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Neonatal outcomes of breech presentation delivered by cesarean section: A retrospective study from a tertiary hospital in Sudan

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Abstract

Breech presentation remains a major obstetric challenge particularly in low resource settings where skilled intrapartum management is not widely available. Cesarean section is a preferred modality of delivery to reduce neonatal morbidity. In this study, neonatal outcomes were assessed for all breech presentations performed by cesarean section at a tertiary hospital in Sudan, with the key factors of gestational age and parity being assessed. A retrospective cross-sectional study was performed at Bashair Hospital, reporting 54 breech presentations by cesarean section within a 1-year period. We conducted analyses of maternal characteristics, neonatal outcomes, and association with gestational age and parity. Important outcomes were birth weight, Apgar scores, NICU admission and immediate neonatal complications. Most mothers were aged 20–34 years and were multigravida. Three quarters of cases were term pregnancies. Nearly half of the neonates were > 3000 g, while one fifth were low birth weight. Mean Apgar score improved from 7.8 at 1 minute to 9.1 at 5 minutes, and only 2 neonates had a score less than 7 at 5 minutes. Admission to NICU was 16.7% based mainly on respiratory distress. Preterm breech neonates had worse outcomes, including rates of low Apgar scores, NICU admission and low birth weight. No significant associations between parity and neonatal outcomes were found. The Cesarean delivery for breech presentation group yielded overall positive neonatal outcomes, most significantly amongst term infants. Prematurity was the best predictor of neonatal morbidity, suggesting the importance of greater antenatal surveillance and preparedness for preterm births due to breech births. For neonatal outcomes, parity had little impact. Improvements in the quality of clinical protocol and the early detection of high-risk pregnancies may also enhance the outcome in comparable settings.

Keywords: Breech presentation, Cesarean section, Neonatal outcomes, Preterm birth, Apgar score, NICU admission

Introduction

Breech presentation has remained one of the most clinically important fetal malpresentations in obstetric practice, affecting approximately 3–4% of all term pregnancies accompanied by a significant proportion of preterm births [1]. Even with improved antenatal surveillance and intrapartum management, breech presentation remains a significant risk for the mother and the neonate. These risks include complications including birth trauma, cord prolapse, head entrapment, and neonatal asphyxia [2,3], indicating that delivery mode is crucial to perinatal outcome. The majority of breech presentations over the last 20 years have included cesarean section, as is the most favoured procedure, especially in settings where external cephalic version (ECV) is unsuccessful, contraindicated, or unavailable [4]. Evidence showed improvements in neonatal outcomes as compared to planned vaginal breech presentation that led to a shift to cesarean delivery in delivery [5], that contributed to the recent trend. Yet, recent studies have highlighted that cesarean section does not completely reduce neonatal risk, and in low resource environments where such delayed decision making is involved in outcomes, there is limited neonatal assistance and intrapartum monitoring may not be consistent, this risk is not eliminated by the surgical method after cesarean section. Moreover, the rising worldwide cesarean section rate has led to higher morbidity, reproductive risk, and health system burden in females, stimulating further investigation into individualized breech management strategies [8]. There are several factors affecting neonatal outcomes in breech presentation, including gestational age, fetal weight, type of breech, congenital anomalies, and the urgency of delivery [9]. Due to the higher respiratory distress, low Apgar score, and NICU admission associated with preterm breech infants compared to term breech

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neonates [10], their well-established effects are limited. Even in term pregnancies, the presentation of a breech is associated with the greater risk of transient tachypnea, birth injuries [11], and early neonatal complications, although in most cases cesarean delivery is more protective. All of these risks highlight the need for prompt surgical intervention, appropriate neonatal resuscitation, and standardized protocols in the institution. The burden of breech-related neonatal morbidity may be exacerbated among countries such as Sudan and low- and middle-income countries due to available resources, insufficient antenatal care, and late presentation to health facilities [12]. Bashair Hospital, an obstetric and general health center with an underprivileged population, also provides a growing number of high-risk pregnancies, including the delivery of surgical breech presentations. Grasp of neonatal outcomes in this regard is useful for informing clinical decision-making, resource utilization, and for developing perinatal care pathways. Notwithstanding the international studies on breech presentation, there are few recent research studies from Sudan and similar settings showing a trend toward similar neonatal outcomes after cesarean section for the presentation of breech. Most studies available are either out-of-date or mainly concentrate on maternal outcomes and not neonatal criteria. This gap illustrates that current, context-specific data are urgently required to support the clinical practice and policy formulation. The objective of this review is to provide evidence-based review to neonatal outcomes for breech presentations following cesarean section at Bashair Hospital. Through the study of Apgar scores, birth weight distributions, NICU admissions, and immediate neonatal complications, the authors aim to present a composite of perinatal risk among our sample. The study also aims to look at the correlations between maternal characteristics (e.g., parity, gestational age) and neonatal status, providing new knowledge that could facilitate more individualized, evidence-based management of breech presentation.

The study aims to build improvements in clinical protocol, neonatal readiness, and performance for breech affected pregnancies in similar healthcare settings.

Materials and Methods

Study design

We conducted a retrospective hospital-based study of neonatal complications after cesarean delivery. Retrospective audits are well-established methods in obstetric research to review real world clinical practices, assess care deficits, and provide evidence for improved maternal and neonatal outcomes over time. Through analysis of existing medical records, this study provides an up-to-date picture of breech related neonatal outcomes within the working practices of Bashair Hospital.

Study area

The study took place at Bashair Hospital, the biggest public maternity and emergency obstetric center in Khartoum area of Sudan. The hospital has a significant and diversified medical population comprising urban, peri-urban and displaced communities. As a referral center, Bashair Hospital maintains a large volume of high-risk pregnancies, including breech presentations, preterm births and those requiring emergency surgery. The hospital is an interdisciplinary unit as well as an acute neonatal intensive care unit with obstetric theatres, a neonatal resuscitation unit and a Level II Neonatal Intensive Care Unit (NICU) which provides comprehensive intrapartum care and immediate postnatal support. The resource-poor clinical setting, although based on national and international obstetric guidelines aligns well with the evaluation of neonatal outcomes in breech deliveries.

Study period

The audit spanned a period of 12 months between January 1, 2022, and December 31, 2022. This was selected to allow for a complete annual cycle of obstetric admissions, which will allow for appropriate representation of seasonal disparities, staffing patterns, and case mix.

Study population

The study population included all women that delivered by cesarean section for breech presentation at the time of the study. Presentation of breech was confirmed by antenatal ultrasound, intrapartum clinical examination or both. After meeting the inclusion criteria, a total of 54 breech cases were included in the comprehensive study results for treatment.

Inclusion criteria

- Singleton pregnancies.
- Confirmed breech presentation (frank, complete, footling, kneeling).
- Cesarean delivery at Bashair Hospital.
- Complete neonatal records are available.

Exclusion Criteria

- Multiple gestations.
- Significant congenital anomalies incompatible with life.
- Absent or incomplete neonatal data.
- Vaginal breech deliveries (none occurred during the study period).

Data collection

Manual data extraction was performed from: patient files, operating theater registers, neonatal records, and delivery ward logbooks. A structured data extraction sheet was used to make sure consistency was maintained and also limit transcription errors. The following variables were taken:

Maternal variables

- Age.
- Parity.
- Gestational age at delivery.
- Indication for cesarean section.
- Type of breech presentation.
- Presence of obstetric complications (e.g., preeclampsia, PROM, scar tenderness).

Neonatal variables

- Birth weight.
- Gender.
- Apgar scores at 1 and 5 minutes.
- NICU admission status.
- Immediate neonatal complications (e.g., respiratory distress, birth trauma, suspected sepsis).

Operational definitions

- Term birth: ≥ 37 weeks' gestation.
- Preterm birth: <37 weeks' gestation.
- Low birth weight: <2500 g.
- Low Apgar score: <7 at 5 minutes.
- NICU admission: transfer to neonatal intensive care within the first hour of life.

Data analysis and management

Data entries were entered into a secure spreadsheet. Descriptive statistics were used to summarize both maternal and neonatal characteristics. Categorical variables (e.g., NICU admission, Apgar categories) were presented as frequencies and percentages, while continuous ones (e.g., birth weight, gestational age) were summarized using means and standard deviations. Comparative analysis was done to examine the associations between maternal factors (parity, gestational age) and neonatal outcomes. Chi square tests were applied for categorical variables, and independent t tests for continuous variables. A p value <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was sought from the Bashair Hospital Research and Ethics Committee. Informed consent was waived because it was a retrospective audit; however, strict confidentiality was maintained. No individuals became identified by personal identifiers and all the data were used only for research purposes.

Table 1. Maternal characteristics of breech cesarean deliveries (n = 54)

Variable	Category	n (%)
Maternal age		6 (11.1%)
	20–34 years	34 (63.0%)
	≥35 years	14 (25.9%)
Parity	Primigravida	18 (33.3%)
	Multigravida	36 (66.7%)
Gestational age	Preterm (<37 wks)	12 (22.2%)
	Term (≥37 wks)	42 (77.8%)
Type of breech	Frank/complete	41 (75.9%)
	Footling	3 (5.6%)
	Breech + complications	10 (18.5%)
Indication for CS	Elective	11 (20.4%)
	Emergency	43 (79.6%)

Results

Overview of study population

The analysis included 54 breech presentations that were delivered by cesarean section during the period of interest.

Table 1 provides a summary of the maternal demographic and obstetric characteristics. Maternal age was between 20 and 34 years, with a greater proportion of multigravida mothers. More than three quarters of the cases were term pregnancies and preterm deliveries made up a little over one fifth for the sample.

Emergency Cesarean section was the predominant delivery mode which also confirmed the urgent, critical clinical condition of breech presentation in the common patient.

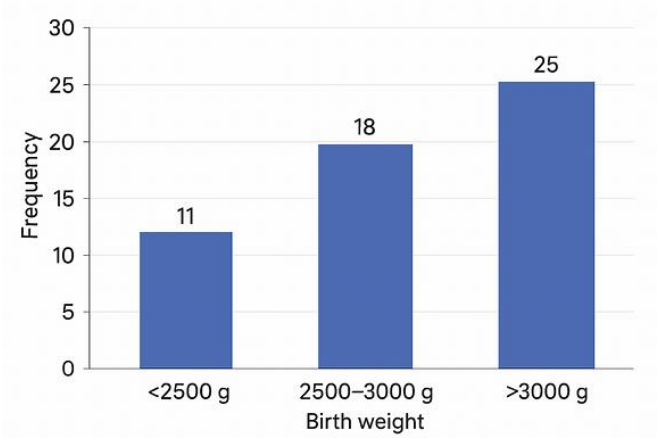

Figure 1. Birth weight distribution in breech neonates

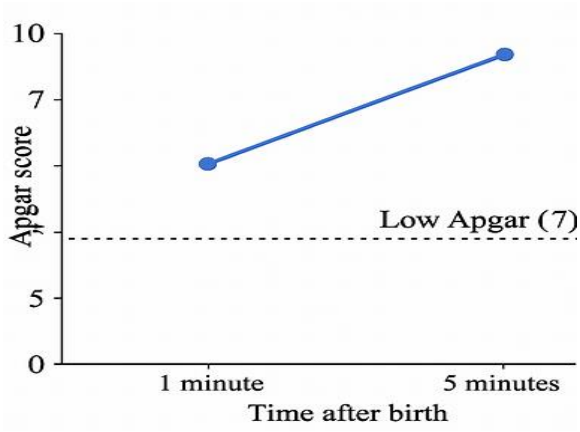

Figure 2. Apgar score trends (1 min vs 5 min)

Neonatal characteristics

Concerning neonatal characteristics and immediate outcomes, Table 2 reflects: Birth weight showed that almost half of the neonates weighed over 3000 g and one third were found between 2500–3000 g. Less than one-fifth of the population were those with a birth weight less than 2500 grams. Figure 1 The distribution of birth weights is shown, as normal and high birth weight infants are the major majority. The Apgar scores suggested generally positive neonatal outcomes. At 1 min, the mean Apgar score was 7.8 for the vast majority of neonates scoring 7 or greater. At 5 minutes, mean Apgar score was 9.1, with 2 neonates scoring below 7 at this time point. Figure 2 shows the improvement in Apgar scores between 1 and 5 minutes and suggests a stable upward trend in neonatal adaptation

during delivery.

Table 2. Neonatal outcomes among breech cesarean deliveries (n = 54)

Outcome	Category	n (%)
Birth weight		11 (20.4%)
	2500–3000 g	18 (33.3%)
	>3000 g	25 (46.3%)
Apgar score at 1 min		7 (13.0%)
	≥7	47 (87.0%)
Apgar score at 5 min		2 (3.7%)
	≥7	52 (96.3%)
NICU admission	Yes	9 (16.7%)
	No	45 (83.3%)
Immediate complications	Respiratory distress	7 (13.0%)
	Birth trauma	1 (1.9%)
	Suspected sepsis	3 (5.6%)

Neonatal morbidity

For 16.7% of neonates, admission to the NICU was indicated. Respiratory distress was the main reason for admission, followed by suspected neonatal sepsis, and one or two rare cases of minor birth trauma. However, the general neonatal morbidity rate remained low despite the complications and no serious adverse outcomes were reported. Gestational age and newborn outcomes.

The relationship between gestational age and neonatal outcomes

This is described in Table 3. Preterm breech neonates showed markedly worse outcomes in all measured outcomes. Low Apgar scores (0–5 min) were more common in preterm infants as compared to term infants, and the results showed significant difference. Preterm neonates were significantly more likely to be admitted to NICU, with half of all preterm infants requiring specialized care compared to a minuscule proportion of term infants. Preterm births were overwhelmingly associated with low birth weight, with a highly significant association. These results support the risk factors of preterm breech neonates and underscore the central role gestational age plays in neonatal health. Preterm infants had a higher morbidity, and more intensive postnatal support when cesarean delivery was included, even when cesarean delivery was employed.

Table 3. Association between gestational age and neonatal outcomes

Outcome	Preterm (n=12)	Term (n=42)	p-value
Low Apgar at 1 min	4 (33.3%)	3 (7.1%)	0.028
Low Apgar at 5 min	2 (16.7%)	0 (0%)	0.021
NICU admission	6 (50%)	3 (7.1%)	0.001
Low birth weight (<2500 g)	10 (83.3%)	1 (2.4%)	

Interpretation: Preterm breech infants had significantly worse outcomes.

Parity and neonatal outcomes

The relation between parity and neonatal outcomes is shown in Table 4. Despite the slightly higher rate of low Apgar score and increased number of NICU admissions among primigravida (versus multigravida) mothers, these disparities did not reach statistical significance. Birth weight distribution did not demonstrate significant difference between the two parity groups either. In general, parity did not seem to have any substantial effect on neonatal outcomes in this cohort of breech cesarean deliveries. These similar outcomes between primigravida and multigravida women suggest that parity alone is not a strong influence on neonatal risk in breech presentation.

Table 4. Association between parity and neonatal outcomes

Outcome	Primigravida (n=18)	Multigravida (n=36)	p-value
Low Apgar at 1 min	4 (22.2%)	3 (8.3%)	0.12
Low Apgar at 5 min	1 (5.6%)	1 (2.8%)	0.55
NICU admission	4 (22.2%)	5 (13.9%)	0.41
LBW (<2500 g)	5 (27.8%)	6 (16.7%)	0.31

Interpretation: Parity did not significantly affect neonatal outcomes

Summary of key findings

Taken as a whole, these data show that gestational age plays an overwhelmingly more powerful role in determining neonatal outcomes than does parity. Term breech neonates had favorable Apgar scores, lower rates of NICU admission and fewer complications. Preterm breech neonates, on the other hand, also were statistically more likely to have low Apgar scores, require NICU treatment and present with low birth weight. Although complications associated with breech presentation were considerable, the majority of neonates that were born at term delivered by cesarean section presented well and with minimal complications.

Discussion

This study investigated neonatal outcomes after breech presentations by cesarean section at Bashair Hospital over a one-year period. As these data demonstrated, while term breech neonates do well, preterm breech neonates have an increased risk of morbidity. These results are in agreement with worldwide evidence that gestational age is a significant determinant of neonatal wellbeing when presenting with breech [15,16]. Multigravida and term pregnancies dominated in this cohort, as anticipated for the women with similar regional and international epidemiology reporting more presentations of breech in late gestation and prior pregnancies [17]. These elevated rates of emergency cesarean section are consistent with that of many breech cases, which are very acute to include the complications of fetal distress, ruptured membranes or scar tenderness. Recent literature from similar low resource settings with high emergency cesarean rates for breech presenting, with the provision of external cephalic version and intrapartum risk toleration compromised [18,19], has also been reported. The neonatal results in our study were generally good. A significant improvement in Apgar index between 1 and 5 min is found as most neonates were healthy born and Apgar index level was significantly higher. This has been confirmed in previous analyses, which found that cesarean delivery for breech-presentation has a significant effect on fast neonatal stabilization and decreased risk of birth trauma [20,21]. With 5-minute Apgar values remaining <7 in this cohort, the efficacy of the timely intervention that must be initiated is once again highlighted. The rate of admission to the NICU of 16.7% observed in this study is comparable to those found in a similar tertiary institution in other regions and highlights that in breech babies, respiratory distress remains an impetus for early neonatal morbidity [22]. Although respiratory problems commonly occur in neonate's cesarean because of late release of fluid, they are not common in breech-present children and in preterm gestational age [23]. The very few suspected events of sepsis or isolated birth trauma events identified in this trial are indicative of present literature on the impact of cesarean section on mechanical blow injury in delivery of a breech [24,33]. Gestational age was the strongest predictor of neonatal outcome. Preterm breech neonates had significantly higher rates of low Apgar scores, NICU admission and low birth weight than other newborns. These results are consistent with those of multiple studies showing that prematurity only increases the risk of breech presentation with cesarean section [25,26]. The fragility of prematurity infants is widely evident and immature respiratory, nervous, and thermoregulatory systems may result in a poorer early adaptation [27]. The association of prematurity with admission to NICU was high and this study suggests that antenatal monitoring and early referral of high-risk pregnancies may be considered as the area more in need of improvement. By contrast, parity did not matter on fetal outcome significantly. Primigravida women recorded higher percentages of low Apgar scores and NICU admission, however, these percentages were not statistically significant. Conclusively, this is consistent with recent reports that parity does little to improve neonatal outcomes in cesarean delivery of breech women because the surgical approach restricts much intrapartum harm we found in primigravida versus multigravida women [28,29]. This is also because parity does not correlate meaningfully with birth weight in this study. The relatively positive results in term breech babies suggested that cesarean delivery

may be an appropriate intervention where skilled vaginal breech delivery is limited. Despite the growing preference of international guidelines for individual decision making, in a number of low-resource settings it is considered the safest, most viable procedure of breech presentation to perform, should cesarean section still be required [30]. Our findings further strengthen this hypothesis, especially the light prevalence of neonatal complications and excellent recovery trend predicted by Apgar score patterns. However, results also emphasized the importance of targeted interventions to prevent postnatal breech incidents. Better antenatal corticosteroid delivery; enhance neonatal resuscitation, neonatal resourcing and timely delivery decision making and to reduce morbidity in this population. Enhancement of referral and early recognition of high-risk pregnancies resulting in favourable prognosis could be achieved by developing more referral pathways [31, 32]. Finally, we demonstrate that Caesarean section delivery for breech presentation at Bashair Hospital is associated with generally favorable neonatal outcomes especially for term infants. Prematurity is the leading cause of neonatal morbidity and requires gestational age-specific management approaches. Such findings provide relevant local data for additional clinician practice and for developing pathways to improving care following presentation of breech in similar healthcare settings. Limitations

Therefore, there are some limitations to this study that should be considered when interpreting the findings. For one, the sample size was relatively small – only 54 breech presentations were included. As indicated in our review findings, while the findings were statistically important, if it was possible to identify minor differences in neonatal outcomes within a larger cohort, these findings could be substantially more potent. Second, the study was conducted in one tertiary hospital, which would limit generalizability in other settings where populations, clinical protocols or resources vary. Third, the retrospective nature of the study required the correct, complete, medical records; in effect, the researchers introduced potential documentation bias or lack of data. Fourth, the research did not explore long-term neonatal outcomes (neurodevelopment, growth trajectories) with relevance for broader phenomena of breech presentation. Lastly, maternal comorbidities, quality of antenatal care and intrapartum management were not taken into account enough to ensure that they could influence neonatal outcomes independent of breech presentation and gestational age.

Strengths

Nonetheless, this study did have a few significant strengths. It uses real-life data from a bustling tertiary hospital in Sudan, providing valuable local information from an uncommon source of regional data in the local evidence area. Neonatal outcome measures were clear and comprehensible Apgar, NICU admission and birth weight which allowed comparative assessment with international literature. Term and preterm breech presentations provide a powerful examination of gestational age as a determinant of neonatal outcome. The study only included cesarean deliveries so the confound from mode of delivery was reduced and the sample was more homogenized. Data is collected in a systematic way and is analyzed in a standardized manner leading to higher-reliability outcomes.

Conclusion

This study demonstrated that there is a positive outcome to breech presentation as administered via cesarean section in terms of neonatal survival with an emphasis on term neonates. The majority of neonates gave suitable Apgar scores with very short resuscitation requirements which did not require NICU admission. In contrast, premature neonates exhibited a significantly higher level of low Apgar, NICU admission, and low birth weight, indicating an important influence of gestational age on neonatal morbidity and mortality. But parity didn't have a big impact on neonatal outcomes and those shouldn't be viewed as evidence that maternal obstetric history makes a big difference in risk when using cesarean delivery. Overall, our study underlines the critical nature of early and appropriate decisions

and processes in preterm breech, and of quality of care for patients with preterm breech.

Recommendations

Improvement of management of breech will also require increased antenatal counseling coverage, more third trimester ultrasound screening, and timely referral to high-risk pregnancies. A continued high-availability external cephalic modality, an increase in readiness to be resuscitated in neonatal and a consistent multi-disciplinary approach also contribute to reduce complication. Continuous investment in training of the professionals, quality of documentation, and long term follow up systems will lead to safer outcomes and strengthen the evidence base needed to guide future clinical care.

Ethical approval

Ethical approval for this study was obtained from the Bashair Hospital Ethics and Research Committee prior to data collection. The following were performed according to the guidelines of the institution and the Declaration of Helsinki. Since this was a retrospective analysis of medical records, informed consent status was waived by the committee. Acknowledgment. The authors appreciate the support provided by Bashair Hospital medical, nursing and administrative staff in data capture and validation. The obstetrics and gynecology unit, with which the doors of clinical records and that of the data were opened up for validation are kudos for its efforts to validate the data.

Author contributions

The study was designed by Awadalla Abdelwahid Suliman Mohammed who also designed the method, the data collection and analysis and the manuscript is to be prepared. Eman Khalaf Allah was involved in the validation of data, review of the literature, editing of manuscript and critique of final draft. All authors reviewed and signed off on the remaining manuscript. Conflict of Interest. The authors declare that there is no conflict of interest in the publication of this study. Funding. The study was not paid for specifically by any state, business or not-for-profit grant agency in the public sector. This study is completely paid for by the authors.

Data availability

These datasets created and analyzed in the current study are publicly available on reasonable request by the corresponding authors. All data were anonymized to protect patient confidentiality.

Abbreviations

- Apgar – Appearance, Pulse, Grimace, Activity, Respiration
- CS – Cesarean Section
- ECV – External Cephalic Version
- LBW – Low Birth Weight
- NICU – Neonatal Intensive Care Unit
- PROM – Premature Rupture of Membranes
- RCOG – Royal College of Obstetricians and Gynaecologists

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