2022-09-19

Magnitude of Neonatal Jaundice and its Associated Factors Among Neonates Admitted to Neonatal Intensive Care Unit, Tibebe Ghion Specialized Hospital, North West Ethiopia, Bahirdar, 2022 Gc.

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BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE

DEPARTMENT OF Pediatrics and Child Health

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A THESIS REPORT SUBMITTED TO THE DEPARTMENT OF PEDIATRICS AND CHILD HEALTH, COLLEGE OF MEDICINE AND HEATLH SCIENCES, BAHIR DAR UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF SPECIALITY IN PEDIATRICS AND CHILD HEALTH

SEPTEMBER 2022 GC

BAHIRDAR, ETHIOPIA

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Declaration

This is to certify that the thesis entitled "Magnitude of neonatal jaundice and its associated factors among neonates admitted to neonatal intensive care unit of Tibebe Ghion specialized hospital, north west Ethiopia, Bahirdar" Submitted To The Department Of Pediatrics And Child Health, College Of Medicine And Heatlh Sciences, University Of Bahir Dar In Partial Fulfillment Of The Requirements For The Degree Of Speciality In Pediatrics And Child Health.

It is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates.

Name of the candidate Date of submission Place

_____ _____ _____

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

Approval Of Thesis

We hereby certify that we have supervised, read, and evaluated this thesis titled "magnitude of neonatal jaundice and its associated factors among neonates admitted to neonatal intensive care unit, Tibebe Ghion specialized hospital, north west Ethiopia, Bahirdar" by Dr. Aderajew Getahun prepared under our guidance. .

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Acknowledgment

I would like to thank Bahirdar University College of Medicine and Health Sciences Department of Pediatrics and child health for giving me this opportunity to prepare this thesis report.

I am also very grateful to thank my advisors, Dr. Belaynew (MD, Assistant professor of pediatrics and child health) and Worku Awoke (Associate professor of epidemiology) for their guidance and encouragement starting from topic selection, writing thesis proposal & this thesis report.

List of acronym & abbreviations

ANC……..Ante Natal Care

AOR……..Adjusted Odds Ratio

BIND…….Bilirubin Induced Neuronal Dysfunction

COR……...Crude Odds Ratio

CS……..Cesarean Section

DM…… Diabetes Mellitus

ETAT……..Emergency Triage Assessment & Treatment

GA…….. Gestational Age

GDM……Gestational Diabetes Mellitus

G6PD…….. Glucose-6-Phosphate Dehydrogenase

KMC……Kangaroo Mother Care

NNJ……..Neonatal Jaundice

Rh…….Rhesus Factor

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Abstract

Background: Jaundice is a yellow discoloration of the skin eyes and mucus membrane caused by hyperbilirubinemia. Neonatal jaundice is a common clinical problem worldwide. Globally, every year, about 1.1 million babies would develop severe hyperbilirubinemia with or without bilirubin encephalopathy, and the majority resides in sub-Saharan Africa and South Asia. Bilirubin induced mortality is highly prevalent in developing countries, in which our country belongs to. Determining the magnitude of and factors leading to neonatal jaundice enables to look ways to decrease associated morbidity, severe complications and mortalities which can easily be treated only if identified earlier.

Objective: To assess the magnitude and associated factors of neonatal jaundice in neonates admitted to neonatal intensive care unit, Tibebe Gion Specialized Hospital, Bahir Dar, Ethiopia, 2022 GC.

Methods: An institutional based cross sectional study design was used in a total of 365 neonates. All the necessary data was collected from patient charts by using data collection format & samples were selected using systematic sampling technique. The data was entered to SPSS version 23 for analysis. Both bivariate & multivariate logistic regression model was used to identify significant variables determining neonatal jaundice. Variables with a p-value <0.05 was considered statistically significant & data collection period was from August 2-14/2022 GC.

Result: A total of 365 neonates were participated in the study from which 144(39.5%) were found to have neonatal jaundice. Neonates who had ABO-incompatibility were 28.3times more likely to have neonatal jaundice than neonates who had no ABO-incomatibility (AOR:28.3(9.1,87.5)), neonates with Rh-incompatibility were 15.4 times more likely to have neonatal jaundice than those who don't have Rh-incompatibility (AOR:15.4(3.9,60.3)), neonates who had birth trauma were 11.1 times more likely to have neonatal jaundice than those without birth trauma (AOR: 11.1(3.2, 38.5)) and neonates born with low birth weight were 3.5 times more likely to have neonatal jaundice than those having normal birth weight (AOR:3.5(1.43, 8.73)).

Conclusion and recommendation: The proportion of neonatal jaundice in this study was higher than the result study done in the same setting in this region. To minimize its proportion and related complications, pregnant mother should have focused ANC.

1. Introduction

1.1. Background

Jaundice is derived from the French word Juan which means yellow. Neonatal jaundice (NNJ) is the yellow discoloration of the skin, sclera, and mucosa caused by excess accumulation of bilirubin in the tissue and plasma. It occurs in up to 60 & 80% of preterm and term as well as 10% of breastfeeding neonates. The bilirubin level in neonates is much higher than in adults because the life span of the erythrocytes is relatively short and the capacity for bilirubin elimination is lower than in adults; however, hyperbilirubinemia, or jaundice, is a life-threatening disorder in newborn (1). Jaundice usually becomes visible on the sclera at a level of 2 to 3 mg/dL(2).

The mechanism of neonatal jaundice is the imbalance between bilirubin production and conjugation, which results in increased bilirubin levels.4 This imbalance is mainly because of the immature liver of the neonate and the rapid breakdown of red blood cells(1)

The predominant source of bilirubin is the breakdown of hemoglobin in senescent or hemolyzed red cells. Heme is degraded by heme oxygenase, resulting in the release of iron and the formation of carbon monoxide and biliverdin. Biliverdin is further reduced to bilirubin by biliverdin reductase. Bilirubin then enters the liver and is modified to an excretable conjugated form that enters the intestinal lumen but can be deconjugated by bacteria so that the bilirubin is reabsorbed into the circulation. Increased production of bilirubin, deficiency of hepatic uptake, impaired conjugation of bilirubin, and increased enterohepatic circulation of bilirubin account for most cases of pathologic jaundice in newborn infants. Increased production of bilirubin occurs in infants of various racial groups, as well as in infants with blood-group incompatibilities, erythrocyte-enzyme deficiencies, or structural defects of the erythrocytes(3).

Almost all newborn infants develop some degree of hyperbilirubinemia as a normal transition in physiology. High levels of unbound unconjugated bilirubin can cross the blood brain barrier and cause neurological symptoms. The terms “Bilirubin Induced Neurological Dysfunction” (BIND) and kernicterus are often used interchangeably, although some authors consider BIND to refer to the clinical presentation and kernicterus to be an anatomical diagnosis(4).

Infants who appear jaundiced should be evaluated by a risk score or by measurement of total serum or transcutaneous bilirubin. Phototherapy is an effective treatment for hyperbilirubinemia, but the number needed to treat varies widely depending on sex, gestational age, and time since delivery. Exchange transfusion is another means of treatment of hyperbilirubinemia leads to complications in about 5% of treated infants and has a mortality rate of three or four per 1,000 infants(5) There is now evidence that hyperbilirubinemia can be effectively prevented or treated with tin-mesoporphyrin, a drug that inhibits the production of heme oxygenase(6). Evidence suggesting that phenobarbitone is useful in the postnatal treatment of hyperbilirubinemia both in significant reduction in bilirubin level and the need for exchange transfusion(7).

1.2. Statement of the problem

Neonatal jaundice is a common clinical problem worldwide. Globally, every year, about 1.1 million babies would develop severe hyperbilirubinemia with or without bilirubin encephalopathy, and the majority resides in sub-Saharan Africa and South Asia. In Nigeria, it is 100 times more than in developed countries. The burden was highest in low and middle income countries of subsaharan Africa and South Asia. The global burden of neonatal juandice reported that the African region has the highest incidence of severe neonatal jaundice per 1000 live births followed by the Southeast Asian and Americas and European regions 4.4 and 3.7 respectively. Ethiopia is one of the top ten countries with jaundice related neonatal mortality(2, 4)

The burden of bilirubin-induced morbidity and mortality was the greatest in Sub-Saharan Africa and South Asia where the sociodemographic index values are within the low-middle or low quintiles. Moreover, neonatal jaundice was the seventh and eighth leading cause of mortality in Sub-Saharan Africa and South Asia, respectively (8). Unless and otherwise the case is early presented and appropriately treated, it can cause bilirubin encephalopathy/kernicterus. The passage of bilirubin into the brain can be affected by several factors and results in the risk of acute bilirubin encephalopathy(2)

Recent global study estimates that about 1.1 million babies would develop hyperbilirubinemia with or without bilirubin encephalopathy worldwide yearly(9) In the early neonatal period, NNJ was the seventh global cause of neonatal mortality, whereas it is also the seventh and eighth leading cause of death in Sub-Saharan Africa and South Asia, respectively. Severe NNJ accounted for 30.8% of neonatal deaths in India,7 34% in Nigeria, 14% in Kenya and 6.7% in Egypt. In Ethiopia, the prevalence of NNJ was ranged from 37.3% to 44.9%. NNJs also contributed to 242 546 patients admitted to the neonatal intensive care unit in Taiwan and 16.67%–31.7% of hospital admissions and a case fatality rate of 32% in Ethiopia(10)

Newborn jaundice continues to have important public health and economic consequences for health care in the United States. Previous evidence-based studies identifying deficiencies in education and practice led to a systems approach that could reduce risks of neurological injury from extreme hyperbilirubinemia (total serum/plasma bilirubin (TB) $\geqslant$25 mg dl $-$ 1 at an age beyond 48 h) in otherwise healthy infants after discharge. Better identification of infants at risk

who may need ‘rescue’ intervention, such as a hazardous double blood volume exchange transfusion, was thought to minimize public health risk due to bilirubin-related injury(11)

Preterm birth, sepsis, hypoxia, seizures, acidosis, and hypoalbuminemia are the most frequently reported factors influencing the level of neonatal bilirubin. The rate of rising the bilirubin level is equally important with the increased risk of kernicterus in newborns with hemolytic diseases, such as glucose-6-phosphate dehydrogenase (G6PD) deficiency, ABO, or Rhesus (Rh) hemolytic disease. In term and preterm neonates, the serum bilirubin levels are usually lower than 12 and 15 mg/dL spontaneously resolving in the first and second weeks, respectively(2).

As it is known, there are high rates of neonatal mortality and morbidity in Ethiopia due to one of the complications of neonatal hyperbilirubinemia. The problem is the availability of the actual rate of neonatal hyperbilirubinemia(12). Neonatal hyperbilirubinemia affects the brain, and bilirubin encephalopathy results in long-term sequels, such as sensory-neuronal hearing loss, in the survivors and mortality. Kernicterus Spectrum Disorder is considered the clinical signs associated with bilirubin toxicity that can result in cerebral palsy, seizure, developmental delay, oculomotor dysfunction, and neurocognitive impairment(13).

The toxic effects of bilirubin on the central nervous system are well known, as is the likely irreversible brain damage, leading to detrimental neurodevelopmental abnormalities, motor problems, cerebral palsy, deafness, and even death. Moreover, some pathologies promote an additional increase of bilirubin or emphasize its toxic effects(14).

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. Several reports have indicated the important contribution of severe hyperbilirubinemia to neonatal morbidity and mortality(15).

Despite the expansion of the neonatal health care system in Ethiopia, there has still been an increase in the admission of neonates to the neonatal intensive care unit (NICU) with infection, jaundice, low birth weight, inability to feed, hypoglycemia, birth asphyxia, and preterm birth. However, there are a limited number of studies carried out in Ethiopia, particularly in the present study area, demonstrating the status of neonatal hyperbilirubinemia and associated factors(2).(**25**)

Different studies showed bilirubin induced mortality is highly prevalent in developing countries, in which our country belongs to. Neonatal jaundice is among the leading causes of neonatal morbidity and mortality in Ethiopia. Even though neonatal jaundice is not totally preventable, with early detection and treatment it is possible to avert irreversible complications(16)

1.3. Significance of the study

This study is aimed at assessing the magnitude of neonatal jaundice and its associated factors in NICU of TGSH, which help:

- For better preparedness and resource allocation in the unit.
- Other sectors working on neonatal health to plan for early detection, treatment of neonatal jaundice and to reduce or to prevent the acute and long term complications of hyperbilirubinemia.
- As a scientific reference for further related studies.

2. Literature review

2.1. Proportion of neonatal jaundice

There were different studies done on magnitude of neonatal hyperbilirbinemia in different countries over the globe. In Asia, Malaysia Pasir Puteh health facilities, a comparative cross-sectional study was conducted in a total of 1154 newborns and out of which more than half (727 (63%)) of them had neonatal jaundice (22). This is a bit higher data when it's compared to the magnitude of neonatal jaundice done in African countries. A study done in Bloemfontein, south Africa showed the magnitude of neonatal jaundice was 55.2% where only 10% of them were black babies (16), in a retrospective cross-sectional study design done in district hospital of Rwanda showed the prevalence of neonatal jaundice in 210 neonates was 44.3% and in a retrospective study conducted at the Special Care Baby Unit of the University of Benin Teaching Hospital, Benin City, out of the 1784 babies admitted, 472 (26.5%) were admitted for neonatal jaundice (17).

Prevalence of neonatal jaundice in a study done at a tertiary health institution in Ondo state, Nigeria among a total of 715 neonates was found to be 35.94 %((12))

In East Africa, Uganda, St. Francis hospital a descriptive study was done and the prevalence of significant hyperbillirubinaemia was 22.7% which is similar to that of Benin (15)

Another study done in 4 Sub-Saharan countries (including our country Ethiopia, Congo, Nigeria and Zimbabwe), a total of **12**,**327** participants and 10 studies were included & the over all prevalence of neonatal jaundice were 28.08%. In this study the prevalence in Ethiopia (41.4%) was similar to that of Zimbabwe (45.4%) and it was low in Congo (4.9%) (18).

Studies were done in different areas of Ethiopia to determine the prevalence of neonatal jaundice. An institutional based cross-sectional study was conducted in Mekelle, Tigray, north Ethiopia from February to April 2016 in a total of 209 neonates and the proportion of neonatal jaundice was found to be 37.3% (19). This is much higher than the result (13.3%) of the study done in St Paul's Hospital Millenium medical college, Addis Ababa, Ethiopia where a total of 338 neonates were enrolled (16).

The magnitude jaundiced neonates in a Cross sectional study involving a total of 356 study subjects admitted at Tikur Anbessa Specialized Hospital, Ethiopia, was 44.9%) (20).

An institutional based retrospective cross-sectional study was conducted on 399 case files of all the admitted inborn and outborn neonates at university of Gondar comprehensive specialized hospital and overall, 31.6% of the admitted neonates developed hyperbilirubinemia (21).

2.2. Associated factors of neonatal jaundice

Neonatal jaundice can be caused by various factors among which prematurity, sepsis, perinatal asphyxia, blood group and Rh incompatibility, G6PD deficiency are among the commonest causes. In a comparative cross-sectional study conducted in Pasir Puteh health facilities, Malaysia neonates of diabetic mother, Caesarean delivery and male gender were the significant factors associated with neonatal jaundice(22). In a similar study which was done in South of Iran (Fars Province) the **r**isk factors of severe hyperbilirubinemia were blood group incompatibility, G6PD deficiency, sepsis, Male sex, previous siblings with severe hyperbilirubinemia, early discharge, NVD, Breast feeding and and some causes were unknown(23).

In a study done in Bloemfontein, South Africa, normal vaginal delivery was the only risk factor associated with neonatal jaundice(13) In another African country, a retrospective cross-sectional study design done in district hospital of Rwanda, showed birth weight, neonatal gender, ABO and other blood group incompatibilities, infections, prematurity, gestation age of the baby and the C/S were predominant associated risk factors with neonatal jaundice(14) whereas the study conducted at the Special Care Baby Unit of the University of Benin Teaching Hospital, Benin City, the identified risk factor was ABO incompatibility was found in 7.6% of babies and there was no risk factor identified in 36.3% of the babies. The case fatality rate in this study was relatively high particularly in association with sepsis, prematurity and asphyxia. Mortality was higher in out-born babies than in in-born babies(17).

A study done in children's hospital in free town, Sierra Leone, the associated factors of 95 jaundiced neonates were prematurity (27.4), probable sepsis, ABO incompatibility(11.6%), cephalohematoma (9.5%), G6PD deficiency (7.6%), Rh incompatibility (6.3%),jaundice occurred in 25.2% in whom no possible associated factor was found (24) similarly a descriptive study done at St. Francis hospital, Uganda, among the neonates who had hyperbilirubinemia, no factors were found to be significantly associated(15).

Two studies were done in north Ethiopia, Tigray. A case control study which was conducted in Mekelle city in a total of 209 neonates showed that RH incompatibility, low birth weight, breastfeeding, polycythemia, prolonged labor, and birth asphyxia were the determinants of neonatal jaundice(19). Similar study among 272 neonates was done in Public General Hospitals of Central Zone, Tigray, and showed low birth weight, birth asphyxia, RH incompatibility, breastfeeding, and polycythemia were the determinants of neonatal jaundice(1).

In a study done in St Paul's hospital millennium medical college among 338 total neonates enrolled, the factors which show statistically significant relationship between hyperbilirubinemia were inadequate breast feeding, followed by presence of cephalhematoma and neonatal infection or sepsis, maternal age, and breast milk jaundice both do not reach statistical significance(16).

Tikur Anbessa Specialized Hospital Cross sectional study was conducted and the major etiologic factors of neonatal hyperbilirubinemia were ABO incompatibility and sepsis which accounts 57(35.6%) and 30(18.8%) respectively(20).

In an institutional based retrospective cross-sectional study conducted on 399 case files of all the admitted inborn and outborn neonates at university of Gondar comprehensive specialized hospital. Maternal and neonatal Rhesus (RH) incompatibility, ABO incompatibility, low birth weight, hypoglycemia, and birth trauma were the main statistically significant factors associated with neonatal hyperbilirubinemia(21).

3. Conceptual frame work

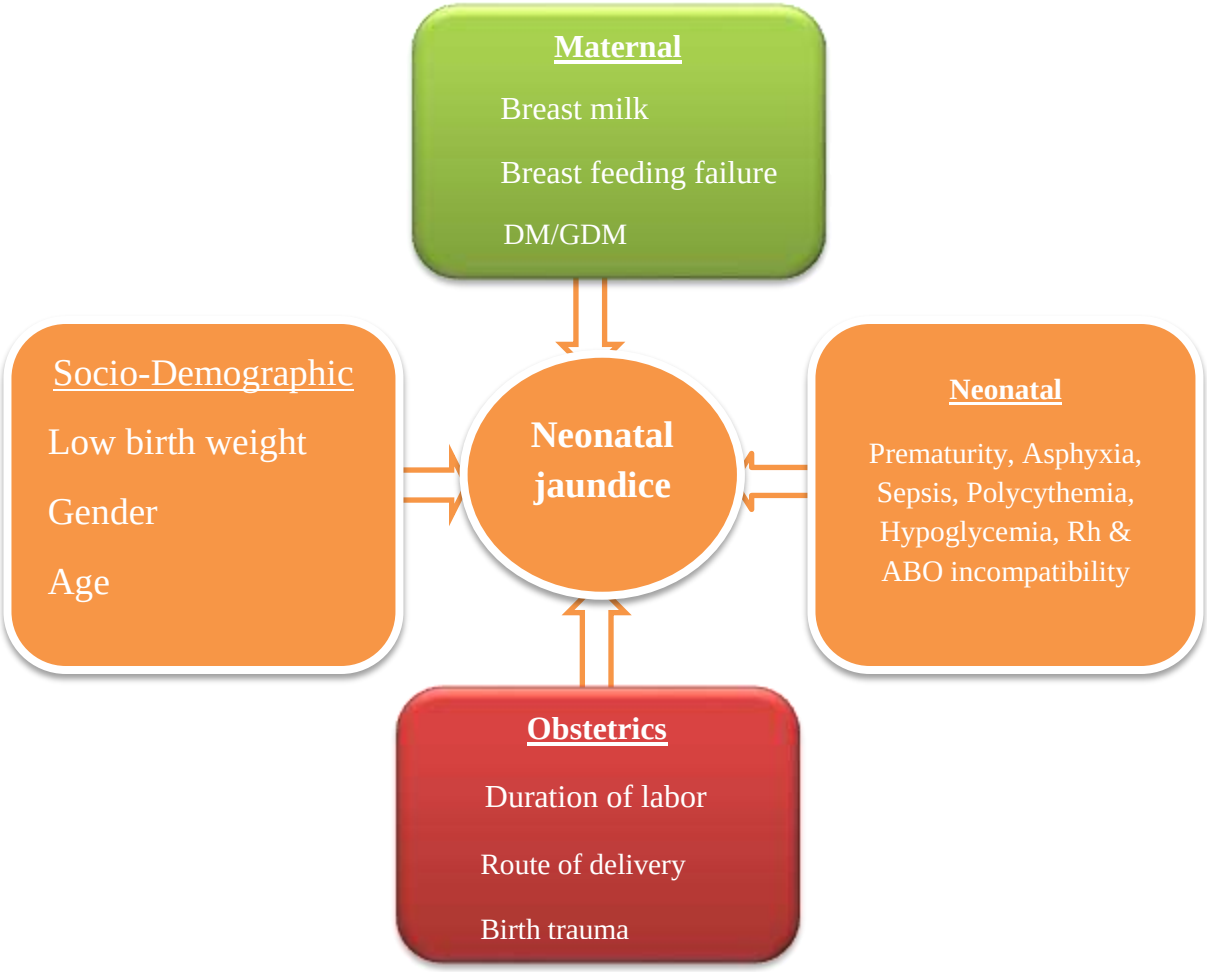

figure 1*:conceptual frame work of neonatal jaundice and its associated factors (reference: adopted from literature review).*

4. Objective

4.1. General objective:

- The general objective this study was to assess the magnitude and associated factors of neonatal jaundice at TGSH neonatal ICU, north Ethiopia, Bahirdar, 2022 GC**.**

4.2. Specific objectives:

- To determine the magnitude of neonatal jaundice
- To identify associated factors of neonatal jaundice

5: Methods and Materials

5.1. Study area and period

The study was conducted at Tibebe Gion Specialized Hospital, Bahir Dar,North-West Ethiopia starting from January 1/2022 to July 30/2022 GC. Bahir Dar city, the capital of Amhara regional state is located Northern-West of Ethiopia, 565 Km far from Addis Ababa, capital city of Ethiopia.

Tibebe Ghion specialized hospital is a newly established tertiary care teaching hospital in Bahir Dar City founded in January 2019GC. It is located about 10km south from the city center and about 7 km from the new bus station ('Addisu Meneharia') on the high way to Addis Ababa. It has more than 450 bed capacity and gives for more than 94,000 clients as outpatient and inpatient services per year.

The pediatric and child health unit has about 112 beds divided into Emergency Triage Assessment and treatment (ETAT), Critical and stable Wards, Neonatal Intensive care unit (NICU) and Pediatric Intensive care Unit (PICU). The neonatal care unit together with the maternal side & KMC has 55 beds (12 preterm, 12 term, 23 maternal, and 8 KMC) staffed with 2 seniors, 5 residents, and 24nurses.

5.2 Study design

An institution-based cross-sectional study design was conducted among neonates admitted at TGSH NICU, north Ethiopia, Bahirdar, 2022 GC.

5.3 Source and Study Populations

5.3.1 source of population: All neonates admitted to TGSH neonatal ICU, north west Ethiopia, Bahirdar.

5.3.2 study population: All neonates who was admitted to TGSH neonatal ICU from January 1/2022 GC to July 30/2022 GC**.**

5.3.2 study subjects: All neonates who are the actual participants of the study.

5.4. Inclusion and Exclusion Criteria

5.4.1 Inclusion Criteria:

All neonates admitted to TGSH neonatal ICU from January 1/2022 GC to July 30/2022 GC.

5.4.2 Exclusion Criteria:

Neonates admitted to TGSH neonatal ICU from January 1/2022 to July 30/2022GC with incomplete documentation of history, physical examination and management.

5.5. Sample Size Determination and Sampling technique

5.5.1. Sample Size Determination

The sample size was calculated by using single population proportion formula with the assumption of 31.6% (21) prevalence of neonatal jaundice done at university of Gondar, 95% confidence level, and 5% margin of error.

$n_0 = Z^2pq/d^2$, where

p=population proportion in problem=0.315

q=1-0.316=0.684

d= degree of error=0.05

Z=the standard normal value at confidence interval of 95%=1.96

n_0 = the minimum sample size from single population = 332

By adding 10% (missed/incomplete charts), the total sample size was calculated to be 365.

5.5.2. Sampling technique

A systematic simple random sampling technique was used to select 365 neonates from NICU registration book. A formula K=N/n was used.
Where:

N=total number of neonates (1200 neonates) admitted to NICU from January 1/2014 to July 30/2014 EC.

n= study population

Giving the value of K (1200/365) =3.

Then a total of 365 charts were selected every 3 chart after selecting the first chart (No. 2) using lottery method.

5.6. Study variables

5.6.1. Dependent variable:

- Neonatal jaundice

5.6.2. Independent variables:

- **Maternal factors**: Diabetes mellitus/gestational DM, breast milk, breast feeding failure
- **Obstetric factors**: Duration of labor, route of delivery, birth trauma
- **Social-demographic factors**: Gender, birth weight
- **Neonatal factors**: polycythemia, prematurity, Rh & ABO incompatibility, hypoglycemia, sepsis, perinatal asphyxia

5.7. Operational definitions

- Neonatal jaundice: yellowish discoloration of a newborns skin, eyes, mucus membrane confirmed by physical examination & laboratory to be in the pathologic range.
- Breast feeding jaundice: Jaundice caused by inadequate intake of breast milk.

5.8. Data collection tools and procedures

Data was collected from the patients' medical records by using an English structured check list format. It was collected by 2 nurses who are currently working at TGSH NICU ward.

5.9. Data quality assurance

To control quality of data, data collectors were oriented about the data collection tool, supervised and daily collected data was checked by principal investigator for its completeness.

5.10. Data processing and analysis

The collected data was checked by the principal investigator and any incomplete document was cleaned, checked before data entry. Then the data was entered to SPSS software version 23 for analysis. The descriptive analysis was done by simple frequencies and proportions, and the results was presented by tables and pie chart. Multivariate analysis was done using variables which was significant during bivariate analysis to find significantly associated factors of neonatal jaundice. A p-value of <0.05 and 95% confidence interval were used to measure the association.

5.11. Ethical Consideration

The study proposal was approved by ethical committee for health research from Bahirdar University, collage of medicine and health sciences. Formal letter was taken from the university to TGSH NICU ward and TGSH card room to be legal for any information that I took from.

5.12. Dissemination and Utilization of the result

The result of this research will be submitted to department of pediatrics and child health, to research center of Bahirdar University College of medicine and health sciences and TGSH medical director and to college of health science department of public health.

6. Result

6.1 Socio-demographic & obstetric distribution of mothers

Most of the mothers (78.6%) were in the age group of 20-35 year, two third of them (66.3%) were multiparous and more than half (56.4%) were from rural. Only 3 (0.8%) had diabetes mellitus, about half of the mothers (51.2 **%**) delivered at nearby health facility & 13(3.6%) delivered at home and two third of the mothers (66.6 **%**) delivered via SVD (Table 1).

Table 1*: Socio-demographic & obstetric distribution of mothers at neonatal intensive care unit of TGSH, north west Ethiopia, Bahirdar, 2014EC.*

Variable	Category	Frequency(n)	Percent
Mothers age	<20	17	4.70 **%**
	20-35	287	78.6 **%**
	>35	61	16.7 **%**
Parity	Primipara	123	33.7 **%**
	Multipara	242	66.3 **%**
Residency	Urban	159	43.6 **%**
	Rural	206	56.4 **%**
Medical illness/diabetes mellitus or Gestational DM	Yes	3	0.80 **%**
	No	362	99.2 **%**
Mode of delivery	SVD	243	66.6 **%**
	Instrumental	44	12.1 **%**
	Cesarean delivery	78	21.4 **%**
Place of delivery	TSGH	165	45.2 **%**
	Nearby health facility	187	51.2 **%**
	Home	13	3.6 **%**

6.2. Proportion of neonatal jaundice and neonatal characteristic distribution

5.2.1. Proportion of neonatal jaundice:

The finding of this study showed that the overall proportion of neonatal jaundice out of (n=365) neonates was 39.5% (CI 34.5, 44.7), which were diagnosed clinically and confirmed by laboratory to have a raised bilirubin level **(Figure 2).**

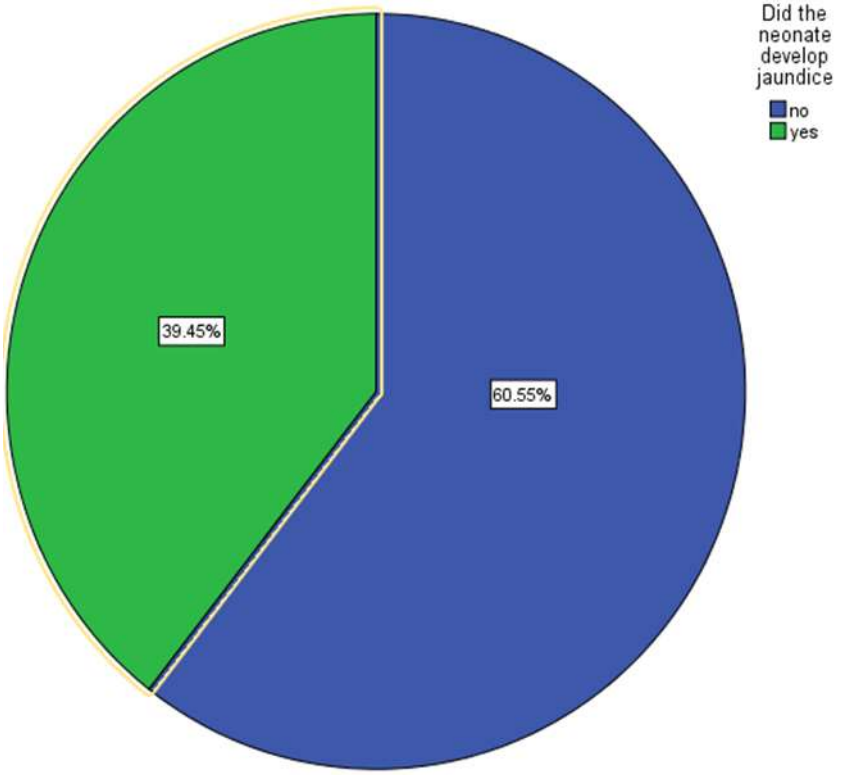

figure 2: *Proportion of neonatal jaundice among neonates admitted to the neonatal intensive care unit of TGSH Bahirdar, Ethiopia, from January 1/2014 to July 30/2014 EC.*

6.2.2 Neonatal characteristic distribution

Out of the total neonates, 188(51.5%) were females, 138(37.8%) had low birth weight (below 2500gm). About two third (64.1%) of the neonates born at term and 95.9% of the neonates had normal (>=7) 5th minute Apgar score. From the total of 144 (39.5%) who had jaundice, all of them were treated with phototherapy where 11 (7.6%) of these neonates had additional exchange transfusion, only 3(2.08%) had developed bilirubin encephalopathy, 137 (95.1%) of them was discharged with improvement, 4(2.8%) neonate were died (immediate cause of were documented other than bilirubin encephalopathy).

***Table 2**: Characteristics of neonates admitted to the neonatal intensive care unit of TGSH, north west Ethiopia,Bahirdar, 2014 EC.*

Variable	**Category**	**Frequency** (n)	**Percent**
Sex of neonate	Male	177	48.5%
	Female	188	51.5%
Birth weight(in gm)	<2500	138	37.8%
	>=2500	227	62.2%
Gestational age(in weeks)	<37	131	35.9%
	>=37	234	64.1%
5th minute Apgar score	<7	15	4.1%
	7-10	350	95.9%
Blood group	A	100	27.4
	B	122	33.4
	AB	11	3.0
	O	132	36.2
	Rh **+ve**	353	96.7
	-ve	12	3.3
Neonatal jaundice	Yes	144	39.5%
	No	221	60.5%
Treatment jaundice	Phototherapy	133	92.4%
	Both phototherapy & Exchange transfusion	11	7.6%
Bilirubin encephalopathy	Yes	3	2.08%
	No	141	97.9 %
Neonatal out come	Improved discharged	137	95.1%
	Discharged with sequele	1	0.7%
	Went against	2	1.4%
	Died	4	2.8%

6.3: Factors associated with neonatal jaundice

Logistic regression analysis was used to determine the effect of each independent variable on neonatal jaundice. Variables statistically significant (p-value of <0.25) at bivariate logistic regression were neonatal sepsis**,** gestational age, birth weight, birth trauma, ABO incompatibility, Rh incompatibility and duration of labor.

All variables statistically significant at bivariate level were included in the multivariate logistic regression analysis to determine factors affecting neonatal jaundice by controlling other variables in the model and variables with P-value of <0.05 were considered significant. Birth weight, birth trauma, Rh-incompatibility & ABO-incompatibility were found to be significant variables associated with neonatal jaundice.

Neonates who had ABO-incompatibility were 28.3 times more likely to have neonatal jaundice than neonates who had no ABO incompatibility (AOR:28.3(9.1,87.5)), neonates with Rh-incompatibility were 15.4 times more likely to have neonatal jaundice than those who don't have (AOR:15.4(3.9,60.3)), neonates who had birth trauma (cephalhematoma or subgaleal hemorrhage) were 11.1 times more likely to have neonatal jaundice than those without birth trauma (AOR: 11.1(3.2, 38.5)) and neonates born with low birth weight were 3.5 times more likely to have neonatal jaundice than those having normal birth weight (AOR:3.5(1.43, 8.73))(**Table:3**).

Even though variables like neonatal sepsis and gestational age were not significant at multivariate logistic regression analysis, the presence of sepsis were 1.22 times to have neonatal jaundice than those of neonates without sepsis (COR: 1.77(1.56, 20.22)) and low gestational age (below 37 weeks) were 2.14 times to have neonatal jaundice than whose who was born at term (COR: 2.14(1.99,4.86)) at bivariate logistic regression where confounders were not controlled.

***Table 3**: Neonatal jaundice and its associated factors among neonates admitted to neonatal intensive care unit of TGSH Bahirdar, Ethiopia, from January 1/2014 to July 30/2014 EC*

Variable	Category	Neonatal jaundice				COR(95% CI)	AOR(95% CI)	P-Value
		Yes		No				
		N	%	N	%			
Sex	Male	75	20.5	102	27.9	1.26 (0.83,1.93)		
	Female	69	18.9	119	32.6			
sepsis	Yes	115	31.5	169	46.3	**1.22 (1.03, 2.43)**	0.6(0.29,1.23)	0.163
	No	29	7.94	52	14.2	Ref		
GA	<37	74	20.3	56	15.3	**2.14(1.99,4.86)**	1.91(0.79,4.61)	0.148
	>=37	70	19.2	165	45.2	Ref		
Birth weight(gm)	<2500	78	20.8	60	16.2	**2.97(1.88,4.55)**	**3.5(1.43, 8.73)**	**0.006**
	=>2500	69	18.6	158	43	Ref		
Apgar score	<7	8	2.1	7	1.9	1.79(0.638,5.072)		
	7-10	136	37.2	214	58.6	Ref		
Polycythemia	Yes	4	1.1	3	0.8	2.07(0.458,9.416)		
	No	140	38.3	218	59.7	Ref		
Hypoglycemia	Yes	5	1.4	5	1.4	1.55(0.442,5.466)		
	No	139	38.1	216	59.2	Ref		
Birth trauma	Yes	15	4.1	4	1.1	**6.30(2.049,19.416)**	**11.1(3.2,38.5)**	**0.000**
	No	129	35.3	217	59.5	Ref		
Breast feeding failure	Yes	6	1.64	3	0.82	3.159(0.77,12.840)		
	No	138	37.8	218	59.7	ref		
ABO-setup	Yes	32	8.8	4	1.1	**15.50(5.34,44.925)**	**28.3(9.1,87.5)**	**0.000**
	No	112	30.7	217	59.4	Ref		
Rh-setup	Yes	12	3.3	3	0.8	**6.60(1.830,23.843)**	**15.4(3.9,60.3)**	**0.000**
	No	132	36.1	218	59.7	Ref		
Mode of delivery	SVD	92	25.2	151	41.3	Ref		
	Instrumental	23	6.3	21	5.7	1.79(0.942,3.429)		
	Cesarean delivery	29	7.9	49	13.4	0.97(0.573,1.646)		
Duration of labor	Normal	114	31.2	199	54.5	Ref		
	Prolonged	30	8.2	22	6	**2.38(1.31,4.32)**	**0.34(0.17,0.69)**	**0.003**

7. Discussion

The overall proportion of neonatal jaundice among all neonates (n=365) in this study were 39.5% (CI: 34.5, 44.7). Having ABO & Rh-incompatibility, presence of birth trauma (cephalhematoma or subgaleal hemorrhage) and low birth weight were found to be signifantly associated factors with neonatal jaundice.

The finding of this study was comparable with the result of a study done in Ethiopia (41.4%) (18), in Mekelle Tigray 37.3%(19), and Tikur Ambesa hospital which was 44.9% (20). The possible justification may be related to the similarity of the study setting and sociodemo-graphic characteristics. In other African countries, in Rwanda (44.3%) (14) & Nigeria (35.94%) (12) was also similar with this study.

The finding of this study (39.5%) was lower than that of the finding of a studies done: in Asia, Malaysia Pasir Puteh health facilities which was (63%) (22) this difference could be because of the lower diagnostic level for hyperbilirubinemia & possibly the higher sample size in that study; in South Africa, Bloemfontein which was (55.2%) which could be because sampling technique they used were convienient method and they classified the neonates as qualified & possibly qualified for phototherapy and they used to treat both groups mainly because of the difficulty to return for follow ups (13).

On the other hand, the finding of this study was higher than that of the studies done: in University of Benin teaching hospital, Benin City (26.5%)(17); in Uganda St. Francis hospital (22.7%) (15); in Ethiopia Addis Abeba St Paul's hospital millenium medical college 13.3%(16) & at university of Gondar comprehensive specialized hospital 31.6%(21). This variation might be linked with the fact that differences do appear among study designs and study areas.

This study showed that birth weight (having low birth weight), presence of birth trauma (cephalohematoma/subgaleal hemorrhage), ABO & Rh-incompatibilty were significant factors associated with neonatal jaundice which is in line with finding of a study done at university of Gondar comprehensive specialized hospital where all of these four variables were significantly associated with neonatal jaundice(21).

In studies done: in children's hospital in Sierra Leone ABO incompatibility, cephalohematoma & Rh incompatibility (24); in public general hospitals of central zone of Tigray low birth weight &

Rh incompatibility(1); in Mekelle city Rh incompatibility & low birth weight (19); in St Paul's hospital millenium medical college presence of birth trauma (16) were some of the variables having significant association with neonatal jaundice which are in line with the result of this study(19).

Similar as in this study, presence of ABO-incompatibilty were significantly associated with neonatal jaundice in a study done at Tikur Ambesa hospital(20); in South of Iran (Fars Province) (23) & in a study done at University of Benin Teaching Hospital, Benin City(17).

On the other hand, prolonged duration of labor was found in this study protective to neonatal jaundice which is opposite to the result of the study done in Mekelle (19) where it was a significant risk factor. This discrepancy could be because of the effect of confounders.

7. Limitations

As a secondary data were used, some charts were having missed variables and it was difficult to assess the effcet of G-6PD deficiency in neonatal jaundice short of its investigation in our setup.

8. Conclusion and recommendations

8.1. Conclusion:

The proportion of neonatal jaundice in this study was higher than that of study done in the same setting in this region. By identifying the contributing factors earlier, we can able to modify them and reduce the need for neonatal intensive care unit admissions for neonatal hyperbilirubinemia. By doing so related morbidity & mortality of neonates including long term sequele can be minimizd.
Presence of ABO & Rh-incompatibilty, having low birth weight and presence of birth trauma were significantly associated with neonatal jaundice in this study.

8.2. Recommendations:

Based on the findings of this study, the following recommendations are proposed:

- Mothers need to have focused ANC so that (to Amhara regional health beauro):
  - Causes of low birth weight can be minimized
  - Rh-negative mothers can get anti-D antibody at appropriate time and better preparedness can be settled for mothers who already develop Rh-sensitization.

- Delivery will be at health facility being attended by responsible personnel so as to preven prolonged duration of labor and misuse (application) of instrumental delivery to prevent birth trauma.

➢ TGSH department of pediatrics and child health should avail all the necessary material needed for treatment of neonatal jaundice including fresh blood and phototherapy so that un necessary referral can be avoided.

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10. Annex-1: Data collection check list

1.Maternal socio-demographic and obstetric factors			
Code	**Question**	**Response**	**Remark**
01	Maternal age (in years)	_____	
02	Parity of mother	_____	
03	Chronic medical illness	A. DM/gestational DM B. Cardiac C. Others_____	
04	Maternal blood group and Rh	A^+ B^+ AB^+ O^+ A^- B^- AB^- O^- Unknown (encircle one)	
05	Place of residency	A. Urban B. Rural	
06	Place of delivery	A. Inborn B. Out born	
07	Mode of delivery	A. SVD B. Instrumental C. cesarean section	
08	Duration of labor	A. Normal B.Prolonged	
09	Birth trauma	A. Yes B. No	
10	Breast feeding habit	A. Adequate (=>8x/day) B. In adequate below 8x/day	
Neonatal demographic & other associated factors			
11	Sex of neonate	A. Male B. Female	
12	Gestational age (in weeks)	_____	
13	Birth weight (in grams)	_____	
14	Fifth minute Apgar score	_____&_____	
15	Type of feeding	A. Breast milk B. Formula C.MF	
16	Neonates blood group	A^+ B^+ AB^+ O^+ A^- B^- AB^- O^- Un known	
16	Family/sibling history of jaundice	A. yes B. No	
17	Family/sibling history of jaundice	A.Yes B.No	
18	Neonatal sepsis	A. Yes B. Yes	
19	Neonatal hypoglycemia	A. Yes B. No	

20	Neonatal polycythemia	A. Yes B. No	
21	Did the neonate developed jaundice	A. Yes B. No	
22	Age at onset of jaundice	_____	
23	What was/were the associated factor/s (cause) of jaundice	A. prematurity B. breast milk C. breast feeding D. sepsis(infection) E. RH Isoimmunization F. ABO incompatibility G. birth asphyxia H. Other reason _____	
23	Type of management	A. phototherapy B. exchange transfusion C. others	
24	Outcome of the neonate	A. Improved without sequale B. Developed sequale C. Went against D. Died	