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RESEARCH ARTICLE

Epidemiological, Clinical and Evolutionary Profile of Newborns Hospitalised for Early-Onset Bacterial Infections in the Neonatal Unit at Béago

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Abstract

Introduction: Early-onset bacterial infection (EOBI) remains a major public health concern in resource-limited settings.

Objective: To describe the epidemiological, clinical, therapeutic, and outcome profile of newborns hospitalized for EOBI in the neonatal unit of Béago Health Center during its first six months of operation.

Methods: This was a retrospective, descriptive, and analytical study conducted from February to July 2023 in the neonatal unit of Yopougon University Hospital, temporarily relocated to Béago. It included newborns admitted within the first 72 hours of life, presenting at least one infectious risk factor and treated for EOBI.

Results: The hospital prevalence was 54.6% (220/403). Most newborns (61.8%) were full-term, with a sex ratio of 1.2. The main risk factors were premature rupture of membranes (28.6%), home delivery (21.4%), stained or foul-smelling amniotic fluid (15.9%), and maternal fever (10.9%). Clinical signs were dominated by respiratory distress (71.8%), neurological disorders (63.2%), and fever (10.9%). Laboratory findings included abnormal white blood cell counts (26.4%), thrombocytopenia (22.7%), anemia (1.36%), and positive C-reactive protein in 66.4% of cases. Only one blood culture was positive, isolating Acinetobacter baumannii. The mortality rate was 32.7%. Death was significantly associated with respiratory distress (OR = 3.905; p = 0.006), prematurity ≤ 34 weeks (OR = 3.835; p = 0.001), and APGAR score ≤ 6 (OR = 2.363; p = 0.007).

Conclusion: In our context, clinical and biological criteria were the only truly usable indicators. Probabilistic antibiotic therapy remains the main strategy to reduce neonatal mortality, which remains unacceptably high in our settings.

Keywords: Newborns, Early-Onset Bacterial Infections, Côte d'Ivoire.

1. Introduction

Neonatal mortality remains high. According to the WHO, 1.9 million children worldwide died in 2021 during their first month of life [1]. This represents approximately 7,000 newborn deaths per day. More than two-thirds of neonatal deaths occur during the first week of life, and approximately one million newborns die within the first 24 hours [2]. In 2018, the average neonatal mortality rate in low-income countries was 27 deaths per 1,000 births, while in high-income countries the rate was 3 per 1,000 [3]. In Côte d'Ivoire, the rate was estimated at 30 per

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1,000 live births in 2021 [4]. According to the World Health Organization [3], neonatal infection is the third leading cause of newborn death after asphyxia and prematurity. It is a major public health problem. At the Yopougon University Hospital, Akaffou described a prevalence of 54% in 2009, with a mortality rate of 34% [5]. N'guessan [6] found a prevalence of 36.25% in 2010. Risk factors, signs, and the bacterial ecosystem were also identified by DICK et al. in 2002, with a prevalence of 48% [7]. It felt necessary to conduct a study whose overall objective was to analyze the epidemiological, clinical, therapeutic, and evolutionary profile of newborns hospitalized for early-onset bacterial infections in the neonatal unit of the Yopougon University Hospital.

2. Patients and Method

We conducted a retrospective descriptive and analytical study in the neonatal unit of Yopougon's Hospital Center relocated to Béago over a period of six months from February to July 2023. It involved a sample of 220 newborns. The study included newborns of both sexes admitted to the department within 72 hours with suspected infection based on maternal and fetal bacterial infection risk (MF-BIR) and treated for EOBI. All newborns who did not undergo standard biological tests (complete blood count and/or C-reactive protein) were excluded from the study.

The classification of early neonatal bacterial infection was based on the National Health Accreditation Agency (NHAA) and MF-BIR criteria before and after assessment [7].

2.1 Sample

Our sample consisted of newborns hospitalized within the first 72 hours of life for EOBI during the study period.

2.2 Data Collection

Information was collected from newborn medical records using pre-established survey forms. The variables studied were the socio-demographic characteristics of the mothers, the anthropometric data of newborns (age, weight), newborns' history (course of pregnancy and delivery), clinical and biological manifestations, therapeutic management, and newborns' outcome.

2.3 Statistical Analysis

For data processing, SPSS 25 software was used, while the creation of charts and tables was carried out with Microsoft Excel. Quantitative variables were summarized using the mean and its standard deviation, or the median and the interquartile range. Qualitative variables were summarized using counts and percentages. The comparison of qualitative variables was performed using the Chi-square test or Fisher's exact test when the observed counts were < 5. The significance level was set at 5%. The odds ratio (OR) was used to determine factors associated with mortality during a EOBI.

2.4 Ethical Considerations

This study was conducted using data from medical records selected in the archives room and posed no direct risk to patients, therefore it did not require written or verbal informed consent. The information collected from the records remained confidential. We ensured strict adherence to patient anonymity for the survey; the form included only the record numbers without mentioning the patients' names.

3. Results

The number of newborns hospitalized during the study period was 403. We recorded 227 cases of neonatal sepsis, representing a hospital prevalence of 54.6% (220/403). Among them, 7 newborns had not undergone standard biological tests (CBC, CRP). Considering our inclusion criteria, we therefore included 220 newborns in the study. The majority of mothers were aged between 25 and 34 years in 55.5% of cases. Mothers' mean age was 27.5 years, with a range from 16 to 44 years. In the 81 cases where the mother's occupation was specified, she worked as a professional in 15.5% of cases. Primiparous mothers were the majority in 47.3% of cases.

The main reasons for admission in our study were respiratory distress (39.1%), prematurity (27.3%), low APGAR score (20.0%), and fever (12.7%). The sex ratio was 1.27 with 56% male. Newborns were admitted on day 0 of life in 65.5%. Our patients were full-term in 61.8% and 37.7% were premature. Vaginal deliveries accounted for 80%. The major criteria of NHAA were dominated by prematurity (28.2%), premature rupture of membranes (26.4%), and rupture of membranes >18h (17.7%). Meconium-stained or discolored amniotic fluid was mostly found as a minor criterion (20.9%) followed by rupture of membranes between 12-18 hours. The main physical signs observed in our newborns were respiratory distress (71.8%) and neurological disorders (63.2%). According to MF-BIR, 53.2% of newborns had a probable infection and 46.8% a possible infection. In the 207 cases where

C- reactive protein was performed, the positivity rate weas 66.4%. The rates of abnormal white blood cells, anemia, and thrombocytopenia were 26.4%, 1.36%, and 22.7% of cases at admission, respectively. After the biological assessment, 70.5% of newborns had a presumptive infection, 29% a clinical infection, and 0.5% a confirmed *Acinetobacter baumannii* infection. Cefotaxime combined with gentamicin was used as first-line treatment in 99.1% of our patients. The mortality rate was 32.7%. The risk factors associated with death were respiratory distress (p=0.006; OR=3.905 [1.885 - 8.086]), prematurity ≤ 34 weeks of gestation (p=0.001; CI [2.073 - 7.089] OR=3.835) (Table I) and an APGAR score ≤6 (p=0.007; OR 2.363; CI [1.261 - 4.430]) (Table II).

Table I. *Relationship between the minor NHAA criteria and death*

Minor criteria		Death		CR (CI 95%)	p
		No	Yes		
Prematurity 35 - 36 GA	No	133 (65,30%)	71 (34,80%)	0,13 (0,03 – 0,63)	0,019
	Yes	15 (93,80)	1 (6,30%)		
Breaking of waters 12-18 h	No	118 (68,20%)	55 (31,80%)	0,76 (0,27 – 2,16)	0,421
	Yes	14 (73,70%)	5 (26,30%)		
Stained or meconium-stained amniotic fluid	No	120 (69,00%)	54 (31,00%)	1,43 (0,73 – 2,79)	0,505
	Yes	28 (60,90%)	18 (39,10%)		
Apgar score ≤ 6	No	73 (77,70%)	21 (22,30%)	2,36 (1,26 – 4,43)	**0,007**
	Yes	75 (59,50%)	51 (40,50%)		

Table II. *Relationship between the major NHAA criteria and death*

Major criteria		Death		CR (CI 95%)	p
		No	Yes		
Prematurity < 34 weeks GA	No	120 (75,90%)	38 (24,10%)	3,84 (2,07 – 7,09)	**0,001**
	Yes	28 (45,20)	34 (54,80%)		
Chorioamnionitis	No	147(67,4%)	71 (32,6%)	2,07 (0,13 – 33,39)	0,966
	Yes	1 (50,00%)	1 (50,00%)		
Maternal fever > 38° at the start of labor	No	117 (66,10)	60 33,90%)	0,65 (0,27 – 1,56)	0,92
	Yes	21 (75,00%)	7 (25,00%)		
Premature rupture of membranes before 37 weeks GA	No	112 (69,10%)	50 (30,90%)	1,37 (0,75 – 2,49)	0,26
	Yes	36 (62,10%)	22 (37,90%)		

4. DISCUSSION

4.1 Epidemiological aspects

The prevalence of EOBI was 54.6%, similar to that reported by Akaffou [5], who found a prevalence of 54% in 2009. N'guessan [6] and Avi [8] found prevalences of 36.25% and 17.3% in 2010 and 2020, respectively. This difference in prevalence can be explained by the method of case recruitment, which involved including all newborns who received antibiotic therapy upon admission based on clinical scores, whether the infection was later confirmed or not in the earlier studies. In contrast, in Avi's study, biological criteria for positivity, particularly C-reactive protein (CRP≥24mg/l), were taken into account in defining the cases.

The majority of newborns included in our study were admitted within the first 24 hours of life (65.5%). Oumar A and Konaté D [9, 10] in Bamako in 2017 and 2019 found 93.8% and 90.4% of newborns admitted within the first 24 hours of life, respectively. These results reflect vertical transmission of EOBI. In our sample, we observed a male predominance of 55.9% (123/220) with a sex ratio of 1.27. This male predominance was comparable to that of Folquet [12] in Cocody, who reported a sex ratio of 1.4 [12]. The average weight was 2541.90 g. Avi [8] and N'guessan [6] found higher weights than ours, at 2900 g and 2847.47 g respectively, with extremes ranging from 1150 g to 4200g.The majority of our respondents were born at term (61.8%) and 37.7% were premature, similar to Kolsi's study in 2022 [11], which reported 46.6% premature births. However, in the study by Konaté D et al in Mali in 2016 [10], premature births were the majority (63.5%).In our study, 80% of mothers gave

birth vaginally. This result is similar to that of Folquet [12] (77%). This rate of vaginal delivery can be explained by the fact that most newborns come from peripheral health facilities. The majority of mothers (60%) had attended at least 4 antenatal care visits; however, none of them had completed the 8 contacts recommended by the WHO [13].

4.2 Anamnesis and Clinical Aspects

The main infectious risk factors found in the mother were similar to those reported by N'Guessan [6], who identified maternal risk factors such as PROM, abnormalities of the amniotic fluid, and maternal fever in 62.5%, 57.5%, and 48.8% of cases, respectively. Our results showed that premature rupture of membranes increased the risk of ascending infection of the amniotic fluid, leading to aspiration pneumonia and, secondarily, sepsis. When the amniotic fluid was stained or foul-smelling, the risk of infection was 1 to 5%. This risk was increased if the gestational age was at least 34 weeks, or if the latency period of premature rupture of membranes exceeded 24 hours. Regarding the infectious risk in the newborn, a low APGAR score was found in 57.3%, roughly equal to that reported by N'Guessan [6] (56.3%). The main reasons for admission were respiratory distress (39.1%), prematurity (27.3%), and fever (12.7%). The clinical signs were mainly represented by respiratory distress (71.8%), neurological disorders (63.2%), and fever (10.9%). In contrast to Konaté D [10], who reported the main signs as respiratory distress (36.5%), hypothermia (36.5%), and pallor (15.4%); Folquet et al. found the main signs to be respiratory distress (41.2%), fever (37.2%), and cerebral suffering (32.8%) [12]. This diversity of physical signs is related to the fact that no sign is specific to neonatal bacterial infection. Any newborn who is unwell is initially suspected of having an infection until proven otherwise. According to the MF-BIR, 53.2% of newborns had a probable infection justifying antibiotic therapy before the completion of the paraclinical work-up, compared to 46.8% who had a possible infection justifying monitoring and additional examinations.

4.3 Paraclinical examination

The abnormalities in the blood count involved changes in total leukocytes, hemoglobin levels, and platelets. Owono [14] found 11.9% hyperleukocytosis and 4% leukopenia. Anemia is common in EOBI but often delayed and very nonspecific. In our series, it was observed in 22.7% of cases. C-reactive protein is currently the most widely used biological marker in the diagnosis of neonatal infection [15]. C-reactive protein was positive in 27.7% of cases; in Folquet's study [12], it was positive in 83.23% of cases. C-reactive protein appears to be a specific marker (84-97%). Its sensitivity before the 12th hour is 51% and 89% after the 12th hour in 2016 [15].

Two newborns underwent bacteriological tests in the absence of a bacteriology laboratory in our healthcare facility. Acinetobacter baumannii was isolated in the blood culture. This germ was resistant to cefotaxime, gentamicin, and ceftriaxone but sensitive to imipenem. The cerebrospinal fluid was sterile. Avi mostly found Enterobacter sp, Klebsiella sp, Escherichia coli [9]. N'guessan [6] identified the main germs as coagulase-negative Staphylococcus, Staphylococcus aureus, and Pseudomonas aeruginosa. In Folquet's study, the main isolated germs were Staphylococcus aureus, Streptococcus B, Klebsiella pneumoniae, and coagulase-negative Staphylococcus [12]. The presence of these germs during EOBI shows the issues of asepsis during obstetric care as well as the importance of establishing the genital ecosystem of pregnant women in our context during the third trimester of pregnancy [16]. According to the RIB-MF, after the biological assessment, 70.5% of newborns had a presumptive infection, 29% a clinical infection, and 0.5% a confirmed infection with Acinetobacter baumanii.

4.4 Treatment

A dual antibiotic therapy based on Cefotaxime and Gentamicin was used as first-line treatment in our patients. The same approach was noted in the study by Avi-Siallou et al. [8] in Bouaké. The combination of Ceftriaxone and Gentamicin was used as first-line treatment in the study by N'guessan [6]. However, Balaka [17] uses the Ampicillin-Gentamicin combination as first-line treatment, which is also the most frequently cited combination in the literature in cases of confirmed Group B Streptococcus infection.

4.5 Evolution

The mortality rate was 32.7%, which was higher than that reported by Folquet [12] and Avi [9], who found a much lower mortality rate than ours, at 11.6% and 9.6% respectively. The delay in referral, inappropriate transport conditions for newborns, and the severity of the infection could explain the high mortality in the study. The risk factors associated with death were prematurity ≤ 34 weeks of gestation and respiratory distress. As for prematurity, it is identified as a risk

factor for neonatal infection and also a factor that increases the risk of neonatal death due to immune immaturity [18].

5. Conclusion

Early bacterial infection in newborns was a major public health problem. The anamnestic, clinical, and biological criteria were the only truly usable data. Risk factors for death were identified, and under our conditions, probabilistic antibiotic therapy remained the only means of reducing neonatal mortality still too high in our countries.

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