

Burden, Associated Factors and Outcome of Jaundice among Babies seen at a Tertiary Hospital in Northern Nigeria.

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ABSTRACT

Background: Jaundice is the yellowish discolouration of the skin and sclera resulting from the deposition of excess bilirubin (hyperbilirubinaemia) on the skin and mucous membranes. Most cases of neonatal jaundice are self-limiting with an excellent prognosis but in some cases complications can ensue. Bilirubin encephalopathy is an uncommon but devastating complication of severe hyperbilirubinaemia which if untreated can lead to kernicterus with eventual risk of death or long-term neurodevelopmental impairments. The aim of this study was to assess the prevalence, associated factors and outcome of neonatal jaundice in Special Care Baby Unit of a tertiary hospital in Bauchi, Nigeria. **Methods:** This retrospective descriptive study was conducted over a one-year period. Information captured included sociodemographic variables, maternal obstetric history, and physical findings of babies. Jaundice was assessed both clinically using visual assessment as the yellowish discolouration of sclera and mucous membranes and laboratory assessment using Selectra ProS chemistry analyser. Data was analyzed using SPSS version 20; both descriptive and inferential statistics were used where appropriate. **Results:** One hundred and twenty (16%) out of 748 babies admitted were diagnosed with jaundice during the study period. Of these, 65 (54.2%) were males and 55 (45.8%) were females giving a M: F ratio of 1.2:1. Majority of the babies developed jaundiced within the first 72 hours of life. Sepsis (72.5%), ABO Incompatibility (25.8%) and prematurity (22.5%) were the leading causes of neonatal jaundice. All babies had phototherapy (100%) while only 29 (24.2%) of them had EBT. The number of patients with BIND score of 4-6 (10.8%) and 7-9 (10.0%) were similar. A majority of the patients (81%) were discharged, eight (6.7%) were discharged against medical advice (DAMA) and 14 (11.7%) cases resulted in mortality. **Conclusion:** Neonatal jaundice is a common cause of morbidity and mortality in our environment, predominantly affecting males. Sepsis is identified as a significant causative factor. Effective management and early intervention are crucial in reducing the burden of this condition.

Keywords: Neonatal jaundice, Male, Sepsis, Outcome

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Introduction

Jaundice is derived from the French word *Juane* which means yellow.¹ Neonatal jaundice (NNJ) is the yellowish discoloration of the skin,

sclera, and mucosa caused by excess accumulation of bilirubin in the tissue and plasma (serum bilirubin level should be in excess 5mg/dl). It occurs in up to 60-80% of neonates as well as 10% of breastfeeding babies.² Most cases of NNJ are self-limiting with an excellent prognosis. However, devastating complications like bilirubin encephalopathy can occur and if left untreated can lead to chronic bilirubin encephalopathy or kernicterus.¹⁻³

Neonatal jaundice is a common clinical problem worldwide. The incidence, aetiological and

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contributory factors to NNJ differs with ethnicity and geographical distribution.^{4,5} Globally, about 1.1 million babies develop severe hyperbilirubinaemia with or without bilirubin encephalopathy annually; this burden is highest in low and middle income countries^{6,7}, majority of which resides in sub-Saharan Africa and South Asia.^{1,8} The global prevalence of severe NNJ is highest in Africa (667.8 to 738.5/1000 live births), followed by Southeast Asia (251.3 to 473.2/1000 live births), with considerably lower rates in the Americas (4.4 /1000 livebirths) and Europe (3.7 /1000 livebirths).¹ It accounted for 1309 deaths per 100 000 livebirths in 2016 and ranked seventh globally among all causes of neonatal deaths in the first week of life.² Among the top ten countries with jaundice-related neonatal mortality is Nigeria.¹

In Nigeria, the incidence of jaundice is about 100 times higher than in developed countries, with 6.9% and 35% of admissions into the SCBU due to jaundice with varying predisposing factors.^{9,10} A study in developed countries reveals blood group incompatibilities as the leading causes of neonatal jaundice⁷ whereas several independent studies in Africa have identified prematurity, sepsis, blood group incompatibilities, glucos-6-phosphate dehydrogenase (G6PD) deficiency and poor breastfeeding practices as common precipitating factors of NNJ.^{4,5,9,11,12}

Severe NNJ leads to acute bilirubin encephalopathy or kernicterus with a significant risk of neonatal mortality and long-term neurologic damage such as cerebral palsy, sensory neural hearing loss, intellectual difficulties, or gross developmental delays.^{1,6,7,13,14} It is estimated to account for 75% hospitalization and hospital readmissions in newborns.¹⁴ Neonatal jaundice also increases the economic and social burden on the families and societies. While developed countries have well-developed systems to identify, investigate, and manage NNJ, LMICs still require further studies and system development to adequately address the issue. Understanding the determinant factors of jaundice is crucial to the prevention and control. Investigating the underlying factors responsible for NNJ cases is essential to prevent the devastating morbidity and mortality associated with this condition. An evidence-based strategy for prevention, early detection, and treatment of NNJ is needed. Therefore, determining the burden and identifying the associated factors of neonatal jaundice in this

environment has paramount importance in mitigating jaundice-related neonatal morbidity and mortality, hence the reason behind this study. Consequently, this study would help in formulating measures of improving preventive strategies, early detection, and management of neonatal jaundice.

Methods

Study Design and Setting

This was a retrospective cross-sectional study. The study was conducted at the SCBU of Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH), Bauchi. ATBUTH is a federal tertiary health care facility located in Bauchi metropolis, Bauchi state, north-east Nigeria. The SCBU admits all neonates (babies in their first 28 days of life) in the hospital and has a capacity of 22 beds (including incubators). The unit is divided into in-born and out-born sections. The in-born unit admits babies delivered within ATBUTH while the out-born unit caters to babies delivered outside the hospital or those initially delivered in ATBUTH but later discharged and then readmitted after contact with the community. The SCBU averages 900 admissions annually.

Study Population

All neonates with clinical and laboratory confirmation of neonatal jaundice admitted and managed in the SCBU of ATBUTH between October 1, 2021 and September 30, 2022 constitute the population for this study.

Data Collection Tool and Procedures

The information of the patients admitted and managed for jaundice in the SCBU were obtained from their medical records. The study proforma was developed by reviewing previous similar studies^{9,15} that consist of all the variables that met the objective of the study. Information taken included sociodemographic factors, maternal obstetric history, maternal age, blood group, occupation, and educational status, paternal age, occupation and educational status and neonatal age at presentation, gestational age, gender and blood group.

Clinically, jaundice is defined as the yellowish discolouration of the skin and sclera while bilirubin-induced neurologic dysfunction is when any feature of neurologic deficit is present using the bilirubin-induced neurologic dysfunction score (BIND) chart. Any baby with BIND score of 1 and above is said to



have neurologic deficit. Scores of 1–3 are consistent with subtle signs of acute bilirubin encephalopathy. Scores of 4–6 represent moderate acute bilirubin encephalopathy while scores of 7–9 represent advanced acute bilirubin encephalopathy.¹⁶ All babies with jaundice had their serum bilirubin (SB) assayed in the chemical pathology laboratory.

Laboratory Procedures

Blood samples for serum bilirubin assay were obtained after securing intravenous access from a peripheral vein or umbilical central vein, following appropriate skin disinfection with alcohol swabs and after air drying of the swabbed skin. The samples were transported to the laboratory immediately after collection and exposure to direct sunlight was avoided by wrapping the sample container in aluminium foils. Serum bilirubin was analysed using Selectra ProS chemistry analyser, which uses the principle of colorimetry. The machine readings are expressed in $\mu\text{mol/L}$.

Ethical clearance:

Ethical approval was obtained from the ATBUTH Health Research Ethics Committee. Informed written consent was obtained from parents or caregivers after thorough explanation of the study. All babies aged 0–28 days old (term or preterm) with clinical and laboratory confirmation of jaundice whose parents/caregivers consented were consecutively recruited into the study. Babies whose parents/caregivers did not give consent and those without laboratory confirmation of jaundice were excluded.

Data Processing and Analysis

Data was entered using the Excel spreadsheet and exported to SPSS version 20. The result was presented using numerical values, texts, percentages, tables and frequencies. Model fitness was checked by the Hosmer and Lemeshow test.

Management protocol

Identified clinically jaundiced babies in the SCBU were treated in accordance with the standard protocol for managing NNJ.¹⁷ Antibiotics were used in babies with clinical and or laboratory features of sepsis.

Results

A total of 748 neonates were admitted into the SCBU during the period under review, out of which 120 were managed for NNJ, giving a prevalence of 16%. There were more males (65, 54.2%) with jaundice than females (55, 45.8%)(Table I). Majority of the babies developed jaundiced within the first 72 hours of life while it was less common after 7 days of life. Over fifty percent (56.7%) of the babies had a BIND score of 0 while 10% had in the range of 7–9. More than 75% of the babies were on exclusive breastfeeding. The majority of the mothers were in their twenties (69%) and also multiparous (66.7%). High socio-economic class (SEC) families had more cases of jaundice (41.7%) compared to the other 2 SEC classes, with more mothers attaining the highest level of education (40%) based on the Oyedeji social class classification. Table I



Table I: Sociodemographic variables of jaundiced babies and their mothers

Variables	Frequency	Percentage (%)
Sex		
Male	65	54.2
Female	55	45.8
Age at presentation (days)		
1-3	61	50.8
4-6	41	34.2
>=7	18	15.0
BIND Score		
0	68	56.7
1-3	27	22.5
4-6	13	10.8
7-9	12	10.0
Feeding method		
Breastfeeding	91	75.8
Breastmilk substitute	15	12.5
No breastfeeding	14	11.7
Mother's age (years)		
15 - 19	8	6.7
20 - 24	32	26.7
25- 29	37	30.8
30- 34	25	20.8
>35	18	15.0
Parity		
Primipara	40	33.3
Multipara	80	66.7
Mother's educational status		
Non formal	7	5.8
Primary	17	14.2
Secondary	47	39.2
Tertiary	49	40
Social class		
High	50	41.7
Middle	34	28.3
Low	36	30.0

Table 2 shows the aetiological factors of neonatal jaundice. The leading cause of NNJ was sepsis 87 (72.5%), followed by ABO incompatibility 31

(25.8%) and prematurity 27 (22.5%). Rhesus isoimmunization was seen in only 6.7% of cases.



Associated Factors and Outcome of Jaundice Among Babies

Table 2: Aetiologic factors of NNJ

Aetiological factors	Frequency	Percentage
Neonatal sepsis	87	72.5
ABO incompatibility	31	25.8
Prematurity	27	22.5
Rhesus isoimmunization	8	6.7
Perinatal asphyxia	6	5.0

Table 3 shows the treatment modalities with their outcome. All patients admitted with NNJ were started on phototherapy. Hence all 120 (100%) cases had phototherapy as a modality of treatment while only 29 (24%) cases had double volume exchange blood transfusion (EBT) in addition to phototherapy. About 102 (85%) of the cases with features to suggest or confirmed sepsis had one

antibiotic or the other. The commonest antibiotic used was cefuroxime followed by a combination of cefuroxime and gentamycin.

Majority of babies (81.6%, 79.3%, and 81.3%) were discharged from each of the 3 categories of treatments. Mortality was highest with babies that had phototherapy (11.6%) while those that had EBT had 3.3% mortality.

Table 3: Treatment of neonatal jaundice and their outcome

Outcome	Phototherapy	Exchange blood transfusion	Antibiotic usage
Discharge	98 (81.6%)	23 (79.3%)	83 (81.3%)
DAMA	8 (6.6%)	2 (6.9%)	8 (7.8%)
Dead	14 (11.6%)	4 (13.8%)	11(10.8%)
Total	120	29	102



Discussion

This study revealed that the prevalence of neonatal jaundice in our facility was 16%. Jaundice occurred more in males and also within the first 3 days of life. A majority (58.7%) of the study participants had BIND score of 0. Sepsis accounts for the majority of the causes of NNJ with perinatal asphyxia being the least. Phototherapy was used in all babies with jaundice while only 29 (24.2%) of them had EBT in addition to phototherapy. The majority of the patients (81%) recovered and were discharged from the unit, 8 patients signed DAMA while 14 (11.7%) patients died. The frequency of occurrence of NNJ (16% of SCBU admissions) observed in our study is high and this is in agreement with the fact that NNJ is one of the leading causes of neonatal morbidity as noted even in previous reports in Nigeria and beyond. Awe and colleagues from Ekiti¹⁸ (southwest, Nigeria), reported a prevalence of 15% similar to what we observed. Similarly, Omekwe et al⁴ also from the southern Nigeria (Bayelsa), reported a prevalence of 17.9%. Other studies reported much higher values ranging from 32- 84%; Oppong et al⁵ from Cape Coast Ghana reported 32.9%, Chime and colleagues from Delta (South-south) Nigeria 33%, Onyearugha and Colleagues⁹ in Abakaliki (south-east) Nigeria- 35%, Khound and Sharma¹⁹ in Assam, India 61.8%, Bhutani et al²⁰ in California reported 84%. Our value is higher than those reported by Olusanya et al¹⁰ in Lagos, (southwest) Nigeria -6.7%, Olubanke and colleagues in Akure, (southwest) Nigeria- 9.5%, Pius and colleagues¹² in Maiduguri (Northeast) Nigeria- 10%, Bowassa et al²¹ in Brazzaville, Congo- 7.2% while Jacob and colleagues²² in Timisoara, Romania reported the prevalence to be 1.71%. The varying prevalence rates from all these regions suggests that varying aetiological factors including racial factors and cultural practices influencing the prevalence (of occurrence of the disease).^{4,5,17}

The finding of male gender predilection (54% Vs 45%) from our study is in agreement with several reported studies.^{1,4,18,23,24} The reason may not be unrelated to the fact that male gender is believed to generally have lower level of G6PD enzyme than their female counterparts resulting in a higher tendency for haemolysis and by extension a higher likelihood of NNJ. Though in this study G6PD assay was not done in any of the patients due to unavailability of the test in our environment, it could have further elucidated this known association.

Approximately, 58% of the babies develop NNJ within the first three days of life, supporting findings from other studies^{4,18,24}, which showed that NNJ is common among neonates in the first week of life. This early occurrence may be attributed to prematurity, sepsis, or the higher educational level and multiparity of the mothers, leading to earlier hospital presentations. Factors like previous NNJ in a siblings or maternal knowledge of NNJ were not assessed in this study.

Sepsis was identified as the leading cause of NNJ, followed by ABO incompatibility and then prematurity. Sepsis causes haemolysis of the red blood cells as well as hepatic dysfunction that leads to accumulation of serum bilirubin in the body. This finding aligns with previous reports from other parts of the country^{9,25,26} but contrasts with reports of G6PD deficiency, ABO incompatibility, prematurity, and 0 received phototherapy in line with the protocol for management of NNJ in our unit. Exchange blood transfusion was performed on 24% of the cases with severe NNJ often within the first 24 hours of admission. West and Colleague¹¹ reported a much lower rate of EBT (8.4%) from Port Harcourt (south south), Nigeria. Eight-five percent (85%) of the jaundiced cases had one form of antibiotic or the other with commonest being intravenous cefuroxime. This is not surprising as majority of the babies had sepsis as a cause of their jaundice. There is considerable overlap as some had combination of the 3 modalities while others had phototherapy and antibiotic combination. This observation is similar to reports from previous studies.^{4,9,24}

Majority (81.6%) of the patients were discharged home. This is similar to previous reports.^{4,9,12,23} Eight babies (6.6%) signed DAMA. Oluwafemi et al²⁶ in Akure (south-west) Nigeria, reported DAMA to be 2.4%. Mortality occurred in 14 (11.6%) patients, with four of them having undergone EBT. This mortality rate is similar though slightly lower than that reported by Pius et al¹² in Maiduguri (northeast) Nigeria, but much lower than that reported by Onyearugha⁹ in Abakaliki, (southeast) Nigeria. Our findings suggests that combination therapy for severe NNJ is associated with better outcomes corroborating a study that showed a 96% survival rate with combined treatments.²⁶

Limitation

Due to the unavailability of screening test for G6PD enzyme, the potential relationship between G6PD



deficiency, Male gender and NNJ could not be explored. The retrospective nature of our study, and small sample size, makes it difficult to generalize our findings.

Conclusion

Neonatal jaundice is a common cause of morbidity and mortality among neonates in our environment. Jaundice was found to occur commonly within the first 72 hours of life. Male gender may be a potential risk factor of NNJ. Sepsis is a significant and leading cause of NNJ in our environment. The utilization of combination therapy for NNJ is associated with better outcome.

Recommendation

There is need for more extensive prospective studies to identify risk factors (both modifiable and non-modifiable) and the rate of complications like kernicterus and cerebral palsy. Public enlightenment on personal hygiene, environmental sanitation, and infection prevention is crucial, given sepsis's prevalence as a cause of NNJ.

Declaration of conflict of interest

The authors declare no conflicts of interest.

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