recording of placenta previa among vaginal/natural births warrants careful interpretation. Clinically significant placenta previa is generally an indication for cesarean delivery. A documented vaginal/natural delivery with placenta previa might reflect a low-lying placenta, a resolved previa, or differences in local documentation practices. Differentiating between placenta previa, low-lying placenta, placental abruption, placenta accreta spectrum, and antepartum bleeding would make interpretations safer [45].

The modal gestational age was 31 weeks for vaginal births and 34 weeks for cesarean births. Since pulmonary maturation, thermoregulation, feeding coordination, immune competence, and metabolic stability all improve with advancing gestational age, gestational age is a major determinant of neonatal vulnerability [2,3,5]. The observed distribution may reflect distinct clinical pathways, but grouped data preclude assessment of whether gestational age confounds the relationship between delivery mode and outcome.

The equal absolute number of neonatal deaths in both delivery groups (n = 2 each) should not be interpreted as equivalent risk. With differing gestational age distributions, indications, and case complexities, numerical equality does not imply equivalence of risk factors. More research should specify timing of death, whether neonates were discharged alive, and diagnostic findings.

The observation that approximately half of neonates did not require nursery or incubator admission may reflect a proportion of late preterm births (34–36 weeks) or clinically stable neonates. Standardized neonatal outcome reporting — distinguishing no admission, nursery admission, NICU admission, length of stay, respiratory support, sepsis, hypoglycemia, jaundice, feeding difficulties, and discharge outcomes — would strengthen comparability with international neonatal research.

Women aged 26 to <31 had the highest proportion of vaginal/natural preterm births, while those aged 15 to <23 and 23 to <26 predominated in the cesarean group. This distribution is informative only and may reflect the demographic profile of women attending the involved hospitals. Maternal age is also a proxy for parity, socioeconomic status, access to prenatal care, nutritional status, and obstetric history [11,51].

Diabetes was identified in 6.7% of the group, slightly more common among cesarean deliveries, though differences were too small to be meaningful. Obstetric decisions can be affected by diabetes through effects on fetal growth, metabolic instability, hypertensive comorbidity, and other risks. The present data do not differentiate gestational from pre-existing diabetes and provide no information on glycaemic control; diabetes should therefore be retained as a maternal characteristic rather than oversimplified as a determinant of delivery route.

From a clinical practice perspective, these findings reinforce the importance of indication-based rather than route-based evaluation of preterm delivery. Cesarean section should be reserved for cases where it is necessary for maternal or fetal safety [44,46,52], while vaginal delivery remains a viable option when clinically appropriate, provided labor is carefully monitored and neonatal resuscitation is immediately available [30-32].

Conclusion

A hospital-based observational study of 45 preterm births across three hospitals in Western Libya found that cesarean delivery occurred slightly more frequently (53.3%) than vaginal/natural delivery (46.7%). Maternal age, gestational age, and recorded indications differed between delivery groups. Placental abruption was the most common single overall indication; urinary tract infection predominated among vaginal/natural births; and cesarean births showed a broader range of indications. Neonatal deaths occurred in both groups. Interpretation of findings requires caution given the descriptive design, small sample size, and absence of several important covariates. The results do not indicate that either delivery mode improves or worsens neonatal outcome. Instead, they emphasize that delivery mode selection should be guided by clinical indication, fetal status, maternal condition, and available neonatal resources. Larger, multicenter studies with standardized maternal and neonatal variables are needed to better characterize preterm delivery patterns and outcomes in Libya.

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