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Mortality and Morbidity in Babies with Omphalocele Delivered by Normal Vaginal Delivery Versus Cesarean Section in Iraq

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Abstract: Background: Omphalocele is a congenital abdominal wall defect associated with significant morbidity and mortality in neonates. The optimal mode of delivery for affected infants remains a subject of clinical debate.

Objective: This study aimed to compare neonatal outcomes between vaginally delivered infants and those delivered via cesarean section (C-section) with omphalocele, hypothesizing that C-section would yield superior clinical results.

Methodology: A comparative retrospective study was conducted on 43 neonates diagnosed with omphalocele at different hospitals in Iraq, over a 12-month follow-up period. The cohort included 23 infants delivered vaginally and 20 delivered via C-section. Outcomes assessed included mortality, morbidity, surgical repair success, hospitalization duration, and feeding progression.

Results: The C-section group demonstrated significantly better outcomes compared to vaginal delivery: lower mortality rate (10% vs. 26.1%).Reduced morbidity, including respiratory distress (40% vs. 65.2%), sepsis (15% vs. 30.4%), and sac rupture (5% vs. 21.7%); shorter hospitalization (40% discharged within 14 days vs. 21.7%); and improved feeding tolerance (70% achieving full oral feeds at discharge vs. 43.5%).

Conclusion: Cesarean delivery is associated with significantly reduced mortality and morbidity in neonates with omphalocele compared to vaginal delivery, where these findings suggest that C-section should be considered the preferred delivery method, particularly for cases involving large defects.

Keywords: Omphalocele, Cesarean Section, Vaginal Delivery, Neonatal Mortality, Congenital Anomalies, Surgical Outcomes.

I. Introduction

Omphalocele is an abdominal wall congenital defect resulting from the herniation of visceral structures like the intestines, liver, and other abdominal contents through the umbilical base covered with a protective membranous sac [1,2,3], albeit relatively rare with an estimated rate of prevalence of 1 in 4,000 to 1 in 7,000 live births, but this is a serious clinical problem, particularly in those with large defects or accompanying anomalies [4], and the embryologic etiology of omphalocele results from the failure of closure of the abdominal wall during the 4th to 10th weeks of gestation, which distinguishes it from gastroschisis, which lacks a covering membrane. The severity of omphalocele is staged based on defect size (small: <5 cm; large: ≥5 cm) and associated congenital anomalies, seen in 50–70% of newborns [5,6]. Due to the risk of high neonatal mortality and morbidity, optimal management requires a multidisciplinary team of obstetricians, pediatric surgeons, and neonatologists [7]. Despite enhanced prenatal imaging and neonatal surgery, the best mode of delivery—vaginal vs. C-section—is still debatable, with minimal consensus on the effect on outcomes. [8]

The choice between Caesarean delivery (C-section) and normal vaginal delivery (NVD) has important short- and long-term consequences for neonatal well-being [9]. Advocates of NVD feel that it provides for physiological adjustment to life after the uterus, reducing respiratory difficulty and promoting early maternal-infant interaction [10]. C-section advocates find advantages of reducing trauma to the herniated viscera, avoiding rupture of the sac, and enabling early operation [11]. This is also further aggravated by the extremely high rate of comorbidities in patients with omphalocele, like pulmonary hypoplasia and cardiac anomalies that may aggravate respiratory distress and increase dependence on mechanical ventilation [12]. Prior studies have yielded conflicting mortality and morbidity rates based on the method of delivery, emphasizing the need for evidence-based comparative evaluation [13]. This study aims to address these deficiencies by comparing systematically mortality, morbidity, and surgery outcomes in a well-characterized group of omphalocele neonates delivered by NVD compared with C-section.

II. Materials and Methods

This is a cross-sectional study compared neonatal outcomes of infants with omphalocele delivered by normal vaginal delivery (NVD) and cesarean section (CS) from different hospitals in Iraq, during January 2024 to December 2024. The study population included 43 neonates with diagnosed omphalocele, which were divided into two groups: 23 delivered vaginally (Group 1) and 20 delivered by CS (Group 2).

Inclusion criteria were used to exclude heterogeneity of the cohort, restricted to singleton pregnancies with prenatal or postnatal diagnosis of omphalocele, gestational age ≥32 weeks (to exclude the impact of extreme prematurity), and availability of complete medical records, including delivery records, surgical records, and NICU follow-up records. Exclusion criteria omitted cases with associated gastroschisis or other major unrelated congenital anomalies (e.g., neural tube defects), and incomplete medical records or lost to follow-up.

Data collection was in a strict protocol utilizing electronic medical records (EMRs), operative reports, and discharge summaries, with the extracted data recorded through a standardized proforma. The database included three domains: (1) maternal factors consisting of age, parity, gestational age at delivery, and indications for CS where relevant; (2) neonatal factors such as birth weight, sex, Apgar scores (1- and 5-minute), omphalocele size classification (small <5 cm; large ≥5 cm), and presence of associated anomalies (cardiac, chromosomal, gastrointestinal); and (3) outcome factors, with primary outcomes of neonatal mortality (death before 28 days) and major morbidity (respiratory distress, sepsis, sac rupture), in addition to secondary outcomes of surgical repair type (primary closure, staged repair, conservative management), postoperative complications (wound infection, bowel obstruction), hospitalization duration categories (<14 days, 14-28 days, >28 days), and feeding outcomes (full oral, partial tube, total parenteral nutrition).

Standardized operative definitions were applied uniformly across the study: respiratory distress was defined as requiring more than 24 hours of supplemental oxygen or mechanical ventilation; sepsis required positive blood culture or clinical indicators necessitating antibiotics; sac rupture was determined on intraoperative or postnatal documentation of membranous tear; and surgical success was characterized by definitive closure of fascia without graft infection or recurrence.

SPSS version 22.0 was used for statistical analysis, beginning with descriptive statistics (means ± standard deviations, frequencies, and percentages) to present the baseline demographics. Comparative analyses made use of chi-square tests of categorical variables (mortality rates and morbidity incidence) and independent t-tests of continuous variables (Apgar scores and birth weights). Multivariable logistic regression models adjusted for potential confounders, including defect size and gestational age, yielding adjusted odds ratios (aORs) with 95% confidence intervals. Statistical significance was at $p<0.05$ in all analyses.

III. Results

The findings of this comparative study on vaginal delivery (VD) versus cesarean section (CS) in cases of omphalocele indicate substantial differences in clinical outcomes. As presented in Table 1, baseline characteristics such as maternal age (VD: 28.5 ± 4.2 years vs. CS: 29.1 ± 3.8 years), gestational age (VD: 36.2 ± 1.8 weeks vs. CS: 37.1 ± 1.5 weeks), and birth weight (VD: 2650 ± 420 g vs. CS: 2780 ± 390 g) were comparable between the two groups.

Table 1: Baseline Characteristics of Mothers & Neonates.

Characteristic	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Maternal Age (years)	28.5 ± 4.2	29.1 ± 3.8
Gestational Age (weeks)	36.2 ± 1.8	37.1 ± 1.5
Birth Weight (g)	2650 ± 420	2780 ± 390
Sex		
Male, n (%)	12 (52.2%)	11 (55.0%)
Female, n (%)	11 (47.8%)	9 (45.0%)

Table 2 demonstrates a different distribution in omphalocele size, revealing a higher proportion of small defects (<5 cm: 60% vs. 43.5%) within the CS group, suggesting a potential selection bias where clinicians may have preferred CS for smaller, more easily managed defects. Conversely, the larger proportion of significant defects (≥5 cm: 56.5%) in the VD group may account for their poorer clinical outcomes, given that defect size is recognized as a critical prognostic factor.

Table 2: Omphalocele Size Classification.

Size	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Small (<5 cm)	10 (43.5%)	12 (60.0%)
Large (≥5 cm)	13 (56.5%)	8 (40.0%)

Mortality outcomes detailed in Table 3 reveal a clinically significant disparity, with the CS group exhibiting a markedly reduced neonatal mortality rate (10% vs. 26.1%). This 2.6-fold reduction in mortality risk supports existing literature indicating that planned delivery can mitigate trauma to exposed abdominal contents.

Table 3: Mortality Rate.

Outcome	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Neonatal Death	6 (26.1%)	2 (10.0%)
Survived	17 (73.9%)	18 (90.0%)

Table 4's morbidity statistics illustrate a consistent trend favoring the CS group across all measured parameters. Notably, the incidence of respiratory distress was significantly lower in the CS group (40% vs. 65.2%), likely due to reduced mechanical compression of the lungs during delivery. Additionally, the lower rates of sac rupture (5% vs. 21.7%) and sepsis (15% vs.

30.4%) in the CS cohort suggest that a controlled intraoperative environment may help prevent contamination and subsequent infection of the omphalocele sac.

Table 4: Morbidity Outcomes.

Complications	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Respiratory Distress	15 (65.2%)	8 (40.0%)
Sepsis	7 (30.4%)	3 (15.0%)
Sac Rupture	5 (21.7%)	1 (5.0%)
Intestinal Ischemia	4 (17.4%)	1 (5.0%)
Hypothermia	9 (39.1%)	4 (20.0%)
Hypoglycemia	6 (26.1%)	3 (15.0%)
Developmental Delay	5 (21.7%)	2 (10.0%)

Surgical outcomes, as shown in Table 5, revealed a higher frequency of primary closure in the CS group (60% vs. 34.8%), while staged repairs were more common in cases of VD (43.5% vs. 30%). This discrepancy may reflect not only the differences in defect size distribution but also potentially more favorable preoperative conditions in infants delivered via CS. Rates of postoperative complications, as detailed in Table 6, further corroborate the advantages associated with CS, indicating lower rates of wound infection (10% vs. 26.1%), bowel obstruction (5% vs. 17.4%), and reoperation (10% vs. 21.7%).

Table 5: Surgical Repair Outcomes.

Repair Type	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Primary Closure	8 (34.8%)	12 (60.0%)
Staged Repair	10 (43.5%)	6 (30.0%)
Conservative	5 (21.7%)	2 (10.0%)

Table 6: Postoperative Complications.

Complications	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Wound Infection	6 (26.1%)	2 (10.0%)
Bowel Obstruction	4 (17.4%)	1 (5.0%)
Reoperation Needed	5 (21.7%)	2 (10.0%)

The associated anomalies depicted in Table 7 reveal slightly lower prevalence rates in the CS group across all categories, including cardiac anomalies (10% vs. 17.4%), chromosomal anomalies (5% vs. 13%), and gastrointestinal anomalies (15% vs. 21.7%). Additionally, Table 8 indicates that hospital stay duration was significantly shorter for CS patients, with 40% discharged within 14 days compared to only 21.7% of VD cases. Prolonged hospital stays (>28 days: 34.8% vs. 15%) in the VD group can likely be attributed to their increased complication rates.

Table 7: Congenital Anomalies.

Anomaly	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Cardiac	4 (17.4%)	2 (10.0%)
Chromosomal	3 (13.0%)	1 (5.0%)
Gastrointestinal	5 (21.7%)	3 (15.0%)

Table 8: Length of Hospital Stay (Days).

Stay Duration	Vaginal Delivery (N=23)	Cesarean Section (N=20)
<14 days	5 (21.7%)	8 (40.0%)
14-28 days	10 (43.5%)	9 (45.0%)
>28 days	8 (34.8%)	3 (15.0%)

Table 9: Apgar Scores at 1 & 5 Minutes

Scores	Vaginal Delivery (Mean ± SD)	Cesarean Section (Mean ± SD)
1-minute	5.2 ± 1.8	6.8 ± 1.5
5-minute	7.1 ± 1.6	8.3 ± 1.2

Apgar scores in Table 9 reflect improved neonatal status for CS cases at both the 1-minute (6.8 ± 1.5 vs. 5.2 ± 1.8) and 5-minute (8.3 ± 1.2 vs. 7.1 ± 1.6) assessments, indicative of reduced delivery stress associated with elective surgical delivery. Respiratory outcomes presented in Table 10 demonstrate that infants delivered via CS required less ventilatory support, with 60% not needing any ventilation compared to 34.8% in the VD group, and only 10% of CS infants requiring prolonged ventilation (≥7 days) versus 26.1% among VD infants. Feeding outcomes reported in Table 11 showed that 70% of CS infants achieved full oral feeding by the time of discharge compared to 43.5% of VD cases, suggesting a quicker recovery of gastrointestinal function following surgical delivery.

Table 10: Need for Ventilatory Supports.

Duration	Vaginal Delivery (N=23)	Cesarean Section (N=20)
None	8 (34.8%)	12 (60.0%)
<7 days	9 (39.1%)	6 (30.0%)
≥7 days	6 (26.1%)	2 (10.0%)

Table 11: Feeding Outcomes.

Feeding Type	Vaginal Delivery (N=23)	Cesarean Section (N=20)
Full Oral Feeding	10 (43.5%)	14 (70.0%)
Partial Tube Feeding	8 (34.8%)	4 (20.0%)
Total Parenteral Nutrition	5 (21.7%)	2 (10.0%)

The multivariable regression analysis depicted in Table 12 identifies vaginal delivery as an independent risk factor for adverse outcomes (OR = 3.2, 95% CI: 1.4-7.1), even after adjusting for defect size. Furthermore, larger omphalocele size (OR = 2.8, 95% CI: 1.2-6.5) and respiratory distress (OR = 2.5, 95% CI: 1.1-5.7) were also found to predict poor outcomes, with sepsis approaching significance (OR = 2.1, p = 0.078).

Table 12: Multivariable Regression of Risk Factors Impact on Patients in Long Term.

Risk Factors	OR (95% CI)	P-value
Vaginal Delivery	3.2 (1.4–7.1)	0.005
Large Omphalocele	2.8 (1.2–6.5)	0.018
Respiratory Distress	2.5 (1.1–5.7)	0.029
Sepsis	2.1 (0.9–4.8)	0.078

IV. Discussion

Our study brought forth robust data that cesarean section (CS) delivery was associated with superior outcomes compared to vaginal delivery (VD) for neonates with omphalocele, a finding affirming and adding to current studies in the field. Our study demonstrated superb group comparability, with no discrepancy in maternal age, gestational age, or birth weight reported, indicative of the Canadian study [14] cohort typicality reported. We found a substantial clinical trend, with the CS group having a higher proportion of small defects (60% compared to 43.5%). This agreed with the selection bias reported by some, in that clinicians referred for CS more frequently for smaller, perhaps more manageable defects [15]. Nevertheless, even with this apparently bias sampling towards VD for the larger defects, our mortality findings confirmed a significant CS benefit (10% vs 26.1%), which is even greater than the 15% meta-analysis-reported decrease in mortality by the French study [16]. This shows that the benefits of CS may be greater than were initially observed.

Further, our morbidity witnessed across-the-board reductions in the CS group for respiratory distress (40% vs 65.2%) and sac rupture (5% vs 21.7%). These results are strong evidence for the mechanistic hypothesis of a controlled delivery minimizing trauma to the herniated contents and protective sac as proposed by a study in the USA [17]. Our CS group's sepsis rate (15% vs 30.4%) is particularly notable in that it closely approximates the Brazilian study's [18] 13% sepsis rate identified in their CS group and significantly exceeds their 25% baseline reported for VD sepsis. It also showed that primary closure was more prevalent in CS cases (60% vs 34.8%), which aligns with the Japanese study's [19] reported success rates for surgery. This higher primary closure rate is likely to be the cause of the reduced postoperative complications shown in Table 6, which shows that CS patients had fewer wound infections (10% vs 26.1%) and reoperations (10% vs 21.7%). These results extrapolate the Welsh study [20] further by showing that the benefits of CS are not confined to the early postoperative period.

Secondly, hospital stay data demonstrated that CS patients had substantially shorter hospitalization periods, with 40% discharged in 14 days compared to a paltry 21.7% of the VD cases. This finding exceeds the difference in durations reported by some research and suggests that the benefits of CS benefit not only to neonatal outcomes at birth but also extend to healthcare resource utilization. The greater Apgar scores at our CS unit in both 1-minute (6.8 vs 5.2) and 5-minute (8.3 vs 7.1) assessments provide objective evidence of enhanced neonatal transition, supporting the physiological advantage of regulated delivery evidenced by a trial conducted in Iran [21]. The reduced rate of requirement for prolonged ventilation (≥7 days: 10% vs 26.1%) and higher rate of discharge with full oral feeding (70% vs 43.5%) in CS cases suggest that such infants enjoy both short-term and long-term advantages from delivery by surgery. These findings concur with but exceed the differences in feeding outcomes reported by the Argentine study [22], which may reflect improvements in neonatal critical care.

The multivariable regression also confirmed that vaginal delivery in itself is an independent risk factor for bad outcomes (OR=3.2), even after controlling for defect size. This is a larger effect size than OR=2.5 in, and could be evidence that our study picked up on some other risk factors or had more sensitive outcome measurement. The strong association between large omphalocele and poor outcome (OR=2.8) is a replication of previous findings by a Spanish study [23], confirming defect size as an important prognostic factor.

V. Conclusions

This study demonstrates a significant association between delivery mode and clinical outcomes for neonates with omphalocele. Cesarean delivery was correlated with superior neonatal prognosis, evidenced by a substantially lower mortality rate (10.0% vs. 26.1%) and a marked reduction in major morbidity, including respiratory distress, sepsis, and sac rupture. These findings are further substantiated by significantly higher Apgar scores, a decreased requirement for prolonged ventilatory support, and a shorter duration of hospitalization in the cesarean cohort. Multivariable regression analysis identified vaginal delivery as an independent and significant risk factor for adverse outcomes. Consequently, the results indicate that cesarean section may confer a protective effect and should be strongly considered in the obstetrical management of omphalocele.

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