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Original article

Prevalence and associated factors of neonatal deafness in the maternity and neonatology services of three reference hospitals in the city of Douala, Cameroon

Prévalence et facteurs associés à la surdité néonatale dans les services de maternité et de néonatologie de trois hôpitaux de référence de la ville de Douala, Cameroun

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Résumé

Contexte : La surdité néonatale (SN) constitue un problème de santé publique aux répercussions majeures sur le développement social, éducatif et biologique des enfants. Lorsqu'elle n'est pas dépistée précocement, elle peut altérer l'intégration sociale, l'acquisition du langage et le développement cognitif. Déterminer la prévalence et les facteurs associés à la SN est essentiel pour mettre en place un dépistage précoce et des interventions adaptées. Cette étude visait à déterminer la prévalence et les facteurs associés à la surdité néonatale dans trois hôpitaux de référence de la ville de Douala.

Méthodologie : Nous avons mené une étude transversale sur une période de 4 mois au sein des unités de maternité et de néonatologie de trois hôpitaux de référence à Douala, incluant un total de 457 nouveau-nés. Les données sociodémographiques et cliniques ont été recueillies à l'aide d'un formulaire d'enquête. Le diagnostic de surdité néonatale reposait sur la détection des émissions otoacoustiques évoquées (EOAE), suivie d'un test diagnostique de confirmation par les potentiels évoqués auditifs du tronc cérébral (PEATC). Des régressions logistiques univariées et multivariées ont été réalisées pour identifier les facteurs associés à la surdité néonatale.

Résultats : Parmi les naissances, 219 étaient de sexe féminin (47,92 %) et 238 de sexe masculin (52,07 %), soit un sex-ratio de 1,08. La durée moyenne d'aménorrhée était de 38 ± 19 semaines, le poids moyen à la naissance de 3,1 ± 0,5 kg, et l'âge moyen au premier dépistage de 6,9 ± 4,6 jours. La prévalence de la surdité néonatale était de 0,21 %, soit 2,1 pour 1 000 naissances. Les facteurs associés à la surdité néonatale comprenaient un séjour hospitalier de plus de 2 jours (aOR = 2,63, p = 0,001***) et la dépendance

à l'oxygénothérapie (aOR = 4,32, p = 0,004***).
Conclusion : Nos résultats soulignent l'importance de renforcer le dépistage précoce de la surdité néonatale et de cibler les interventions vers les nouveau-nés à risque afin de minimiser l'impact de la surdité sur leur développement.
Mots-clés : surdité néonatale, prévalence, facteurs associés, dépistage précoce.

Abstract

Background: Neonatal deafness (ND) is a public health issue with significant repercussions on the social, educational, and biological development of children. When undetected, it can impact social integration, language acquisition, and cognitive development. Determining the prevalence and associated factors of ND is crucial to establishing early screening and tailored interventions. This study aimed to determine the prevalence and associated factors of neonatal deafness in three reference hospitals in the city of Douala.
Methodology: We conducted a cross-sectional study over a period of 4 months within the maternity and neonatology units of three reference hospitals in Douala, recruiting a total of 457 newborns. Sociodemographic and clinical data were collected using a survey form. The diagnosis of neonatal deafness was based on the detection of evoked otoacoustic emissions (EOAE), followed by a confirmatory diagnostic test using auditory brainstem response (ABR). Univariate and multivariate logistic regressions were performed to identify factors associated with neonatal deafness.
Results: Of the births, 219 were female (47.92%) and 238 were male (52.07%), yielding a sex ratio of 1.08. The average duration of amenorrhea was 38 ± 19 weeks, the mean birth weight was 3.1 ± 0.5 kg, and the average age at first screening was 6.9 ± 4.6 days. The prevalence of neonatal deafness was 0.21%, or 2.1 per 1000 births. Factors associated with neonatal deafness included a hospital stay of more than 2 days (aOR = 2.63, p = 0.001***) and dependence on oxygen therapy (aOR = 4.32, p = 0.004***).
Conclusion: Our results highlight the importance of strengthening early neonatal deafness screening and targeting interventions for at-risk newborns to minimise the impact of deafness on their development.
Keywords: neonatal deafness, prevalence, associated factors, early screening.

Introduction

Neonatal Deafness (ND) is defined as congenital or early-onset hearing loss affecting newborns, which impairs or limits their ability to perceive sounds from the very first days of life. This condition, often invisible at birth, poses a major risk of delaying language acquisition and cognitive development if it is not promptly diagnosed and treated. The World Health Organisation (WHO) estimates that over 5% of the global population, or approximately 432 million adults and 34 million children, have disabling hearing loss, with higher incidence rates in low-income countries and disadvantaged areas (1). Globally, the prevalence of neonatal deafness ranges from 1 to 3 per 1,000 births in developed countries, while it can reach between 2 and 6 per 1,000 births in low- and middle-income countries (2,3). In sub-Saharan Africa, studies indicate a high prevalence of childhood deafness, mainly attributed to perinatal infections, low vaccination coverage, and neonatal complications (4,5).
In Cameroon, specific data on neonatal deafness is scarce, though regional studies suggest that prevalence may be significant, particularly in large cities such as Douala and Yaoundé (6). The lack of systematic screening, combined with logistical and financial constraints, limits early detection of

deafness cases (7). In this context, the mortality rate associated with deafness-related complications and neonatal infections remains challenging to evaluate precisely; however, it is widely acknowledged that newborns with hearing impairment are at higher risk of experiencing long-term complications (8).

Neonatal deafness significantly affects the biological, social, and educational development of the child. Biologically, early hearing loss prevents the optimal development of auditory pathways in the brain, which impacts cognitive abilities and language acquisition (9). Socially, undetected and untreated deafness may limit a child's interaction with their surroundings, reducing opportunities for communication and increasing risks of marginalisation (10). Educationally, the absence of early screening and appropriate intervention decreases the likelihood of adequate learning, limiting the development of academic and socio-professional skills (11,12).

In the city of Douala, Cameroon, the lack of reliable data on the prevalence and associated factors of neonatal deafness complicates the planning of effective screening and prevention strategies. This information gap makes it difficult to raise awareness among families and healthcare professionals about the risks of this condition, thereby delaying interventions that could mitigate its adverse effects on the child's overall development (13). The general objective of this study is therefore to determine the prevalence and associated factors of neonatal deafness in the maternity and neonatology services of three reference hospitals in the city of Douala, Cameroon, to contribute to the establishment of suitable screening and intervention strategies.

Methodology

- Type, Duration, and Study Location

We conducted a cross-sectional study over a four-month period from February to May 2023. The study took place in the maternity and neonatology departments of Douala General Hospital (HGD), Laquintinie Hospital of Douala (HLD), and the Douala Gynaeco-Obstetrics and Paediatrics Hospital (HGOPED). These three reference hospitals in Douala (HGD, HLD, and HGOPED) play an essential role in the Cameroonian healthcare system, providing comprehensive coverage and high-quality maternity and neonatology care for the city of Douala and its surrounding areas. They are central in managing births and providing care for newborns, including high-risk infants. Their collaboration and expertise in specialised care make them crucial for screening and managing neonatal conditions such as deafness.

- Study Population

Our study included all newborns recorded in the three hospitals during the study period, regardless of their neonatal status. Newborns whose parents declined participation in the study were excluded.

- Ethical and Administrative Considerations

After informing the parents of the newborns about the nature of the study, we obtained their informed consent for participation. Ethical approval was granted by the Institutional Ethics Committee of the Faculty of Medicine and Pharmaceutical Sciences at the University of Douala, and the necessary authorisations were obtained from the officials of the respective recruitment sites. To ensure confidentiality, patient anonymity was strictly maintained. The study was conducted in accordance with the fundamental principles of medical research: the interest and benefit of research, the principle of non-harm, confidentiality of collected data, and respect for justice.

- Diagnosis of Neonatal Deafness

The diagnosis of neonatal deafness was based on standardised hearing screening tests, often performed in multiple steps to ensure accuracy and minimise false positives. For this purpose, we used OAE and

ABR:

- First Screening Test: Evoked Otoacoustic Emissions (OAE)

Evoked otoacoustic emissions (OAE) are the most common first-line test in neonatal deafness screening. This non-invasive test measures the inner ear's responses to sounds using a small probe placed in the child's ear canal. Newborns who fail this test require further evaluation, as a failed result may indicate hearing loss but can also result from temporary obstructions in the ear canal, such as vernix or secretions (14).

- Second Screening Test: Auditory Brainstem Response (ABR)

For newborns who do not pass the OAE test, an Auditory Brainstem Response (ABR) test is recommended. This test measures electrical activity in the auditory nerve and brainstem in response to sounds. It is more precise for detecting sensorineural and conductive hearing loss. ABR is often used to confirm the diagnosis, as it provides more detailed information on the level and type of hearing loss (15).

- Confirmation and Follow-up

Newborns who fail both screening tests (OAE and ABR) should be referred for a comprehensive audiological assessment by a specialist to confirm the diagnosis of deafness and determine appropriate interventions, such as hearing amplification or early intervention programmes (16). Regular follow-up is also recommended to monitor the auditory and language development of these children.

• Data Analysis

Data were entered into an Excel spreadsheet (Microsoft Office, USA) and analysed using R software version 4.4.2 for Windows. Categorical variables were presented as frequencies (N, n) and percentages (%), and quantitative variables as means ± standard deviation (SD). Univariate and multivariate logistic regressions were used to calculate odds ratios (cOR, aOR), confidence intervals, and p-values to identify factors associated with neonatal deafness.

Results

• Sociodemographic Factors of the Study Population

We screened 457 newborns. Of these, 219 were female (47.92%) and 238 were male (52.07%), with a sex ratio of 1.08 (Figure 1). The average gestational age was 38 ± 19 weeks, the mean birth weight was 3.1 ± 0.5 kg, and the average age at first screening was 6.9 ± 4.6 days (Table I).

• Prevalence of Neonatal Deafness

One newborn out of 457 (0.21%) was diagnosed with neonatal deafness, giving a prevalence of 2.1 per 1000 births (Figure 2).

• Factors Associated with Neonatal Deafness

Univariate logistic regression performed between perinatal and postnatal factors and neonatal deafness showed that the only perinatal factor associated with neonatal deafness was skull base or petrous bone fracture (cOR = 2.72, p = 0.03*). The postnatal factors associated with neonatal deafness were a hospital stay of more than 2 days (cOR = 4.21, p = 0.001***) and dependence on oxygen therapy (cOR = 1.98, p = 0.01*) (Table II).

Multivariate logistic regression, including factors that showed an effect in univariate logistic regression, indicated that the factors associated with neonatal deafness in our study population were a hospital stay of more than 2 days (aOR = 2.63, p = 0.001***) and dependence on oxygen therapy (aOR = 4.32, p = 0.004***) (Table III).

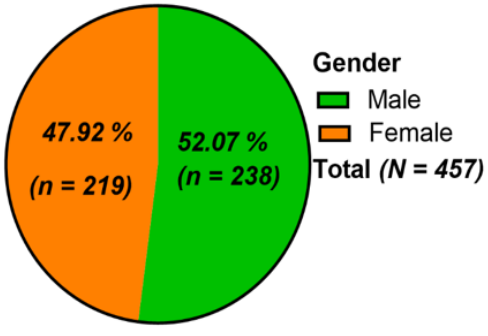

Figure 1: Pie chart showing the distribution of gender

Table I: Weeks of amenorrhea, Birth weight and Mean age at first screening.

Variables	Mean ± SD	[minimum - Maximum]
Weeks of amenorrhea	38 ±19	[29 - 42]
Birth weight (Kg)	3.1 ± 0.5	[0.9 - 4.2]
Mean age at first screening (days)	6.9 ± 4.6	[2 - 28]

Table II: Univariate logistic regression assessing the association between perinatal and postnatal factors and neonatal deafness

Factors	cOR	95%CI	pvalue
Perinatal factors			0.7
Asphyxia	1		
Prematurity	0.22	0.03, 1.24	0.1
Dystocic delivery	0.35	0.05, 1.43	0.2
Birth weight < 1.5 kg	0.63	0.09, 2.90	0.5
Neonatal infection	0.67	0.07, 6.50	0.7
Craniofacial malformation	0.46	0.06, 2.84	0.4
Skull base or petrous bone fracture	2.72	0.5, 6.84	0.03*
Postnatal factors			0.02
Neonatal jaundice	1		
Hospital stay > 2 days	4.21	1.62, 9.51	0.001***
Aminoglycoside-based treatment	0.4	0.15, 1.12	0.4
Diuretic-based treatment	1.02	0.15, 4.39	0.07
Dependence on oxygen therapy	1.98	1.12, 3.56	0.01*

cOR: Crude Odds ratio

Table III: Multivariate logistic regression assessing the association between perinatal and postnatal factors and neonatal deafness

Factors	aOR	95%CI	pvalue
Skull base or petrous bone fracture	1		<0.001***
Hospital stay > 2 days	2.63	0.32, 5.3	0.001***
Dependence on oxygen therapy	4.32	1.62, 10.56	0.004*

aOR : Ajuste Odds ratio

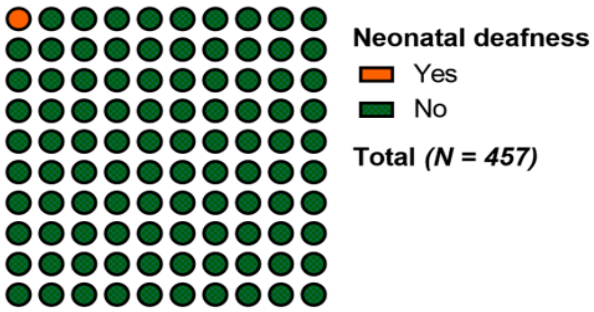

Figure 2: Prevalence of neonatal deafness in our study population

Discussion

Neonatal deafness (ND) is a major public health issue, particularly in low-resource countries such as Cameroon, where early screening and treatment are often inaccessible. Identifying the prevalence and risk factors associated with neonatal deafness in maternity and neonatology services in reference hospitals in Douala would enable the adoption of more targeted and effective screening strategies, reducing diagnostic delays and allowing early intervention to optimize child development. This work is essential to raise awareness among healthcare professionals and health authorities, with the aim of establishing neonatal screening policies and appropriate management programs.

The sex distribution in our study, with a sex ratio of 1.08 in favor of boys, aligns with global trends observed in neonatal deafness research. Many international studies, such as those by Brown et al. (17) and Liu et al. (18), report a slightly higher sex ratio for boys in the populations studied, with no significant difference in terms of deafness risk. In Africa, similar research, such as that by Nguefack et al. (19), indicates a slightly higher prevalence of deafness in boys, though this difference is not statistically significant.

Regarding the mean gestational age in our study (38 ± 19 weeks), it is relatively consistent with averages observed in high-resource countries, where full-term gestation generally reaches 39 weeks, as reported by Smith and Roberts (20). However, greater variability is observed in Africa, influenced by socio-economic factors, availability of prenatal care, and high rates of preterm births. For example, Adamu and Aliyu (21) found that gestational age is often lower in rural African areas, with implications for neonatal complications and deafness risk.

The mean birth weight in our study (3.1 ± 0.5 kg) is similar to international norms, though African countries often report lower birth weights. For instance, Mugalu et al. (22) found a higher prevalence of low birth weight (< 2.5 kg) due to factors such as maternal malnutrition, which increases the risk of complications, including hypoxia—a factor associated with neonatal deafness.

Finally, the average age at first screening (6.9 ± 4.6 days) is relatively low in our study but remains higher than standards in many developed countries, where neonatal hearing screening is often conducted within the first 48 hours after birth (23). In Cameroon and many African countries, limited access to screening equipment and trained professionals leads to delays in detection. Nguefack et al. (19) reported an average initial screening age of 7 days in a context similar to ours, highlighting the challenges of early diagnosis for effective care.

The prevalence of neonatal deafness in our study, estimated at 0.21% (or 2.1 per 1,000 births), is a key data point for comparing the burden of this condition with the results of similar studies in different regions. Globally, neonatal deafness prevalence varies significantly by region, available resources, and screening practices. In developed countries with systematic screening, prevalence is generally lower, ranging from 1 to 2 per 1,000 live births (23). This relatively low prevalence in these contexts is due to better access to prenatal care, prevention of perinatal infections, and effective management of associated risk factors.

In Africa, neonatal deafness prevalence is generally higher, ranging from 2 to 5 per 1,000 births, and even higher in some rural areas due to limited healthcare resources, insufficient prenatal and perinatal care, and the absence of systematic neonatal hearing screening

(21). Studies in sub-Saharan countries, particularly Nigeria and Uganda, report prevalences up to 3.5 per 1,000 live births, higher than the rates observed in our study. This difference may be due to the specific health context in Cameroon, particularly in urban reference centres where perinatal care is slightly more structured than in rural areas.

In Cameroon, data on neonatal deafness prevalence remain limited. However, available studies indicate prevalences similar to those observed in our study, although they vary by region and healthcare facility level. Nguefack et al. (19), for example, reported a prevalence of about 2 per 1,000 births in a reference hospital in Yaoundé. This figure is close to our results, suggesting a similar prevalence in urban reference centres. The lower prevalence in our data may also be influenced by selection biases in our sample or by differences in screening and diagnostic methods for deafness.

Our study results show that a hospital stay of more than two days and dependence on oxygen therapy are significantly associated with neonatal deafness. A prolonged hospital stay often indicates perinatal complications, requiring closer monitoring, which increases the risk of hearing impairment. International studies, such as that by Martínez-Cruz et al. (24), confirm that newborns hospitalised for more than 48 hours have an increased risk of neonatal deafness—a trend also observed in Africa, notably in studies by Olusanya et al. (25) in Nigeria and Nguefack et al. (26) in Cameroon. Prolonged dependence on high-concentration oxygen therapy can also damage the inner ear, increasing the risk of deafness, as demonstrated by studies by Cochrane (27) and Swanepoel et al. (28) in South Africa. A Cameroonian study by Chiabi et al. (29) also confirmed that newborns under prolonged oxygen therapy have an increased risk of deafness. These findings highlight the importance of closely monitoring newborns requiring prolonged hospitalisation and oxygen therapy, with systematic hearing screening protocols for these at-risk populations to ensure early detection and intervention, essential for optimal child development.

Conclusion

This study determined a neonatal deafness prevalence of 0.21% (2.1 per 1,000 births) in three reference hospitals in Douala, Cameroon, and identified two significant associated factors: a hospital stay of more than two days and dependence on oxygen therapy. These results underline the importance of establishing systematic and early screening for deafness in maternity and neonatology services, particularly for at-risk newborns.

Clinical Benefits, Care, and Prevention of Neonatal Deafness

Early and systematic screening for neonatal deafness has major clinical benefits. Early diagnosis allows for rapid intervention, including the use of hearing aids, cochlear implants, and the implementation of auditory rehabilitation and parental support programmes. This significantly improves language acquisition, cognitive development, and social integration for children with neonatal deafness. In terms of prevention, raising awareness among families and healthcare professionals about risk factors, such as prolonged hospital stays and dependence on oxygen therapy, is essential to reduce the incidence of this condition.

Study Limitations

This study has certain limitations. Firstly, the study period was limited to four months, which may not reflect the annual prevalence of neonatal deafness in this population. Additionally, data were collected only in urban reference hospitals, which may not represent the situation in rural areas where resources are more limited and medical practices may vary. Finally, some potential risk factors, such as maternal infection or exposure to ototoxic substances, could not be included in this analysis, which may influence the results.

Perspectives

In the future, it would be beneficial to expand this study to other regions of Cameroon, including rural

areas, to obtain a more representative estimate of neonatal deafness prevalence across the country. Increasing the study duration to include larger samples and conducting further research on additional risk factors, such as maternal infections and ototoxic substances, would enhance our understanding of the determinants of neonatal deafness. Finally, implementing systematic neonatal hearing screening programmes in Cameroonian hospitals, along with early follow-up and intervention protocols, would be a crucial investment for the development and social integration of children with deafness.

Ethical Approval and Consent to Participate

Studies involving human participants were reviewed and approved by the Institutional Ethics Committee for Health Research at Douala General Hospital and the University of Douala. Written informed consent for participation in this study was obtained from the legal guardian/closest relative of the participants.

Availability of Data and Materials

The raw data supporting the conclusions of this article will be made available by the authors without undue restriction and upon reasonable request by the applicant.

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Conflict of interest : None

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