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Factors Associated with Neonatal Mortality in Preterm Infants: A Retrospective Study at Dalal Jamm National Hospital in Dakar

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Abstract

Introduction: Prematurity remains a leading cause of neonatal mortality in sub-Saharan Africa. The aim of this study was to assess the prevalence, epidemiological profile, and risk factors for mortality among preterm infants admitted to the newly opened neonatal unit of Dalal Jamm Hospital, a referral center in the suburbs of Dakar. **Methods:** We conducted a retrospective, descriptive, and analytic study over a 24-month period (March 2021 - March 2023). All preterm newborns (<37 weeks of gestation) hospitalized during this period were included. Sociodemographic, clinical, and outcome data were analyzed using R software. Chi-square and Fisher's exact tests were used to identify factors associated with death, with a significance level of $p < 0.05$. **Results:** Out of 651 admissions, 237 were preterm infants, representing a hospital prevalence of 36.4%. Most of mothers came from suburban areas (67.9%), and 60.3% had attended fewer than four antenatal care visits (ANC). The main reasons for admission were respiratory distress (37.6%) and risk of infection (25.7%). The overall mortality rate was 27%, rising to 44.4% in infants born before 28 weeks. Factors significantly associated with mortality were lack of antenatal care ($p = 0.04$), grand multiparity ($p = 0.01$), extremely low gestational age ($p = 0.02$), and early-onset neonatal sepsis ($p < 0.001$). **Conclusion:** Prematurity at Dalal Jamm Hospital is characterized by a high burden and significant mortality among extreme preterm infants. Improving outcomes requires strengthening antenatal care coverage in the suburbs and reinforcing infection prevention and control measures within the neonatal unit.

Keywords

Prematurity, Neonatal Mortality, Prenatal Care, Neonatal Sepsis, Senegal

1. Introduction

Prematurity, defined as birth occurring before 37 weeks of gestation, remains a major global public health challenge. In 2020, the World Health Organization (WHO) estimated the number of preterm births at 13.4 million, representing approximately one in ten newborns, with a particularly alarming prevalence in developing countries [1]. Africa and South Asia alone account for more than 65% of these births [2]. Despite technological advances in neonatology, prematurity remains the leading cause of neonatal morbidity and mortality, causing approximately 900,000 deaths annually [1].

In Senegal, the situation is of concern, with approximately 67,000 preterm births per year resulting in nearly 3870 deaths among children under five years of age [3]. These figures are likely underestimated, particularly in rural areas where accurate gestational dating remains difficult. Consequently, hospital-based data remain the most reliable sources for assessing this phenomenon, although they are not always generalizable to the overall population.

The Dalal Jamm National Hospital (CHNDJ), a referral center located in the greater suburbs of Dakar, opened its neonatal unit in March 2021. After two years of operation, the objective of this study was to determine the prevalence of prematurity, to describe the epidemiological and clinical profile of newborns admitted for prematurity, and to identify the risk factors associated with their mortality within this unit.

2. Methods

Study Design and Setting: This was a retrospective, descriptive, and analytic study conducted over a 24-month period, from March 1, 2021, to March 1, 2023. The study took place at the Pediatric Department of the Dalal Jamm National Hospital, a Level 3 public health facility located in Guédiawaye, a suburb of Dakar. The neonatal unit, with a capacity of 12 to 18 beds, provides care for newborns aged 0 to 28 days.

Study Population: The study included all preterm infants (born before 37 weeks of gestation) hospitalized during the defined period. Incomplete medical records or those that could not be retrieved were excluded from the analysis.

Data Collection: Data were collected from patient records and compiled into an Excel file. The variables studied included:

- *Maternal data*: Age, geographic origin, parity, and medical/obstetric history.
- *Pregnancy monitoring*: Number of antenatal care (ANC) visits and associated pathologies.
- *Delivery*: Gestational age, mode, and place of delivery.

- *Neonatal parameters*: Growth status, clinical signs, paraclinical examinations, and outcome.

Early-onset sepsis was classified as either culture-proven (positive blood culture) or clinical (clinical signs, abnormal laboratory findings, and major risk factors).

Statistical Analysis: Data processing was performed using R software (version 4.2.2). The descriptive study presented qualitative variables as frequencies and percentages, and quantitative variables as means with standard deviations. For the analytic study, Fisher's exact test and the Chi-square test were used to identify factors associated with neonatal death. A value of $p < 0.05$ was considered statistically significant.

3. Results

During the study period, 651 newborns were admitted to the neonatal unit. Among them, 237 were born preterm, corresponding to a hospital prevalence of 36.4%. Regarding maternal age, the 25 - 34 age group was the most represented (49.3%). Only 36.7% of mothers had attended at least four antenatal care (ANC) visits during their pregnancy. Abortion (36.6%) and history of preterm birth (24.7%) were the most frequent gynecological antecedents (Table 1). In most cases (n = 187, or 78.9%), pregnancies were singleton. In 54.5% of cases, prematurity was moderate, with a gestational age between 33 and 37 weeks of gestation. A male predominance was observed among newborns, with a sex ratio of 1.19. Small-for-gestational-age status (SGA) with a weight/age index below the 10th percentile was noted in 76 newborns (32%), while 21 newborns (8.8%) were below the 3rd percentile. Jaundice (34.6%) and respiratory distress (55.2%) were the most common clinical signs (Table 2).

We noted that 78 preterm infants (43.6%) presented with anemia. Serum glucose disorders were noted in 126 newborns (53.1%) (Table 3). Early-onset neonatal sepsis was the primary final diagnosis (37.9%), followed by transient tachypnea of the newborn (16.8%) and hyaline membrane disease (13.5%) (Table 4).

The mean length of hospital stay for preterm infants was 9.23 days. The mortality rate was 27%. Deaths were significantly associated with parity, antenatal care visits ($p = 0.04$), gestational age ($p = 0.02$), and early-onset neonatal sepsis ($p < 0.001$) (Table 5).

Table 1. Maternal and obstetric characteristics.

Maternal and obstetric data	Frequency (n)	Percentage (%)
Age		
Under 20 years	36	15.2
20 - 24 years	43	18.2
25 - 34 years	117	49.3
35 years and older	41	17.3

Continued

Parity		
Primiparous (1)	92	38.9
Pauciparous (2 to 3)	103	43.4
Multiparous (4 to 5)	29	12.2
Grand multiparous (≥6)	13	5.5
Maternal history		
Preterm birth	23	24.7
Abortion/Miscarriage	34	36.6
Stillbirth	18	19.3
Fibroid	12	12.9
Ovarian cyst	6	6.5
Antenatal care (ANC) visits		
0	7	2.9
1 to 3	143	60.4
≥4	87	36.7
Medical conditions		
Urogenital infection	23	10.4
Hepatitis B	13	5.8
HIV infection	1	0.4
COVID-19 infection	7	2.9
Syphilis	3	1.4
Toxoplasmosis	8	3.7
Rubella	5	2.2
Hypertension	24	10.9
Anemia	46	21.4
Obstetric complications		
Retroplacental hematoma (Abruptio placentae)	15	6.6
Threatened preterm labor	19	8.2
Premature rupture of membranes (PROM)	50	22.3
Preeclampsia/Eclampsia	56	24.0
Placenta previa	6	2.6
Gestational diabetes	20	8.6
Place of Birth		
Dalal Jamm Hospital	183	77.2
Other public facility	36	15.2
Private facility	10	4.2
Home	8	3.4
Mode of delivery		
Cesarean section	113	47.7
Vaginal delivery	124	52.3
Gestational age		
Between 33 and 37 weeks	129	54.5
Between 28 and 32 weeks	72	30.3
<28 weeks	36	15.2

Table 2. Main clinical signs observed in newborns.

Clinical signs	Frequency (n)	Percentage (%)
Fever	127	53.5
Hypothermia	110	46.4
Dehydration/Undernutrition	34	14.3
Pallor	41	17.2
Cyanosis	39	16.4
Jaundice	82	34.6
Respiratory distress	131	55.2
Respiratory pauses (Apnea)	22	9.2
Seizures	23	9.7
Vomiting	24	10.1
Abdominal distension	23	9.7

Table 3. Main biological abnormalities observed in newborns.

Parameters	Categories	Frequency (n)	Percentage (%)
Hemoglobin (g/L)	<7.5	5	2.1
	Between 7 and 10	8	3.3
	Between 10 and 14	65	27.4
	≥14	101	42.6
White blood cells	Leukocytosis	46	19.4
	Leukopenia	15	6.3
Platelets	Thrombocytopenia	16	6.7
	Thrombocytosis	40	16.8
Glycemia	Hypoglycemia	79	33.3
	Hyperglycemia	47	19.8
Bilirubin	Unconjugated (Free)	56	23.6
	Conjugated	18	7.5

Table 4. Distribution of newborns according to final diagnostics.

Final diagnostics	Effectif (n)	Pourcentage (%)
Maternal-fetal infection (Early-onset sepsis)	90	37.9
Clear amniotic fluid aspiration	37	15.6
Meconium aspiration syndrome	15	6.3
Hyaline membrane disease	32	13.5
Transient tachypnea of the newborn	40	16.8
Apnea of prematurity	17	7.2
Necrotizing enterocolitis	7	2.9
Birth trauma	32	13.5
Undernutrition/Dehydration due to lack of intake	12	5.1
Congenital heart disease	14	5.9
Other congenital malformations	34	14.3

Table 5. Factors associated with risk of death.

Parameters	Death		p-value
	Yes n (%)	No (%)	
Antenatal care (ANC) visits			**0.04**
None	4 (57.1)	3 (42.9)	
1 to 3	43 (30.1)	100 (69.9)	
4 and more	17 (19.6)	70 (80.4)	
Obstetric complications			
PROM	11 (22.0)	39 (78.0)	0.58
Preeclampsia/Eclampsia	20 (35.7)	36 (64.3)	0.10
Retroplacental hematoma	6 (40.0)	9 (60.0)	0.20
Threatened preterm labor	6 (31.6)	13 (68.4)	0.59
Gestational diabetes	9 (45.0)	11 (55.0)	0.06
Placenta previa	2 (33.3)	4 (66.7)	0.65
Gestational age			**0.02**
33 - 36 weeks + 6 days	28 (21.7)	101 (78.3)	
28 - 32 weeks	20 (27.8)	52 (72.2)	
<28 weeks	16 (44.4)	20 (55.6)	
Diagnostics			
Maternal-fetal infection	34 (37.7)	56 (62.3)	**<0.001**
Hyaline membrane disease	13 (40.6)	19 (59.4)	0.08
Transient tachypnea of the newborn	14 (35.0)	26 (65.0)	0.24
Meconium aspiration syndrome	7 (46.6)	8 (53.4)	0.12
Clear fluid aspiration	12 (32.4)	25 (67.6)	0.42
Maternal age			0.86
<20 years	10 (27.8)	26 (72.2)	
20 - 24 years	11 (25.5)	32 (74.5)	
25 - 34 years	34 (29.1)	83 (70.9)	
35 years and older	9 (21.9)	32 (78.1)	
Parity			**0.01**
Primiparous (1)	28 (30.5)	64 (69.5)	
Pauciparous (2 to 3)	19 (18.5)	84 (81.5)	
Multiparous (4 to 5)	10 (34.5)	19 (65.5)	
Grand multiparous (≥6)	7 (53.9)	6 (46.1)	

4. Discussion

In our series, the hospital prevalence of prematurity was 36.4%. This rate is significantly higher than national estimates for Senegal, which are often situated around

10% - 12%. It is comparable to, or even lower than, the 40.9% reported at the Ziguinchor maternity ward in southern Senegal [4]. However, it exceeds figures reported by other Level 3 facilities in Dakar, such as those by Sow *et al.* (28.1%) and Diagne *et al.* (27.2%) [5] [6]. A lower prevalence was also reported in the Central African Republic by Bobossi *et al.* (28.4%) [7]. This high prevalence can be explained by Dalal Jamm Hospital's status as a referral center, which concentrates high-risk pregnancies and in utero transfers from the Dakar suburbs, a densely populated area.

Furthermore, our prevalence rate is significantly higher than rates observed in developed countries (approximately 6 to 7% in Europe) or in the Maghreb (9.9% in Oran, Algeria) [8] [9]. This disparity highlights the disproportionate burden of morbidity borne by referral centers in sub-Saharan Africa, where prematurity remains the leading cause of neonatal hospitalization.

The maternal profile (young, multiparous, and from disadvantaged backgrounds) is consistent with classic data from West African literature [6] [10] [11]. This supports literature data reporting that young or advanced maternal age constitutes a risk factor for prematurity.

Pauciparous women were the majority, representing 43.4% of our patients. This percentage is close to the results of Aidibé (60.42%) and Seydi (34.5%) [12] [13]. Parity was significantly associated with the risk of death. The neonatal mortality rate was much higher among multiparous women. This high prevalence of mortality in these groups could be linked to the risk of obstetric complications.

In our study, one or more gynecological or obstetric antecedents were found in 39.2% of mothers, dominated by abortions and preterm birth. Guissé in Dakar found a slightly lower proportion of gynecological-obstetric history (31.9%) with a predominance of abortions (53%) [14]. Balaka in Togo noted that 11.3% of mothers of preterm infants had a history of induced abortions [15]. Diallo found in his series that the risk of preterm birth was multiplied by 12 in cases of a history of stillbirth and by 7 in cases of a history of preterm birth [16].

With only 36.7% of mothers having attended at least four ANC visits, our population falls short of WHO recommendations. Our results confirm the strong link between lack of antenatal care and neonatal mortality ($p = 0.04$). The death rate reached 57.1% among newborns of mothers who attended no ANC visits. This finding corroborates data from West African literature. In Ziguinchor, southern Senegal, Ndiaye *et al.* had already demonstrated a strong correlation between lack of ANC and the occurrence of prematurity [17]. Similarly, in Algeria, the absence of medical follow-up increases the risk of perinatal complications by nearly threefold (OR = 2.83) [9]. Unlike developed countries where follow-up is almost systematic, the lack of pregnancy monitoring in our context of Low- and Middle-Income Countries (LMICs) remains a major preventable risk factor, delaying the management of maternal pathologies such as hypertension and infections. This underscores the urgency of strengthening not only the coverage but especially the quality of ANC in the Dakar suburbs to detect pregnancy-related pathologies

(preeclampsia, infections) early, which we found in large numbers.

Preeclampsia and eclampsia were the most represented obstetric pathologies with a rate of 24.2%. Other authors have revealed the implication of preeclampsia or eclampsia in prematurity [18] [19]. We noted a male predominance among newborns with a sex ratio of 1.19. This male predominance was reported in Dakar in a previous study, in Gabon, and in Tunisia [20]-[22].

In our study, SGA was associated with prematurity in 32% of cases. Intra uterine growth restriction, is responsible for significant neonatal morbidity and mortality. The rate of SGA associated with prematurity was high at 77% according to Ndiaye, and 71% for Katz in Latin America [17] [23].

Early-onset neonatal sepsis (maternal-fetal infection), the primary diagnosis in our study (37.9%), remains a predominant cause of morbidity and death ($p < 0.001$). This association was reported at the Cocody University Hospital [24]. This profile is characteristic of LMICs where neonatal infections account for a massive share of mortality [4]. In this context, maternal-fetal infection represents a significant cause of neonatal morbidity and mortality, requiring close collaboration between obstetricians, neonatologists, and bacteriologists to improve management. In contrast, in developed countries, although infection remains a concern, morbidity is more dominated by complications of extreme immaturity (bronchopulmonary dysplasia, neurosensory sequelae) managed over the long term [25].

The mortality rate was 27%. This rate is lower than those found in hospital series in Senegal for facilities of the same level (between 50% and 60%) [14] [20]. In the majority of studies conducted in West and Central Africa, the neonatal mortality rate for preterm infants varies between 30% - 50% [15] [21] [26]. Our rate therefore suggests an encouraging quality of care.

Among very preterm infants (<28 weeks of gestation), we recorded a mortality of 44.4%. Although this rate is high, it is significantly more favorable than WHO estimates for low-income countries, where more than 90% of extremely preterm infants die [27]. In Dakar, a previous study on preterm infants under 1000g reported a mortality of 84.3%, indicating potential progress in management. Nevertheless, the gap remains significant compared to high-income countries, where less than 10% of these extreme preterm infants die thanks to advanced intensive care. This study is limited by its retrospective design and reliance on institutional records, which may affect data completeness and accuracy. The exclusion of incomplete medical charts introduced a potential selection bias, as the characteristics of excluded patients could not be assessed.

5. Conclusion

This study confirms that prematurity remains a major public health challenge in resource-limited settings, particularly in Senegal, within the suburbs of Dakar. Improving the survival of these vulnerable newborns requires strengthening public health policies aimed at enhancing the accessibility and quality of obstetric surveillance, specifically for disadvantaged suburban populations. While the man-

agement of very preterm infants has improved, mortality remains high among those born before 28 weeks of gestation. Optimizing neonatal technical resources—specifically respiratory support and surfactant availability—remains essential to improve viability outcomes in this context.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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