

Full Length Research Paper

Neonatal jaundice: Prevalence and associated factors as seen in Federal Medical Centre Abakaliki, Southeast Nigeria

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To determine the occurrence, aetiological and other associated factors of neonatal jaundice in Federal Medical Centre Abakaliki, Southeast Nigeria with a view to determining strategies for prevention, using patients' and maternal case folders and Neonatal Intensive Care Unit (NICU) admission register, all cases of neonatal jaundice (NNJ) admitted to Federal Medical Centre, Abakaliki from January 1st 2008 to December 31st 2009 were retrospectively studied. The study revealed that NNJ accounted for 35% of all NICU admissions. The leading aetiological factors of NNJ were septicaemia (32.5%) and prematurity (17.5%). Significant bilirubinaemia, septicaemia, contact with naphthalene ball contaminated clothes occurred significantly more in the outborn than in the inborn babies 40(48.2%) vs 66(63%) $p = 0.000$, 33(50%) vs 17(42.5) $p = 0.046$, 6(9.1%) vs 0(0.0%) $p = 0.045$ respectively. Significantly more mothers of outborn than of inborn babies were unbooked and took herbal medications in pregnancy. Overwhelming majority of the subjects (89.6%) developed jaundice within the 1st week of life. Significantly more inborn than outborn were preterm and exclusively breastfed, 25(30.1%) vs 14(19.7%) $p = 0.001$; 75(90.4%) vs 9(12.7%) $p = 0.000$ respectively. Also, significantly more outborn than inborn babies had exchange blood transfusion and kernicterus, 27(38%) vs 5(6%) $p = 0.000$; 14(19.7%) vs 1(1.2%) $p = 0.000$ respectively. Hence, there is need for sustained education of the general populace on the essence of regular antenatal supervision of pregnancy and delivery in appropriate health care facility to ultimately curb the incidence of severe NNJ.

Key words: Neonatal jaundice, aetiological factors, Abakaliki.

INTRODUCTION

Neonatal jaundice is a very common condition worldwide occurring in up to 60% of term and 80% of preterm newborns in the first week of life (Slusher et al., 2004; Haque and Rahman, 2000). Even though extreme hyperbilirubinaemia is rare in developed countries it is still quite rife in developing countries often resulting in kernicterus with its attendant medical, economic and social burden on the patient, family and society at large (Wang et al., 2005; Ho, 2002). The incidence, aetiological and contributory factors to neonatal jaundice vary

according to ethnic and geographical differences (Ipek and Bozayakut, 2008). Unlike the developed countries where feto-maternal blood group incompatibilities are the main causes of severe neonatal jaundice, it is mostly prematurity, G6PD deficiency, infective causes as well as effects of negative traditional and social practices such as consumption of herbal medications in pregnancy, application of dusting powder on baby, use of camphor balls to store baby's clothes that mainly constitute the aetiology in developing countries (Olusanya et al., 2009; Eneh and Ugwu, 2009; Oladokun et al., 2009; Owa and Ogunlesi, 2009). Severe neonatal jaundice can therefore be said to have modifiable risk factors particularly in developing countries (Sarici et al., 2004).

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This study sets out to determine the prevalence and associated factors of neonatal jaundice in Federal Medical Centre, Abakaliki, Ebonyi State, South east Nigeria. It is hoped that the result would be a necessary tool in formulating measures of prevention, early detection, and management of severe neonatal jaundice thereby reducing the disease burden in the community.

METHODOLOGY

This was a retrospective study conducted in the Neonatal Intensive Care Unit (NICU) of Federal Medical Centre (FMC), Abakaliki, Ebonyi State, Southeast Nigeria from 1st January 2008 to 31st December 2009. The hospital is a baby-friendly health care institution and one of the two secondary health care facilities located in Abakaliki, the fast-growing capital of Ebonyi State which also harbours the State University Teaching Hospital, a tertiary health care centre. Its annual delivery rate averages approximately 1,500 while the annual paediatric and neonatal admissions are approximately 1,331 and 230 respectively.

Management protocol of neonatal jaundice

Identified clinically jaundiced newborns in the hospital have their serum bilirubin (SB) level determined immediately. Those with jaundice noticed on the first day of life, conjugated bilirubinaemia, bilirubinaemia above the expected level for age and gestational age as well as other clinical and/or laboratory presentation necessitating admission are admitted for further investigations and management (Chan, 1994). These also constituted the subjects of this study. Phototherapy is commenced when jaundice is noticed within 24 h of life, SB level rises more than 5 mg/dl (85 $\mu\text{mol/L}$) per 24 h or attains a level of up to 12 mg/dl (200 $\mu\text{mol/L}$) in preterms or earlier in the very immature, or above 15 mg/dl (255 $\mu\text{mol/L}$) in term babies with unconjugated bilirubinaemia. It is stopped when there is a progressive decline in SB level to less than 170 $\mu\text{mol/L}$ which continues after withdrawing the source (Chan, 1994).

Septicaemia is defined as clinically ill newborn with positive bacterial blood culture result (Ipek and Bozayakut, 2008) in the inborn, or laboratory haematological features (including toxic granulations, neutrophilic band forms on blood film) with or without positive body fluid culture result in the outborn.

Diagnosis of kernicterus is made on the basis of unconjugated hyperbilirubinaemia of more than 340 $\mu\text{mol/L}$ in the term newborn or 200 $\mu\text{mol/L}$ in preterm with features such as poor sucking, vomiting, drowsiness, hypotonia in the early type, or hypertonia, paralysis of upward gaze, high pitched cry, opisthotonus, involuntary movements, high fever and convulsions in the established category (Chan, 1994).

Medical treatment is used in the management of sepsis and other abnormalities in the clinical state and laboratory results of patients. Exchange blood transfusion (EBT) is used in the management of severe unconjugated bilirubinaemia of 340 $\mu\text{mol/L}$ SB level or more in term newborns or less in preterms or additionally babies, newborns with early kernicterus, septicaemia with disseminated intravascular coagulation with bleeding and anaemia, hypoxaemia in hyaline membrane disease and to remove drugs in depressed newborns (Chan, 1994).

The Neonatal Intensive Care Unit (NICU) admission register was reviewed and the registration numbers of all neonates admitted and managed for NNJ were noted. The registration numbers were used to retrieve the admission folders from the Medical Records Department. Maternal case folders for inborns were also retrieved. Relevant information extracted included age of the newborn,

whether inborn or outborn, booking status, place of antenatal supervision of unbooked mothers, taking of herbal drugs by mother in pregnancy, use of naphthalene balls in storing clothes used in carrying or worn by babies, age at onset of jaundice, gestational age, mode of feeding of the newborn, aetiological factors, maximum level of serum bilirubin, mode of treatment, complications of therapy, duration of admission and outcome of treatment. The total number of neonatal admissions over the study period was also derived.

Sample means and percentages were calculated, from which a simple frequency table was created. Data were analysed using soft ware EPI-info version 6.04 and SPSS version 11. P values less than 0.05 were considered as significant.

The study was approved by the Ethics Committee of the hospital before it was commenced.

RESULTS

During the 24 month study period 160 neonates were managed for neonatal jaundice (NNJ) while the overall number of neonatal admissions in the NICU was 457, hence NNJ accounted for 35.0% of all NICU admissions. Six of the newborns were excluded due to inadequate data, so 154 comprising 83 inborn and 71 outborn babies were used for further analysis. Out of the 83 inborn babies, 46(55.4%) were males and 37(44.6%) were females giving a male/female ratio of 1.2:1. Also, 40 of the outborn babies (56.3%) were males and 31(43.7%) females giving a male/female ratio of 1.25:1. Significant bilirubinaemia (SB level > 169 $\mu\text{mol/L}$) occurred significantly more in outborn babies 66(63%) than in inborn newborns 40(48.2%) ($p = 0.000$, Table 1).

The leading aetiologic factors of NNJ in the 40 inborn babies with significant bilirubinaemia were septicaemia 17(42.5%) and prematurity 13(32.5%) (Table 1). Also, the predominant aetiologic factors of NNJ in the outborn babies were septicaemia 33(50%), and prematurity 14(21.2%) (Table 1). Significantly, more outborn than inborn babies had septicaemia $p = 0.046$ (Table 1). Contact with naphthalene ball contaminated clothes occurred significantly more in the outborn 6(9.1%) than in inborn babies 0(0%) ($p = 0.045$, Table 1).

NNJ due to Rhesus incompatibility was not encountered in the study. Eighty of the mothers of the inborn subjects (96.4%) were booked and were significantly more than 30 of those of outborn babies (42.3%) that were booked. $P = 0.000$. Places of antenatal supervision of mothers of outborn babies were as follows: traditional birth attendants' place, 25(35.1%); private maternity, 20(28.2%); churches, 10(14.1%); private clinic, 10(14.1%); none, 6(8.5%).

Two of the mothers of inborn babies (2.4%) and 25 of those of outborn newborns (35.2%) took herbal medications in pregnancy with the difference between them being statistically significant $p = 0.000$.

The mean maximum SB of the outborn subjects was 334.2 $\mu\text{mol/L}$ (range 156.6 - 526.2 $\mu\text{mol/L}$) and that of the inborn subjects 276.7 $\mu\text{mol/L}$ (range 96.4 - 364.4 $\mu\text{mol/L}$).

The median age of the inborn subjects at onset of neonatal jaundice was 4 days (range < 1 to 9 days).

Table 1. Aetiological factors of neonatal jaundice in the subjects with significant bilirubinaemia.

Aetiological factor	Number of inborn subjects (%)	Number of outborn subjects (%)	P value
Significant Bilirubin			
anemia	40(48.2)	66(63.0)	0.000
Sepsis	17(42.5)	33(50.0)	0.046
Prematurity	13(32.5)	14(21.2)	0.128
Cephal haematoma	4(10.0)	1(1.5)	0.548
ABO incompatibility	3(7.5)	4(6.1)	0.761
Contact with naphthalene ball contaminated cloth	0(0.0)	6(9.1)	0.045
Severe anaemia	0(0.0)	1(1.5)	
Biliary atresia	0(0.0)	2(3.0)	
Unknown	3(7.5)	5(7.6)	

Overwhelming majority, 82(97.6%) of the inborn babies developed jaundice within the first week of life. The median of age of the outborn babies at onset of jaundice was 4 days (range <1 - 15 days). Eight (9.6%) of the inborn babies and 16 of the outborn subjects (22.5%) developed jaundice on the first day of life respectively with a significant difference ($p = 0.035$) between them. Also, majority of the outborn babies, 56(78.9%) developed jaundice within the first week of life. Fifteen outborn babies (21.1%) and 2 inborn newborns (2.4%) developed jaundice after the 1st week of life with the difference between them being significant ($p = 0.000$).

The median of age of the inborn subjects at presentation was 4 days (range <1 to 9 days). Overwhelming majority of the inborn newborns 79(95.2%) presented in early neonatal life (within 7 days of birth). The median of age at presentation of outborn babies was 6 days (range <1 to 22 days). Smaller majority of the outborn babies, 51(71.8%) presented in the first week of life. Significantly more outborn, 20(28.2%) than inborn babies 4(4.8%) presented beyond the first week of life ($p = 0.000$).

The mean gestational age of the inborn subjects was 37.2 weeks (range 28 to 43 weeks) while that of outborn subjects was 38.7 weeks (range 32 - 43 weeks). Preterm delivery occurred significantly more in the inborn babies, 25(30.1%) than in the outborn subjects 14(19.7%) ($p = 0.001$).

Seventy-five of the inborn babies (90.4%) and nine of the outborn subjects (12.7%) were exclusively breast-fed with a significant difference ($p = 0.000$) being between them.

Twenty-six of the inborn (31.3%) and 8 of the outborn babies n(11.3%) had phototherapy only while 25 of the inborn subjects (30.1%) and 35 of the outborn newborns (49.3%) received medical treatment with the difference between them being significant $p= 0.001$, $p=0.045$ respectively. Medical treatment administered to the inborn subjects was for sepsis 17, hypoglycaemia, 3, hypocalcaemia, 3 and respiratory distress syndrome, 2; whereas for the outborn babies, it was for sepsis, 33, and

hypocalcaemia, 2. Five inborn neonates (6%) underwent exchange blood transfusion (EBT) and were significantly less than 27 outborn subjects (38%) who had the same procedure ($p = 0.000$). All the EBTs were double-volume. In all, 38 were done: 5 on the 5 inborn babies and 33 on the 27 outborn subjects. Twenty-eight of the inborn babies (33.7%) had spontaneous decline of SB level and ultimately no intervention.

The median of duration of admission for the inborn babies was 6 days (range 4 to 54 days) while that for the outborn newborns was 9 days (range 5 to 52 days). However, 26 of all the inborn babies (31.3%) and 43 of all the outborn babies (60.6%) were admitted for > 7 days with the difference between them being significant ($p = 0.000$).

Fifteen of the overall subjects (9.7%) made up of 14 of the outborn babies (19.7%) and 1 of the inborn baby (1.2%) developed kernicterus with a significant difference between them $p = 0.000$. All the six outborns who had contact with naphthalene ball contaminated clothes were among the subjects that developed kernicterus.

Documented adverse events arising from intervention procedures occurred in 16 of the subjects (10.4%) and included development of malaria parasitaemia and fever within 72 h after exchange blood transfusion in 10 subjects (6.5%), (3 inborn and 7 outborn); severe anaemia in 2 subjects (outborn); hypocalcaemia in 2 (outborn) and hypoglycaemia in 1 (inborn), each manifesting with seizures. Each of these was managed appropriately. Also 1 death within 6 h after EBT occurred of an outborn admitted with severe NNJ with bilirubin encephalopathy and gasping.

One hundred and forty-one of the subjects (91.6%) comprising 80 of inborn subjects (95.2%) and 61 of outborn subjects (85.9%) were discharged home; 8 (5.2%), comprising 2 inborn babies (2.4%) and 6 outborn babies (8.5%) died; while 2 and 3 outborn babies were referred and withdrawn contrary to medical advice respectively. Four of the 8 deaths were due to sepsis and the other 4, kernicterus. The 2 dead inborn babies were cases of sepsis and kernicterus respectively, while 3 of

the 6 outborn babies died of sepsis and the other 3, of kernicterus. The 2 referred outborn subjects were cases of biliary atresia while the 3 outborn subjects withdrawn by the parents contrary to medical advice had kernicterus.

DISCUSSION

The occurrence of neonatal jaundice of 35.0% of NICU admissions observed in this study goes to confirm NNJ as among leading causes of neonatal morbidity as noted even in previous reports in Nigeria and other parts of the world, ranging between 10 to 35% of neonatal admissions (Ipek and Bozayakut, 2008; Sarici et al., 2004; Sarici et al., 2002; Alpay et al., 2000; Azubuike, 1985; Ahmed et al., 1995; Udo et al., 2008; Ezechukwu et al., 2004; Udoma et al., 2001). Significant bilirubinaemia occurred significantly more in the outborn than in the inborn subjects. This agrees with the observation in previous surveys (Owa and Ogunlesi, 2009; Ahmed et al., 1995). The study has also demonstrated septicaemia followed by prematurity as the leading aetiological factors of NNJ in the hospital with septicaemia occurring significantly more in the outborn babies. While Ahmed et al. (1995) from northern Nigeria and Owa and Ogunlesi (2009) from Ile-Ife, southern Nigeria reported septicaemia and G6PD deficiency as well as prematurity and G6PD deficiency as leading causes of NNJ respectively, Ho from Asia documented ABO incompatibility and G6PD deficiency as the leading causes (Ho, 2002). Unfortunately, for lack of facilities, G6PD assay was not done in this study. It is also noteworthy that the aetiology of NNJ in 8 of the subjects in this study was unknown and that 6 subjects developed severe jaundice on exposure to naphthalene ball contaminated clothes. Naphthalene is one of the drugs causing haemolysis and jaundice in G6PD deficient subjects (Ipek and Bozayakut, 2008).

The study also revealed that significantly more of the mothers of outborn babies were not booked. Also, significantly more of these outborn babies developed septicaemia. Lack of booking by pregnant women in Nigeria and indeed developing counties in general is rife (Udo et al., 2008; Ezechukwu et al., 2004). Expectant women, unfortunately often patronize unorthodox places including traditional birth attendants and churches for purposes of pregnancy supervision and delivery. Often, the attendants and employees in these settings are at best inadequately trained for the purpose and practise in unhygienic environment ultimately resulting in septicaemia in the newborn. Early booking, effective and regular attendance to antenatal care, optimum maternal nutrition and delivery in appropriate health care facility can help to curb the incidence of prematurity and septicaemia thereby reducing the incidence of severe NNJ in the community (Welbeck et al., 2003).

Significantly, mothers of the outborn babies with

significant bilirubinaemia took herbal drugs. Maternal use of herbal medications being associated with severe NNJ has been reported previously from Lagos, southern Nigeria (Olusanya et al., 2009), though in a much earlier study in the north observed that the association was not significant (Ahmed et al., 1995). Overwhelming majority of the subjects (97.6% of the inborn and 60.6% of the outborn babies) developed jaundice in early neonatal life (within 7 days of birth) (Udo et al., 2008; Udoma et al., 2001). This observation has been reported in previous studies and could be readily explained by the fact that most causes of neonatal jaundice including prematurity and septicaemia, even as observed in this study often manifest in early neonatal life. Significantly more outborn babies developed jaundice post early-neonatal life. This could be related to septicaemia from environmental contamination due to delivery in unhygienic circumstances.

Prematurity was the second leading cause of NNJ in both the inborn and outborn babies. Preterm newborns are prone to developing jaundice due to immaturity of their bilirubin conjugating system, higher rate of haemolysis, increased enterohepatic circulation and decreased caloric intake (Chan, 1994).

Overwhelming majority of the inborn babies, 90.4% in this study were exclusively breastfed and were significantly more than 12.7% of the outborn babies fed likewise. Severe NNJ occurring in exclusively breast-fed infants even as in this survey, has been documented previously (Olusanya et al., 2009). This could be explained, at least in part, by reduced intake of calories, dehydration and jaundice associated with breastfeeding. Rooming-in and breastfeeding on demand which provide adequate calories and hydration help to reduce the incidence of severe NNJ in exclusively breast-fed newborns. Though 28 of the inborn babies (33.7%) had spontaneous regression of their SB level without intervention, the contribution of jaundice associated with breastfeeding (which can subside spontaneously) cannot be ascertained. Factors that can possibly result in regression of such SB level in these babies without medical intervention (though not investigated in this study) include passage of meconium and adequate caloric intake (Chan, 1994).

Significantly more outborn than inborn babies were admitted for more than 7 days. This could be explained by the fact that the outborn babies were generally more seriously ill and needed longer duration of admission for effective treatment.

20.8% of the patients had EBT in this survey. This is greater than EBT rate of 5.8% reported by Owa and Ogunlesi from southwest Nigeria (Owa and Ogunlesi, 2009). However, their calculation was based on overall neonatal admission. It is noteworthy that EBT is an invasive procedure fraught with potentially serious risks and it is being increasingly abandoned for effective phototherapy in advanced countries (Owa and Ogunlesi,

2009).

Fifteen of the overall subjects (9.7%) comprising 14 outborn babies (19.7%) and 1 inborn (1.2%) developed kernicterus. This is similar to the incidence of kernicterus of 20.3 and 2.6% in outborn and inborn babies respectively reported from Zaria (Ahmed et al., 1995). Improperly supervised pregnancy and outborn delivery are often associated with development of more severe jaundice and later presentation of affected newborns to the hospital often requiring EBT and resulting in lifelong morbidity and mortality.

Adverse events following intervention procedures occurred in 10.4% of the subjects comprising mostly malaria parasitaemia and occurrence of fever within 72 h. This is not surprising since malaria is endemic in the population and blood for transfusion is not screened and discarded for the presence of malaria parasites. One death that occurred about 3 h after an EBT procedure in an outborn subject with bilirubin encephalopathy and gasping might not be categorically classified as procedure-related death since the baby was *ab initio* gravely ill. However, Jackson reported 3 deaths/1000 procedures of EBT-related deaths in a previous study (Jackson, 1997).

Of the eight deaths recorded in this study, 6 occurred in outborn babies. This was because the outborn babies presented in a more severely ill state with higher SB levels and relatively late. This further underscores the need for pregnant women to have their antenatal supervision and delivery in appropriate healthcare facilities where they receive proper pregnancy management and counselling on the care of their yet to be born baby with delivery under skilled supervision and hygienic circumstances.

Conclusion

The hospital prevalence of neonatal jaundice in this study is quite high. Effective and sustained health education of the citizenry and particularly expectant women on the need for early booking, regular antenatal supervision of pregnancy and delivery in appropriate health facility, as well as on early signs of NNJ and prompt presentation of affected newborn for appropriate medical care must be implemented forthwith to curb this unacceptable position.

LIMITATION OF THE STUDY

This being a retrospective study did not afford the authors the opportunity to actively enquire for the application of dusting powder on the subjects as a possible cause of NNJ. Lack of facility for assay of the G6PD status of the subjects denied the investigators of the opportunity to highlight possible cases of NNJ with this well acknowledged predisposing factor as their aetiology. In addition, inability to locate and follow-up documentation

on the discharged subjects who developed bilirubin encephalopathy, if they ever presented again, denied the investigators knowledge of their long-term sequelae.

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