



**ASSESSMENT OF THE PREVALENCE AND MANAGEMENT
OUTCOME OF NEONATAL JAUNDICE AT ST.PAUL'S
HOSPITAL MILLENIUM MEDICAL COLLEGE**

PREPARED BY: Dr. NAHOM HAILEMICHAEL (INTERN)

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Dr. EPHREM (PEDIATRITIAN)

**A STUDENT RESEARCH TO BE SUBMITTED TO THE DEPARTMENT
OF PUBLIC HEALTH, SPHMMC, IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF MEDICINE**

OCTOBER, 2017

ADDIS ABABA, ETHIOPIA

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ACRONYMS AND ABBREVIATIONS

ABBREVIATIONS USED

AAP: American Academy of Paediatrics

ABE: Acute bilirubin encephalopathy

BAEP: Brainstem auditory evoked potential (also known as brainstem auditory evoked response, BAER, and auditory brainstem response, ABR)

BNBAS: Braselton Neonatal Behavioural Assessment Scale

BSID: Bayley Scales of Infant Development

DDST: Denver Developmental Screening Test

ECT: Exchange transfusion

G6PD: Glucose-6-phosphate dehydrogenase

ICD: International Classification of Diseases

MG/DL: Milligrams per decilitre

NNG: Neonatal jaundice

NPV: Negative predictive value

PPV: Positive predictive value

SPHMMC: St.paul's hospital millennium medical college

TSB: Total serum bilirubin

TcB: Transcutaneous bilirubin

ABSTRACT:

Background information: Neonatal jaundice is a very common condition worldwide occurring in up to 60% of term and 80% of preterm new-borns occurring in the first week of life. It's uncommon in developed countries, but a common cause of neonatal morbidity and mortality in developing countries often resulting in kernicterus with its resultant burden. This study assesses the occurrence of neonatal jaundice, and other associated factors of neonatal jaundice and the management outcomes at SPHMMC.

Material and Method: A retrospective descriptive study (chart review) of all inborn and out born neonates admitted in NICU at SPHMMC from august 1, 2016 to January 1, 2017. Information from case file of the neonates were collected using data collection sheet within a 4 weeks' time. Socio-demographic, risk factors, treatment modes used, and the treatment outcomes were collected and determined. The data was analysed using SPSS software.

Result: A total of 1693 neonates were admitted into the NICU at SPHMMC in the 6 months study period. From these 166 neonates were diagnosed with neonatal jaundice accounting 9.8% of all admissions. Majority of the neonates, 156 subjects (93.9%) of them developed jaundice with in the first week of life. Out of 166 neonates 98 subjects (59%) were males and 68 (41%) were females, giving a male to female ratio of 1.4:1. Majority of mothers of neonates with neonatal jaundice are in age between 21-25 years (104 mothers, 62.6%). The identifiable risk factors in this study were Neonatal sepsis (37.3%), prematurity (20.4%), low birth weight (38.5%) and low APGAR score (56.1%).The study shows that combination treatment showed better outcome in management of neonatal jaundice.

Conclusion and recommendation: The study signifies that neonatal jaundice is one of the common admitted cases to the NICU at SPHMMC. The outcome of the neonates admitted with neonatal jaundice is good at our hospital. Provision of ante natal care, parent education, strengthening NICU care is essential in managing neonatal jaundice in our hospital.

Keywords: Neonatal jaundice, neonatal sepsis, phototherapy, hyperbilirubinemia, kernicterus

CHAPTER ONE

1.1. INTRODUCTION

BACKGROUND OF THE STUDY

Neonatal hyperbilirubinemia is a term for elevated total serum bilirubin in new-borns and infants less than one month of age.

Neonatal hyperbilirubinemia has multiple aetiologies and is a detectable risk factor for acute bilirubin encephalopathy (ABE) and chronic bilirubin encephalopathy, the latter also known as kernicterus. [1]

Neonatal jaundice is a very common condition worldwide occurring in up to 60% of term and 80% of preterm new-borns in the first week of life. [2]

Extreme hyperbilirubinemia is uncommon in developed countries. It is still a common cause of neonatal morbidity and mortality in developing countries often resulting in kernicterus with its resultant burden, such as medical, economic and social, on the patient family and society at large. [3]

The incidence, aetiological and contributory factors to neonatal jaundice differs in ethnicity and geographical distribution. In developed countries feto-maternal blood group incompatibilities are the leading cause of neonatal jaundice, but in developing countries, the case is different as it is mostly prematurity, G6PD Deficiency, infective causes as well as effects of herbal medications in pregnancy, application of dusting powder on baby, use of camphor balls to store baby's clothe that mainly constitute the aetiology in developing countries. [4]

Two types of neonatal jaundice exist, they are conjugated and unconjugated. The unconjugated is further divided into: physiologic and pathologic.

PHYSIOLOGICAL JAUNDICE

This usually appears about the 2nd or 3rd day of life, peaks at about 5th day and disappears within 10 days. The serum bilirubin levels are usually <12mg/dl (204umol/l). The baby is said to be otherwise well. It is a diagnosis of exclusion. The causes include relative high red cell mass and hence increased bilirubin load to the liver. Reduced red cell life span, increased release of haem from infective erythropoiesis, reduced hepatic uptake due to low ligandin concentration, increased enterohepatic circulation.

PATHOLOGICAL JAUNDICE

This occurs in unwell babies. It is jaundice in the first 24 hr of life. The total serum bilirubin level >12mg/dl (204umol/l) in term or >5mg/dl (85umol/l)/day. It is also characterised by conjugated bilirubin >2mg/dl (34umol/l), clinical jaundice lasting >2 weeks, with evidence of haemolysis.

Common causes of pathologic unconjugated hyperbilirubinemia in Nigeria are ABO Incompatibility, G6PD deficiency, infections, and prematurity. Studies have also shown that increased haemolysis due to rhesus incompatibility, pyruvate kinase deficiencies, membranopathies, hemolytic agents (such as naphthalene balls, dusting powder), and liver cell membrane defects. The risk factors for pathological jaundice are; previous sibling with neonatal jaundice, maternal diabetes, maternal drugs (such as oxytocin, diazepam, and promethazine), prematurity, and low birth weight male sex, ethnicity, and geographical location. It is a known fact that neonatal jaundice is a common problem worldwide. In Nigeria, it accounts for between 23% and 60% of admission into the Special Care Baby Unit (SCBU), and that various factors are responsible for its occurrence. Several studies assessed a large number of new-borns and monitored them for hyperbilirubinemia and subsequent manifestations of acute bilirubin encephalopathy during the newborn period. [5]

Data on infants with hyperbilirubinemia were collected prospectively through the Canadian Paediatric Surveillance Program from 2002 to 2004. Of the 258 infants, 32 (12.4%) identified had neurological abnormalities consistent with ABE, and infants in the highest peak bilirubin level group (>32 mg/dL) had a higher number of acute neurological abnormalities consistent with ABE (9/27 or 30%). [6]

1.2. STATEMENT OF THE PROBLEM

Neonatal jaundice is a common physiological occurrence in new-borns with over half of term and 80% of preterm neonates showing clinical signs including yellow discoloration of the skin and sclera resulting from high serum levels of bilirubin. [7]

For the majority of these infants, hyperbilirubinemia is a natural transition that resolves within the first week of life with maturing of the liver; however, hyperbilirubinemia is also the main reason for hospital readmission during the neonatal period. [8]

Hyperbilirubinemia is a primary concern associated with jaundice due to the connection between increased levels of unconjugated bilirubin and neurotoxic effects causing long-term sequelae including cerebral palsy, hearing loss and kernicterus.

Of the 7.6 million deaths estimated to occur in children below the age of 5 years in 2010, 40% occurred during the neonatal period. [9]

Given Millennium Development Goal four to reduce under-five child mortality by two-thirds by 2015 (United Nations (UN) 2008), attention needs to be focused on the neonatal period and associated morbidity and mortality. [10]

Several reports have indicated the important contribution of severe neonatal jaundice and hyperbilirubinemia to neonatal morbidity and mortality. In low-resource settings, where the majority of births occur outside facilities and access to monitoring and laboratory testing is limited, many of the proven diagnostic and treatment strategies are not available.

Worldwide, an estimated 14.1 million new-borns (10.5% of live births) require phototherapy for jaundice; of these, 6 million do not have access to treatment and 2.4 million without access to treatment are in Central and South Asia. [11]

The survey is selected because of the following reasons.

- Neonatal hyperbilirubinemia can lead to chronic bilirubin encephalopathy, causing permanent damage to the central nervous system (CNS). Once damage is permanent, there are few, if any, therapeutic options to improve outcomes, which in developing countries like Ethiopia where resources are limited the condition will worsen.
- Early identification of risk factors for chronic and acute bilirubin encephalopathy, including elevated serum bilirubin, may allow interventions to lower the risk.
- The ability to measure TcB or TSB is available in our setup.
- Treatment is widely available for neonatal hyperbilirubinemia in our setup.

This study provides information on the incidence and risk factors associated with neonatal jaundice in SPHMMC, with the objective of identifying potentially modifiable risk factors to reduce the incidence and consequences of jaundice in neonates and to review the management outcomes.

1.3. OBJECTIVE OF THE STUDY

A. GENERAL OBJECTIVE

- The general objectives of this survey is to determine the occurrence, and the management outcomes at SPHMMC.

B. SPECIFIC OBJECTIVE

- To determine the occurrence and the prevailing risk factors specific to neonatal hyperbilirubinemia at SPHMMC.
- To critically asses the management outcomes of those neonates diagnosed with neonatal hyperbilirubinemia at SPHMMC.
- To forward recommendation based on the survey findings

CHAPTER TWO

2.1. LITERATURE REVIEW

Jaundice is one of the most common conditions requiring medical attention in newborn babies. Approximately 60% of term and 80% of preterm babies develop jaundice in the first week of life, and about 10% of breastfed babies are still jaundiced at 1 month of age. In most babies with jaundice there is no underlying disease, and this early jaundice (termed 'physiological jaundice') is generally harmless. [12]

However, there are pathological causes of jaundice in the newborn, which, although rare, need to be detected. Such pathological jaundice may co-exist with physiological jaundice.

Neonatal jaundice refers to yellow colouration of the skin and the sclera (whites of the eyes) in newborn babies that results from accumulation of bilirubin in the skin and mucous membranes. This is associated with a raised level of bilirubin in the circulation, a condition known as hyperbilirubinemia. [13]

Bilirubin is a breakdown product of the red cells in the blood. Red cell breakdown produces unconjugated (or 'indirect') bilirubin, which is mostly bound to albumin. Unconjugated bilirubin is metabolised in the liver to produce conjugated (or 'direct') bilirubin, which then passes through the gut and is excreted in the stool. Bilirubin can be reabsorbed again from stools remaining in the gut. [14]

Breastfed babies are more likely than bottle-fed babies to develop physiological jaundice within the first week of life but the appearance of jaundice is not a reason to stop breastfeeding. Physiological jaundice refers to the common, generally harmless, jaundice seen in many newborn babies in the first weeks of life and for which there is no underlying cause. The reasons for the association between breastfeeding and neonatal jaundice have not yet been fully elucidated but may include inadequate breastfeeding support leading to a reduced intake, sluggish gut action leading to an increase in the entero-hepatic circulation of bilirubin, or unidentified factors in breast milk. [15]

Finally, it may be that there is a relative reduction of bilirubin levels in formula-fed babies due to increased clearance of bilirubin from the gut. Prolonged jaundice, that is jaundice persisting beyond the first 14 days, is also seen more commonly in term breastfed babies. The mechanism for this 'breast milk jaundice' is still not completely understood and the condition appears to be generally

harmless. However, prolonged jaundice can be a clue to serious underlying liver disease and should be assessed carefully. Jaundice may also have other, non-physiological, causes, including blood group incompatibility (most commonly Rhesus or ABO incompatibility), other causes of haemolysis, sepsis, bruising and metabolic disorders. Gilbert syndrome and Crigler–Najjar syndrome are rare causes of neonatal jaundice and are caused by liver enzyme problems. Deficiency of a particular enzyme, glucose-6-phosphate dehydrogenase (G6PD), can cause severe neonatal jaundice. [16]

G6PD deficiency is more common in certain ethnic groups and is familial. Congenital obstruction and malformations of the biliary system, such as biliary atresia, cause an obstructive jaundice with conjugated hyperbilirubinemia. This condition needs specialist investigation and early surgical treatment, preferably before 8 weeks of life. [17]

Several studies addressed the subtle, acute and chronic effects of neonatal hyperbilirubinemia.

Several small studies assessed neonates for clinical manifestations potentially associated with elevated bilirubin levels, at levels less than that used to meet the complete case definition for acute bilirubin encephalopathy. Among neonates with TSB >13mg/dL, the Brazelton Neonatal Behaviour Assessment Scale (BNBAS) showed statistically significant differences between the 28 study and 28 control neonates in orientation, range of state, regulation of state and autonomic regulation. [18]

Canadian Paediatric Surveillance Program from 2002 to 2004 showed, of the 258 infants, 32 (12.4%) identified had neurological abnormalities consistent with ABE, and infants in the highest peak bilirubin level group (>32 mg/dL) had a higher number of acute neurological abnormalities consistent with ABE (9/27 or 30%). [19]

A Danish population study identified 113 neonates, among a population of 249,308 births, with hyperbilirubinemia (TSB >23.4 mg/dL). Among the 113 neonates, peak TSB ranged from 26.3–42.9 mg/dL (median = 28.3mg/dL). The most common cause was ABO incompatibility (52/113) and the second was of unknown aetiology (43/113). (39%) had symptoms associated with bilirubin toxicity. Forty-three had subtle changes (lethargy, poor sucking or hypotonia) and one had advanced phase ABE (retrocollis, opisthotonos, shrill cry, no feeding, seizures, apnoea, fever or deep stupor). [20]

A recently published retrospective study from Iraq followed 162 term and near-term neonates (age range 1–23 days, 90% <10 days old) admitted to the hospital with hyperbilirubinemia (mean TSB 22.6 mg/dL). The authors reported 87 of the 160 neonates (54%) had symptoms of ABE. The investigators found no evidence of a specific bilirubin level confirmed to lead to bilirubin

encephalopathy; however, higher bilirubin levels were consistent with higher occurrence of bilirubin encephalopathy (found by physical exam at 3 months) and death. [21]

A subset of the literature focused on infants with high bilirubin levels in the newborn period and associated chronic manifestations or death. A study by the British Paediatric Surveillance Unit identified 14 infants with chronic bilirubin encephalopathy among 108 identified cases of physician-reported severe hyperbilirubinemia (≥ 29.8 mg/dL during the first month of life) (Manning et al., 2007). Among the 108 infants, the mean TSB level was 33.9mg/dL (range 29.8-46.8mg/dL); however the mean among infants with chronic bilirubin encephalopathy was 36.6mg/dL compared to 33.5 among infants with no bilirubin encephalopathy. Infants with chronic bilirubin encephalopathy were also likely to have a coexisting infection ($p=0.007$). Of the 14 infants with bilirubin encephalopathy, at follow up at 12 months of age, three subjects had died (all with history of infection), three were described as normal, two were lost to follow-up, four had abnormal development felt to be related to chronic bilirubin encephalopathy (hearing loss, athetosis and severe hearing loss, athetosis and epilepsy, and cerebral palsy and severe hearing loss), and two had abnormal development felt to be unrelated. [22]

An increasing number of newborn infants are discharged from the hospital within 48 hours after birth, and it is therefore not surprising that hyperbilirubinemia detected before discharge less often than it was in the past. The need for phototherapy is one of the most commonly reported reasons for readmission of newborn infants, suggesting the need for early detection of hyperbilirubinemia and follow-up after discharge. [23]

Clues to an infant's propensity for severe hyperbilirubinemia can be obtained from characteristics of the mother and perinatal and neonatal factors. The evaluation of serum bilirubin concentrations in newborn infants by means of a percentile-based nomogram allows physicians to predict the risk of hyperbilirubinemia. In one study, infants who had serum bilirubin concentrations in the high-risk category (higher than the 95th percentile) 18 to 72 hours after birth had a 40 percent probability of subsequent, moderately severe hyperbilirubinemia (serum bilirubin concentration of more than 17 mg per decilitre), whereas infants with concentrations in the low-risk category (lower than the 40th percentile) had a probability of zero.

Evaluating the serum bilirubin concentration early for all infants with the use of a percentile-based nomogram and possibly screening for genetic conditions should facilitate the anticipation and diagnosis of pathologic jaundice before discharge. Improved phototherapy and the use of metalloporphyrins may decrease the need for exchange transfusion and even make possible the successful treatment of hyperbilirubinemia at home. [24]

Ultimately, serious consideration should be given to a universal screening program for hyperbilirubinemia the first 24 to 48 hours after delivery, with the establishment of a registry to assess the severity of bilirubin toxicity. Kernicterus is a condition that leads to devastating neurologic injury. This complication occurs infrequently and can be prevented by continued vigilance and available therapies. [25]

CHAPTER THREE

3.0 METHODS AND MATERIALS

3.1 STUDY AREA: The survey is conducted at SPHMMC Neonatal ICU. SPHMMC is the second largest central referral hospital in Ethiopia that provides service for patients referred from. The Hospital was built by Emperor Haileselassie I in 1969 G.C as a source of medical care for underserved populations. The college has undergraduate programs in medicine, emergency nursing & ICU care and OR nursing. The postgraduate programs were launched in 2012 with departments of OBS & GYN and IESO (Integrated Emergency Surgery and Obstetrics). The college has already started the postgraduate program in departments of internal medicine, pediatrics and surgery. It currently has 392 beds, has an annual average of 200,000 patients and a catchment population of more than 5 million.

3.2 STUDY DESIGN: A retrospective descriptive study (chart review) of all inborn and out born neonates admitted in NICU at SPHMMC from august 1, 2016 to January 1 2017.

3.3 STUDY POPULATION: All inborn and out born neonates admitted in NICU for neonatal jaundice from august 1, 2016 to January 1 2017.

3.4 VARIABLES OF THE STUDY

- **DEPENDENT VARIABLES:** Management outcome of neonatal jaundice
- **INDEPENDENT VARIABLES:** Age, sex, maternal age, gestational age, birth weight, APGAR score, neonatal sepsis, breast feeding status, form of treatment,

3.5 DATA COLLECTION PROCEDURES: The primary data were retrieved from the chart and record room at SPHMMC and filled on proforma of data collecting sheet which contains independent variables.

3.6 DATA PROCESSING AND ANALYSIS: The data was checked for completeness and was fed into SPSS. After fed to the SPSS software the data was crosschecked with the proforma of collecting sheet. The data analysis was done in 2 steps, first frequency of variables was determined and next association of the identifiable risk factors was analysed. Statistical analysis techniques were applied to compute percentages and other quantitative data to analyse and interpret the outputs using SPSS software.

3.7 DISSEMINATION OF THE RESULTS: The results of the research will finally be presented to the medical college's community.

3.8 ETHICAL CONSIDERATION: Approval is requested from the public health department and paediatrics department of SPHMMC to prepare the survey.

3.9 INCLUSION AND EXCLUSION CRITERIA

All in-born and out-born neonates admitted in NICU for neonatal jaundice from august 1, 2016 to January1 2017are included, while neonates with incomplete chart's data are excluded.

3.10 OPERATIONAL DEFINITION

NEONATAL HYPERBILIRUBINEMIA: Clinically significant hyperbilirubinemia in the neonatal period has been defined as TSB levels>95th percentile for age in hours, which may require follow-up and treatment.

ACUTE BILIRUBIN ENCEPHALOPATHY (ABE): ABE is a term to describe the variable spectrum, from subtle to advanced manifestations of bilirubin toxicity present in the first weeks of life (American Academy of Paediatrics Subcommittee on Hyperbilirubinemia, 2004).

CHRONIC BILIRUBIN ENCEPHALOPATHY (KERNICTERUS): chronic bilirubin encephalopathy is a term reserved to describe persistent and permanent brain damage caused by bilirubin toxicity (American academy of paediatrics subcommittee hyperbilirubinemia, 2004).

CONVENTIONAL PHOTOTHERAPY: Phototherapy given using a single light source (not fibre optic) that is positioned above the baby.

DIRECT ANTIGLOBULIN TEST (DAT): Also known as the direct Coombs' test; this test is used to detect antibodies or complement proteins that are bound to the surface of red blood cells.

EXCHANGE TRANSFUSION: A potentially lifesaving procedure that is done to counteract the effect of serious jaundice by slowly removing the patients' blood and replacing it with fresh donor blood.

MULTIPLE PHOTOTHERAPY: Phototherapy that is given using more than one light source simultaneously; for example, two or more conventional units, or a combination of conventional and fibre optic units.

NEAR-TERM: 35 to 36 weeks gestational age

PRETERM: Less than 37 weeks gestational age

POST TERM :> 42 weeks gestational age

PROLONGED JAUNDICE: Jaundice lasting more than 14 days in term babies and more than 21 days in preterm babies.

SIGNIFICANT HYPERBILIRUBINAEMIA: An elevation of the serum bilirubin to a level requiring treatment.

TERM: 37 weeks or more gestational age.

VISIBLE JAUNDICE: Jaundice detected by a visual inspection.

3.11 LIMITATION OF STUDY

This survey face difficulty in collecting complete data, 3 were incomplete thus discarded from the study. Poor clerking also resulted difficulty to include other risk factors such as maternal educational status not to be included in the study.

3.12 RESULTS

During the 6 month study period a total of 1693 neonates were admitted to the SPHMMC NICU. From these 169 neonates were diagnosed for neonatal jaundice. Neonatal jaundice accounted for 9.8 % of all NICU admissions.

Table 1. Prevalence of neonatal jaundice, SPHMMC, ADDIS ABABA ETHIOPIA, 2017

	Frequency	Percentage
Neonates with neonatal Jaundice	166	9.8%
Neonates without jaundice	1527	90.2%
Total	1693	100%

3 neonates were excluded from the study because of inadequate data thus a total of 166 neonates were used for further analysis.

Out of these 166 neonates 98 subjects (59%) were males and 68 (41%) were females, giving a male to female ratio of 1.4:1.

And from the total of 166 neonates diagnosed with neonatal jaundice 41 of the subjects are delivered at health canter, 19 neonates from other hospital, 2 home deliveries and 104 neonates delivered at SPHMMC.

Majority of the neonates, 156 subjects (93.9%) of them developed jaundice with in the first week of life. And 10 neonates (6 %) of the neonates developed jaundice after 1 week of life.

Mean gestational age of the neonates who presented with neonatal Jaundice is 37 weeks, range being (28 to 43).

From these neonates diagnosed with neonatal jaundice 34 of them are preterm (GA < 37 wks.) 122 are terms (GA 37-40wks) and 10 subjects were post terms (GA >42wks).

100 neonates (60.2%) were delivered by SVD and 56 neonates (33.7%) delivered via C/S and 2 neonates (1.8%) were delivered with instrumental delivery.

Also these neonates with neonatal jaundice 138, (83.1%) neonates were exclusively breast fed, and 18 of these (10.8%) were on formula fed, and only 10 neonates (6%) were on mixed feeding.

Majority of mothers of neonates with neonatal jaundice are in age between 21-25 years (104 mothers, 62.6%), 10 (6.02%) of these mothers were < 21 yrs and 38 mothers (22.8%) were in age between 26-30 years. 11 of the mothers (6.6%) were aged 31-35 and only 3 of the mothers (1.8%) were in age between 36-40.

All of these neonates were managed for neonatal jaundice using different treatment modalities. Out of these 51 neonates (30.7%), were treated with phototherapy alone and for 8 neonates (4.8%), phototherapy and exchange transfusion was done. For 79 neonates (47.5%), phototherapy exchange transfusion and chemotherapy was the treatment choice. And for 28 neonates (16.8%) phototherapy and chemotherapy only was the treatment mode.

From the total of 166 subjects studied, 147 of them (88.5%) were discharged improved. 3 of them (1.8%) developed kernicterus and 16 neonates (9.6%) expired after diagnosed with neonatal jaundice. Among these 7 neonates (4.2%) expired with kernicterus.

Neonatal sepsis was diagnosed in 62 neonates (37.3%), ABO incompatibility in 17 neonates (10.2%), RH incompatibility in 14 neonates (8.4%), and prematurity was diagnosed in 19 subjects (11.4%). Cephalhematoma and subgalealhaemorrhage each were diagnosed in 22 neonates (13.2%). Other diagnoses comprised (7.2%) which diagnosed in 12 neonates.

1 neonate with neonatal jaundice expired due to neonatal sepsis, 2 neonates expired with development of kernicterus and 2 neonates developed kernicterus all due to neonatal sepsis.

1 neonate expired after diagnosed with ABO incompatibility and 3 neonates expired with diagnoses of RH incompatibility, 1 neonate had expired with kernicterus after diagnosed with RH incompatibility.

2 neonates were also expired with the diagnosis of prematurity, 1 with Cephalhematoma, 1 with subgaleal haemorrhage and 1 neonate with other diagnosis. Subgalealhaemorrhage was diagnosed in 2 neonates who expired with kernicterus and Cephalhematoma and prematurity each, were both diagnosed in neonates who expired with kernicterus.

Table 2. Socio demographic characteristics of the neonates

Variable	Neonates with hyperbilirubinemia Freq (%)	Neonates without hyperbilirubinemia Freq (%)	Total
Sex:			
Male	98 (59%)	814 (53.3%)	912 (53.8%)
Female	68 (40.9%)	711 (46.5%)	779 (46.0%)
Ambiguous	0	2 (0.13%)	2 (0.11%)
Total	166(100) $\chi^2=2.479$ $P= 0.648$ $Df=1$	1527 (100%)	1693 (100%)
Admission age in days			
1-2	61 (36.7%)	911 (59.6%)	972 (57.4%)
3-4	59 (35.5%)	509 (33.3%)	568 (33.5%)
5-6	36 (21.6%)	81 (5.3%)	117 (6.9%)
=/>7	10 (6.02%)	26 (1.7%)	36 (2.12%)
Total	166 (100%) $\chi^2=94.8$ $P=0.221$ $df=6$	1527 (100%)	1693 (100%)
Maternal age in yrs			
<21	10 (6.02%)	71 (4.64%)	81 (4.75%)
21-25	104 (62.6%)	1279 (83.7%)	1383 (81.6%)
26-30	38 (22.8%)	131 (8.5%)	169 (9.98%)
31-35	11 (6.62%)	28 (0.74%)	39 (2.3%)
36-40	3 (1.8%)	11 (6.64%)	14 (0.82%)
>/=40	0 (0%)	7 (0.45%)	7 (0.41%)
Total	166 (100%) $\chi^2= 57.7$ $P=0.031$ $df=10$	1527 (100%)	1693 (100%)

Table 3. Association of the identifiable risk factors with neonatal jaundice

Variable	Neonates with hyperbilirubinemia Freq (%)	Neonates without hyperbilirubinemia Freq (%)	Total Freq (%)
Gestational age in weeks			
<37 wks= preterm	34 (20.4%)		
37-42wks = term	122 (73.4%)	556 (36.4%)	590 (34.8%)
>42wks= post term	10 (6.02%)	916 (59.9%)	1038 (61.3%)
	166 (100%)	55 (3.6%)	65 (3.8%)
Total	$\chi^2= 23.1$ df= 2 P=0.000	1527 (100%)	1693 (100%)
Birth weight			
Low birth weight	64 (38.5%)	700 (45.8%)	764 (45.1%)
Normal B. weight	100 (60.2%)	820 (53.7%)	920 (54.3%)
Macrosomia	2 (1.2%)	7 (0.45%)	9 (0.5%)
Total	166 (100%)	1527 (100%)	1693 (100%)
	$\chi^2= 26.1$ df= 2 P=0.000		
Apgar score			
Normal	73 (43.9%)	904 (59.2%)	977 (57.7%)
Mild	58 (34.9%)	401 (26.2%)	459 (27.1%)
Moderate	33 (19.8%)	200 (13.0%)	233 (13.7%)
Severe	2 (1.2%)	22 (1.44%)	24 (1.41%)
	$\chi^2= 182.264$ df=3 P=0.030		
Breast feeding			
Breast milk	138 (83.1%)	1433 (93.8%)	1571 (92.7%)
Formula	18 (10.8%)	41 (2.68%)	59 (3.48%)
Mixed feeding	10 (6.02%)	53 (3.47%)	63 (3.72%)
	$\chi^2=41.83$ p=0.000 df=1		
Neonatal sepsis			
Present	62 (37.3%)	952 (60.5%)	1014 (59.8%)
Absent	104 (62.6%)	620 (39.41%)	724 (42.7%)
Total	166 (100%)	1572 (100%)	1693 (100%)
	$\chi^2=165.342$ df= 1 P=0.000		

Table 4. Treatment modality used and the treatment outcomes

Treatment mode	Improved	Died	Developed kernicterus	Total
Phototherapy alone	44 (29.9%)	5 (31.25%)	2 (66.6%)	47 (28.3%)
Phototherapy+ exchange transfusion	8(5.4%)	0 (0%)	0 (0%)	8 (4.8%)
Phototherapy +exchange transfusion+ chemotherapy	73 (49.6%)	5 (31.25%)	0 (0%)	79 (47.5%)
Phototherapy+ chemotherapy	22 (14.9%)	6 (37.5%)	1 (33.33%)	28 (16.8%)
Total	147 (88.5%)	16 (9.6%)	3 (1.8%)	166 (100%)
$\chi^2=8.030$ $P=0.084$ $df=4$				

3.13 DISCUSSION

Neonatal jaundice is a very common condition worldwide, occurring in up to 60% of term and 80% of preterm new born in the first week of life [1, 2]. In these study 1693 neonates were admitted to the NICU of the paediatrics department at SPHMMC. From these neonates 166 were diagnosed with neonatal Jaundice with In the 6 month of study period.

The occurrence of neonatal jaundice of 9.8% of the NICU admissions which is observed in this study suggests that neonatal jaundice is the most important cause of neonatal morbidity. As studies shows in previous studies from other countries, neonatal jaundice ranges between 10- 35 % of the 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). [5, 6]

This study signifies that neonatal jaundice is still one of the leading cause of neonatal morbidity in our setup as seen in other countries.

Majority of the neonates diagnosed with neonatal jaundice are aged 1-2 days which makes (36.7%). This result is closely related from studies seen in Nigeria and others suggesting that NNJ is common among neonates in the first week of life. [5, 6]

Based on this study, neonatal jaundice is seen in 20.4% of the preterm neonates and 73.4% term neonates. This result is quite different from worldwide occurrence which states the occurrence to be 60% of term and 80% of preterm new born in the first week of life [1, 2].

But a similar survey which is performed in Nigeria showed NNJ occurring in 56.8% of term and 40.7% of pre-term newborn. [5, 6]

The result is closely related to other studies which showed that NNJ occurs in 60% of newborn, while the occurrence of NNJ in preterm neonates is not in consonant with other studies [1, 2].

Neonatal sepsis, male sex, maternal age, APGAR score, birth weight breast feeding status, and gestational age, were the etiologic risk factors that are associated with neonatal jaundice.

The leading etiologic factors in decreasing order are male sex (59%), low APGAR score (56.1%) and low birth weight (38.5%). Onyearugha et al in a retrospective study conducted in South East Nigeria, to determine the occurrence, etiological, and other associated risk factors of neonatal jaundice, it was discovered that the leading aetiological factors of neonatal jaundice in that study were septicaemia (32.5%), and prematurity (17.5%) [5, 7].

In this study, ABO-incompatibility and RH-incompatibility were also the studied identifiable risk factors being present in 10.2% and 8.4% respectively. This result is closely related to previous research done in Nigeria, where ABO- incompatibility prevailing in (7.5%). [8]

Male sex is a leading risk factor for Neonatal Jaundice which is present in 59% of all the neonates diagnosed with neonatal Jaundice. This result is quite similar to other studies done in the western population and similarly in African studies. [8, 9]

Particularly in Nigerian study male comprised 60.8% of those with neonatal Jaundice. Neonatal sepsis is the 4th leading cause of neonatal Jaundice in this study, which accounts for 37.3% (62 of 166) neonates. This study agrees with other studies which considers neonatal sepsis as a major risk factor for neonatal Jaundice. [7, 10, 11]

The other etiologic risk factor identified in this study was low birth weight, 53 % of neonates diagnosed with neonatal Jaundice had also low birth weight. This is also consistent with other studies which reported low birth weight as a major risk factor for neonatal Jaundice. [6, 8, 12]

83% of the neonates (138 of the 166) were breast fed, 10.8% formula fed and 6% were on mixed feeding. In this study there is an association between breast feeding and NNJ. This is also seen in other studies. [4, 7]

The other significant association seen in this study is between APGAR score and neonatal jaundice. Low APGAR score is seen in 56.1% of neonates diagnosed with neonatal jaundice. The lower the APGAR score the higher the risk for neonatal jaundice.

In the study the treatment modalities that are used for the management of neonatal jaundice are phototherapy alone, phototherapy and exchange transfusion, and chemotherapy used with the other treatment modalities.

All of the 166 neonates diagnosed with neonatal jaundice were treated and only 16 neonates expired while only 3 developed kernicterus. This makes a total of 147 neonates (87.9%) treated and improved well from neonatal jaundice.

Majority of these cured neonates were treated with combination of the 3 treatment modalities. This study shows that combination treatment showed better outcome in management of neonatal jaundice. This result is sound with previous study which showed 96% survival rates in neonates treated for NNJ with all three modalities. [13]

3.14 CONCLUSION

The prevalence of neonatal jaundice in our set up comprises 9.8%, signifying that it is one of the common admitted cases to the NICU at SPHMMC.

The risk factors that are responsible for neonatal jaundice such as low APGAR score and neonatal sepsis are those factors that needs attention in attempts to minimize the occurrence of neonatal jaundice.

It's clearly witnessed that the outcome of the neonates with neonatal jaundice is very good, showing excellent care and management at SPHMMC NICU.

The other important point is that, most of the risk factors that are assessed in this study are possible to be modified hence can play an important role in the management of neonatal jaundice.

At last, neonatal jaundice is associated with permanent long term sequelae, which affects the whole being of the child. It's also related with decreased productivity, existence of comorbid heath conditions, economical burdens to family and society. Thus concern should be given to this neonatal health condition.

3.15 RECOMMENDATION

It's good to point out that improving the neonatal care at our hospital is important means to enhance the management out come and to minimize mortality due to neonatal jaundice, thisshould be implemented by the paediatrics department and the hospital administrator.

At every health centre and Hospital, provision of good antenatal care and educating parents regarding neonatal jaundice can be effective means of early identification of the risk factors and neonatal jaundice, which in turn helps in minimizing the occurrence of neonatal jaundice.

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ANNEX

1. STRUCTURED DATA COLLECTING SHEET

CARD NO: _____

SOCIO DEMOGRAPHIC CHARACTERISTICS		
A. SEX	1. MALE 2. FEMALE 3. ABIGIOUS	REMARK
B. ADMISSION AGE (DAYS)	1. 1-2 2. 3-4 3. 5-6 4. >/= 7	
C. MATERNAL AGE (YRS)	1. <20 2. 21-25 3. 26-30 4. 31-35 5. 36-40 6. >40	
D. BIRTH PLACE	1. HEALTH CENTER 2. SPHMMC 3. OTHER HOSPITAL 4. HOME	
DIAGNOSTIC CHARACHTERSTICS		
E. GESTATIONAL AGE (WEEKS)	1. < 37 WK 2. 37-42 WK 3. > 42 WK	
F. APGAR SCORE	1. 0-2 2. 3-4 3. 5-6 4. 7-10	
G. BIRTH WEIGHT (KG)	1. <1 2. 1-1.5 3. 1.6-2.5 4. > 2.5 5. > 4	
H. FEEDING TYPE	1. BREAST MILK 2. FORMULA MILK 3. MIXED	

I. MODE OF DELIVERY	1. SVD 2. CESAREAN SECTION (C/S) 3. INSTRUMENTAL	
J. MAJOR DIAGNOSIS OF THE NEONATE	1. NEONATAL HYPERBILIRUBINAEMIA ONLY 2. NEONATAL HYPERBILIRUBINAEMIA WITH ADDITIONAL DIAGNOSIS 3. WITH OUT NEONATAL HYPERBILIRUBINAEMIA	
K. NEONATAL SEPSIS	1. PRESENT 2. ABSENT	
L. ADDITIONAL DIAGNOSIS	1. ABO- INCOMPATIBILITY 2. RH- INCOMPATIBILITY 3. PREMATURITY 4. CEPHALHEMATOMA 5. SUBGALEAL HEMORRHAGE 6. OTHERS	
M. TREATMENT MODE	1. PHOTOTHERAPY ALONE 2. PHOTOTHERAPY AND EXCHANGE TRANSFUSSION 3. PHOTOTHERAPY+EXCHANGE TRANSFUSSION+ CHEMOTHERAPY 4. PHOTOTHERAPY AND CHEMOTHERAPY	
N. TREATMENT OUTCOME	1. IMPROVED 2. DIED 3. DEVELOPED KERNICTERUS	