Assessment of Neonatal Nurses' Performance Regarding Early Detection of Neurological Dysfunction among Neonates Having Hyperbilirubinemia

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Abstract

Background: Neonatal hyperbilirubinemia is the most common health hazard of neonates which have toxic effects on the brain and cause serious complications Nurses' apply the bilirubin induced neurological dysfunction for early detection of neurological dysfunction have decrease incidence of neurological dysfunction among neonate having hyperbilirubinemia. **Aim of The study** was to assess nurse's' performance regarding early detection of neurological dysfunction among neonates having hyper-bilirubinemia. **Research design**: descriptive study was utilized. **Research settings** the study was conducted in neonatal intensive care units at Benha University Hospitals and Specialized Children Hospital in Benha City. **Subjects:** (50) nurses who work in the previous mentioned settings and (100) neonates were selected **Tools of data collection:** ***1st tool*** Interview questionnaire sheets were used to collect the participants' characteristic data and knowledge of the studied nurse regarding hyperbilirubinemia, ***2nd tool:*** observational checklist about bilirubin induced neurological dysfunction tool to assess nurses' performance for early detection of neurological dysfunction**. Results**: The present study indicated that nurses' knowledge about bilirubin induced neurological dysfunction and application of bilirubin induced neurological dysfunction tool was unsatisfactory and there was a statistically significant difference between mean scores of nurses' skills **Conclusion:** It was concluded that, the highest percentage of nurses had unsatisfactory knowledge, while minority of nurses' had satisfactory score regarding early detection of neurological dysfunction among Neonates Having Hyperbilirubinemia. **Recommendation:** It was recommended that, neonatal intensive care units should provide training courses for nurses about hyperbilirubinemia and application of bilirubin induced neurological dysfunction tool

Key words: Neonatal Nurses; Neurological Dysfunction; Hyperbilirubinemia.

Introduction

Neonatal hyperbilirubenemia is a common condition affecting newborn babies. Two thirds of human neonates develop clinically evident indirect hyperbilirubin-emia in the first few days of life making it the most common clinical condition in the newborn requiring evaluation and management **(Abdallah, & Elsabbagh, 2015).**

Neonatal hyperbilirubinemia occurs in about 60% of newborns. If not managed properly, it can progress to severe neonatal hyper-bilirubinemia (SNNJ) leading to death or permanent disability (**Abai et al., 2011; Canadian pediatric society, 2007; Su and Pahang, 2014).**

Neonatal hyperbilirubinemia which is yellow coloration of the skin and sclera in newborns from the accumulation of unconjugated bilirubin occurs in most

newborn infants and it is the most common condition that requires medical attention in newborns (**Slusher, Olusaniya, 2012).**

Most jaundice is benign (physiological) and usually need no treatment as it resolves within two weeks.

However, the diagnosis of physiological jaundice is retrospective because sometimes jaundice can start with bilirubin in the physiological range and then escalate or become prolonged or show signs of cholestasis (**Slusher and Olusaniya, 2012 and American Academy of Pediatrics, 2004).**

More importantly is the neurotoxicity (acute bilirubin encephalopathy) or death in newborns and lifelong neurologic sequelae in infants who survive (kernicterus) from excessive rise of unconjugated bilirubin.

For these reasons, newborn infants with jaundice must be identified early and the level of jaundice monitored to identify those who might develop severe jaundice, acute bilirubin encephalopathy & kernicterus **(Adebami (2011) and Queesland Maternity and Neonatal Clinical guidelines Program (2012)**.

It is known that missed diagnosis of jaundice, trivializing all cases of neonatal jaundice, poor monitoring, and prescriptions of wrong and ineffective medications for jaundice has been found responsible for the persistence of acute bilirubin encephalopathy and cerebral palsy in the sub region **(Adebami, 2011)**. Among the babies who presented late with acute bilirubin encephalopathy in a teaching hospital, about 80% were seen by at least a health worker 24 hr. before the brain damage and were given ineffective prescription, wrong counsel and reassurance (**Adebami, 2011)**. Primary and the secondary health facilities and the workers are the closest health care providers to the community in terms of availability, accessibility and affordability. The role of primary and secondary health care levels is very critical to neonatal hyper-bilirubinemia management. Parents heavily depend in most cases on the advice and care being provided by these facilities without cross checking whether they are right or not. **(Adebami, et al., 2015)** Nurses play a very important role in caring the baby during phototherapy. Of all care givers in the NICU, nurses usually spend the most time at the baby's bedside **(Angel, 2015).**

Aim of the study:

The study aimed to assess Nurses' Performance about Early Detection of Neurological Dysfunction among Neonates Having Hyperbilirubinemia.

Research Question:

What are the level of knowledge and practice of nurses about Early Detection of Neurological Dysfunction among Neonates Having Hyper-bilirubinemia?

Subjects and methods:

Research design:

Descriptive design was used for this study.

Setting:

This study was carried out at Neonatal Intensive Care Units (NICUs) at Benha University Hospitals and NICUs in Children Specialized Hospital at Benha City **Sample size** all nurses (50) who work in the previous mentioned settings and (100) neonates were selected

Tools of data collection:

Two tools of data collection were used as follow;

l- Structured interviewing questionnaire format. It was designed in simple Arabic language by the researcher after reviewing of relevant literature regarding to care of neonates with hyperbilirubinemia. It consists of the following two parts:

Part I: It was concerned with the characteristics of the studied nurses, as regards their age, level of education, years of experience and attendance of previous training programs about management of hyperbiliru-binemia.

Part II: It was dealt with the characteristics' of the studied neonates as gestational age, gender, types of delivery, types of feeding.

2nd Part: it was related to assess nurses' knowledge about kernicterus such as: definition, causes, importance of assessing neurological function, BIND tool definition, and component. This tool was used.

➢ **Scoring system of nurses' knowledge:-**

The total score for the questionnaire formats was "128" marks.

The nurses' answers were categorized into:

- Score > 85%, referred to satisfied knowledge.
- Score less than 85% referred to unsatisfied knowledge.

An Observational Checklist for BIND: It was adopted from Bhutani (2006) used to assess nurses' performance for early detection of neurological dysfunction ,this observational checklist was translated into Arabic to be easily understood and used by nurses. The observational checklist about BIND tool includes 3 parts assessment: Mental status, Muscle tone and Cry pattern.

Mental status includes 3 items, Muscle tone 3 items and Cry pattern 3items.

Numeric values are assigned to the levels of in each category and stared from 0-3 in Mental status, from0-3 in Muscle tone and from 0-3 in Cry pattern

- total Score of BIND tool 9
- Score of 7-9 represent advanced ABE: urgent, prompt and individualized interventions are recommended to prevent further brain damage, minimize severity of sequelae and possible reverse acute damage.
- Score of 4-6: represent moderate ABE and are likely to be reversible with urgent and prompt bilirubin reduction strategies.
- Score of 1-3: are consistent with subtle signs of ABE in infants with HB

➢ **Scoring System of Observational Checklist on BIND tool**:

An observational checklist on BIND tool included 3 parts; the Total numbers of items in the observational checklist were 9 items. Regarding skills of the nurses in the observational checklist in each part every item done correctly and accurately was giving 1 score and each item not done/or done inaccurately was giving 0 score. Allow them to re-demonstrate application of BIND tool upon regarding to total skills' **scores of the observational. Checklist** was 9 scores, the scores of the items were summed up and the total divided by the number of the items.

Nurses get scores from 0-5 were considered having incompetent skills. Nurses get scores from 6-9 were considered having competent skills.

Ethical consideration:

The ethical research considerations in this study were included the following:

Informed consent was obtained from participant after explaining the purposes of the study. No harm occurred to participant. Each participant had right to withdraw from the study at any time. Data was confidential and used by researcher only.

Methods for data collection:

The study was carried out in three phases:

Phase (1): Preparatory phase: This letter was including a brief explanation of the objectives of the study and permission was requested from each nurse to carry out the study. The study tools were developed by the researcher after an extensive review of the relevant literature.

Validity and Reliability: The tools were tested for content validity by 5 experts of academic medical and nursing staff from faculty of nursing at Ain shams University. Modifications were done accordingly, and then the tools were designed in its final format and tested for reliability by using internal consistency for the tools measured using Cronbach test, the tools proved to be reliable (0.73).

Pilot study: A pilot study was conducted on 10% of the study sample (5 nurses) in a selected setting to evaluate the applicability & clarity of the tool. No modification was done in the study tool based on the pilot study. This sample was included in the study sample

Field work:

The actual fieldwork carried out for data collection started in the beginning of March 2018 and lasted until the end of May 2018. Data collected four days per week during the morning and afternoon shifts (Saturday, Monday, Tuesday and Thursday), the researcher was visiting the two NICUs time stay in each unit was 3hour per day. The researcher was observing 5-6 nurses per day divided them to two groups during performances' care for neonates The researcher introduced herself to the nurses who will share in the study, explained the purpose of study and methods of data collection. After that researcher assessed nurses' knowledge about hyperbilirubinemia and BIND score by using nurses' knowledge questionnaire, this took about 20-30 minutes for each nurse. researcher assessed skills of each nurse in application of BIND score by using the observational checklist about BIND score, this took about 20-30 minutes for each nurse. Then researcher summarized all the information and techniques and answered all nurses' questions and clarified any misunderstanding and thanked nurses. The researcher collected the socio demographic data about children from medical record and this took about 5-10 minutes for each neonates.

Administrative design:

An official written approval letter clarifying the purpose of the study was obtained from the Dean of Faculty of Nursing, Ain Shams University to collect data from the pre mentioned study settings, also written approval was submitted to the director of Benha University Hospitals and director of Specialized Children Hospital to collect data from pre mentioned study setting.

Statistical design:

After completion of data collection, the data were entered and tabulated, statistically analyzed using Data entry was done using Epi-Info 6.04 computer software package, while statistical analysis was done using statistical software package SPSS 15.0. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables.

Result:

Table (1): This table show that, more than one third of studied nurses (36%) were in age group of 25-30 years. Regarding nurses' qualifications, more than half of studied nurses (60%) had nursing diploma. In relation to years of experience, approximately one third of studied nurses (32%) had < 5 years of experience. Regarding training courses, the majority of studied nurses (96%) did not attend any previous training courses.

Table (2): This table shows that, more than half of studied neonates were males (68%). According to type of feeding, the majority of studied neonates had artificial feeding (72%). more than half (60%) of studied neonates were delivered by cesarean section, while the rest of them (40%) were delivered by normal vaginal delivery. However, for (62%). neonates was preterm for Gestational age.

Table (3): This table shows that, more than Two third of studied nurses (74.0%) had Unsatisfied knowledge about Method to assess the Bilirubin- induced neurological dysfunction and majority of studied nurses (82%) had Unsatisfied knowledge about nursing Early symptoms of Bilirubin-induced neurological dysfunction.

Table (4): This table shows that, the majority of studied nurses (92.0%) had unsatisfied knowledge about Definition the BIND tool and majority of studied nurses (90%) had unsatisfied knowledge about BIND tool items.

Table (5): This table shows that, the near to half of studied nurses (46.0%) had satisfied knowledge about Purpose of using phototherapy and majority of studied nurses (70%) had Unsatisfied knowledge about The distance required between a traditional phototherapy device and the neonate.

Table (7): This table shows that, more than two third of studied neonates (74%) had Low Risk. And the minority of studied neonates (6 %) had severe risk about BIND score this by the researcher and also shows that more than two half of studied neonates (62%) had Low Risk. And the studied neonates (20%) had severe risk about BIND score by the nurses.

Table (8): This table shows a highly statistical significant difference between total score level of nurse's total knowledge, x^2=23.188, with p-value <0.001.

Table (9): reveals that there is a highly statistically significant correlation between total practice and total knowledge with p-value (<0.001).

Table (10): This table shows the relation between nurses' demographic characteristics and satisfied regarding knowledge score. The result found that there were statistically significant relation between knowledge and their years of experience and educational level with p-vale (<0.05).

Table (1): Number and percentage distribution of the studied nurses according to their socio-demographic characteristics (N=50).

Socio-Demographic data	No.	%
Age in year		
20 <25	13	26
25 <30	18	36
30 <35	9	18
≥35	10	20
Mean±SD	29.23±4.29	
Years of experience		
<5	16	32
5<10	14	28
10 <15	12	24
≥15	8	16
Mean±SD	7.88±2.68	
Educational level		
Nursing diplomas	30	60
Technical nursing education	10	20
Bachelor degree of nursing	9	18
Postgraduate nursing study	1	2
Work place		
Benha University Hospitals	24	48
Children's Hospital in Benha	26	52
Training programs		
No	42	96
Yes	2	4

Table (2): Number and percentage distribution of the studied neonates according to their characteristics (N=100).

Characteristics of the newborn	No.	%
Type of newborn		
Male	68	68
Female	32	32
Gestational age of the child		
Pre term	62	62
Full-term	31	31
Post term	7	7
Age days		
≤3 days	38	38
>3-6 days	37	37
>6-9 days	19	19
>9 days	6	6
Mean±SD	4.81±2.52	
Birth Type		
Normal delivery	40	40
Cesarean section	60	60
Feeding Type		
Artificial feeding	72	72
Artificial feeding & Breast feeding	28	28
Maternal Blood group		
O	19	19
B	39	39
A	37	37
AB	5	5
Maternal RH		
Negative	63	63
Positive	37	37
Baby Blood group		
O	26	26
B	34	34
A	38	38
AB	2	2
Baby RH		
Negative	34	34
Positive	66	66
Total Bilirubin		
21-25	60	60
>25-30	36	36
>30-35	4	4
Mean±SD	25.47±3.16	
Comb's direct		
Negative	93	93
Positive	7	7
CRP		
Negative	81	81
Positive	19	19

Table (3): Distribution of nurses according to their knowledge regarding bilirubin- induced neurological dysfunction (N=50).

Knowledge	Satisfied		Unsatisfied		p-value
	No.	%	No.	%	
Definition bilirubin- induced neurological dysfunction of newborns with Hyperbilirubinemia	13	26.0	37	74.0	<0.001**
Causes of bilirubin- induced neurological dysfunction	13	26.0	37	74.0	<0.001**
Method to assess the bilirubin- induced neurological dysfunction.	14	28.0	36	72.0	<0.001**
High risk neonatal to bilirubin- induced neurological dysfunction	14	28.0	36	72.0	<0.001**
Early symptoms of bilirubin- induced neurological dysfunction	9	18.0	41	82.0	<0.001**
Method to treat bilirubin- induced neurological dysfunction	13	26.0	37	74.0	<0.001**
Complications of bilirubin- induced neurological dysfunction	13	26.0	37	74.0	<0.001**
Total	13	26.0	37	74.0	<0.001**

**p-value <0.001 H

Table (4): Distribution of nurses according to their knowledge of nurses working in neonatal care units about BIND tool for early detection of neonatal dysfunction with hyperbilirubinemia (N=50).

Knowledge	Pre		p-value
	No.	%	
Definition the BIND tool			
Satisfied	4	8.0	<0.001**
Unsatisfied	46	92.0	
Importance of the BIND tool.			
Satisfied	4	8.0	<0.001**
Unsatisfied	46	92.0	
BIND tool components include:			
Satisfied	5	10.0	<0.001**
Unsatisfied	45	90.0	
The importance of using the BIND tool			
Satisfied	4	8.0	<0.001**
Unsatisfied	46	92.0	
Parameters are used in the BIND tool			
Satisfied	2	4.0	<0.001**
Unsatisfied	48	96.0	
Total scores of the BIND tool			
Satisfied	6	12.0	<0.001**
Unsatisfied	44	88.0	
BIND items			
Satisfied	5	10.0	<0.001**
Unsatisfied	45	90.0	
The degrees of the tool BIND			
Satisfied	4	8.0	<0.001**
Unsatisfied	46	92.0	
Total			
Satisfied	4	8.0	<0.001**
Unsatisfied	46	92.0	

**p-value <0.001 HS

Table (5): Distribution of nurses according to their knowledge nurse about phototherapy (N=50).

Knowledge	Pre		p-value
	No.	%	
Definition of phototherapy.			
Satisfied	19	38.0	<0.001**
Unsatisfied	31	62.0	
Purpose of using phototherapy			
Satisfied	23	46.0	<0.001**
Unsatisfied	27	54.0	
Phototherapy complications			
Satisfied	15	30.0	<0.001**
Unsatisfied	35	70.0	
The light used is			
Satisfied	5	10.0	<0.001**
Unsatisfied	45	90.0	
Proportion of bilirubin during phototherapy			
Satisfied	10	20.0	<0.001**
Unsatisfied	40	80.0	
Care eyes during phototherapy			
Satisfied	15	30.0	<0.001**
Unsatisfied	35	70.0	
The distance required between a traditional phototherapy device and the neonate			
Satisfied	11	22.0	<0.001**
Unsatisfied	39	78.0	
Method of purification of phototherapy equipment			
Satisfied	6	12.0	<0.001**
Unsatisfied	44	88.0	
Phototherapy device be closed when blood is withdrawn for bilirubin			
Satisfied	15	30.0	<0.001**
Unsatisfied	35	70.0	
Care the skin of the child under phototherapy			
Satisfied	11	22.0	<0.001**
Unsatisfied	39	78.0	
Total			
Satisfied	13	26.0	<0.001**
Unsatisfied	37	74.0	

**p-value <0.001 HS

Table (6): Distribution of nurses and researcher according to their practice of BIND score (N=50).

Practice of BIND score sheet	Pre	
	No.	%
Mental status: Nurses		
Normal	5	10.0
Sleepy, poor feeding	26	52.0
Lethargic, irritable	15	30.0
Semi- Conscious, seizures, coma	4	8.0
Mental status: Researcher		
Normal	22	44.0
Sleepy, poor feeding	25	50.0
Lethargic, irritable	0	0.0
Semi- Conscious, seizures, coma	3	6.0
Muscle tone: Nurses		
Normal	9	18.0
Mild, hypertonia or hypotonia	25	50.0
Mild truncal arching	6	12.0
Opisthotonos, bicycling movements	10	20.0
Muscle tone: Researcher		
Normal	26	52.0
Mild, hypertonia or hypotonia	15	30.0
Mild truncal arching	9	18.0
Opisthotonos, bicycling movements	0	0.0
Cry pattern: Nurses		
Normal	9	18.0
High pitched	22	44.0
Shrill	16	32.0
Inconsolable	3	6.0
Cry pattern: Researcher		
Normal	4	8.0
High pitched	39	78.0
Shrill	7	14.0
Inconsolable	0	0.0
Total Score Nurses		
Low Risk	31	62.0
Moderate Risk	9	18.0
Severe Risk	10	20.0
Total Score Researcher		
Low Risk	37	74.0%
Moderate Risk	10	20.0%
Severe Risk	3	6.0%

Table (7): Number and Percentage distribution of the studied nurses according to their total knowledge pre and post implementation of guidelines (N=50).

Total Knowledge	Knowledge		Chi-square test	
	No.	%	x2	p-value
Satisfied	11	22.0		
Unsatisfied	39	78.0	23.188	<0.001**
Total	50	100.0		

**p-value <0.001 HS

Table (8): Correlation between studied nurse's practices and their knowledge.

Total knowledge	Mean Score of practice			
	Pre		Post	
	R	p-value	R	p-value
Pre	**0.255**	**0.303**		
Post			**0.463**	**<0.001****

P-value >0.05 NS; **p-value <0.001 HS

Table (9): Relation between nurses total knowledge and their demographic characteristics (n=50).

Socio-Demographic data	Total knowledge				Chi-square test	
	Unsatisfied (N=15)		Satisfied (N=35)		x2	p-value
	No.	%	No.	%		
1) Age in year						
20-	4	26.7	12	34.3	1.190	0.755
25-	4	26.7	8	22.9		
30-	1	6.7	5	14.3		
≥35	6	40.0	10	28.6		
2) Years of experience						
<5	10	66.6	6	17.1	18.155	<0.001**
5-	2	13.3	14	40.0		
10-	1	6.6	11	31, 4		
≥15	0	0.0	8	22, 8.		
3) Educational level						
Nursing diplomas	13	86.7	15	42.9	8.900	0.031*
Technical nursing education	2	13.3	10	28.6		
Bachelor degree of nursing	0	0.0	9	25.7		
Postgraduate nursing study	0	0.0	1	2.9		
4) Work place						
Benha University Hospitals	9	60.0	15	42.9	1.236	0.266
Children's Hospital in Benha	6	40.0	20	57.1		
5) Training programs						
No	15	100.0	33	94.0	0.000	1.000
Yes	0	0.0	2	6.0		

p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Discussion

This study was designed to assess Nurses' Performance about Early Detection of Neurological Dysfunction among Neonates Having Hyperbilirubinemia including recognition, knowledge about BIND tool causes, complications, treatment, and prevention and to identify the factors that influence knowledge of neonatal hyperbilirubinemia. Neonatal jaundice is the most common health hazards of neonates. It is caused by hyper-bilirubinemia that appears in almost 60% of the term neonates and approximately in more than 80% of the premature neonates in the first three days after birth ***(Henny-Harry, & Trotman, 2012; National Collaborating Centre for Women's and Children's Health, 2010).***

The most appropriate nursing intervention for neonates with hyperbilirubinemia is to monitor bilirubin level, identify infants at risk for developing severe form of hyperbilirubinemia and implement prescribed treatment effectively when indicated ***(Watson, 2012).***

The current study answer research question that, what are the level of knowledge and practice of nurses about early detection of neurological dysfunction among neonates having hyper-bilirubinemia?

Regarding characteristics of studied nurses, the present study illustrated that more than one third of studied nurses were in age group 25-30 years. This finding was consistent with ***Ashor (2016)*** who conducted a research about "Effect of a Designed Nursing Care Protocol on Clinical Outcomes of Neonates with Hyperbilirubinemia" and found that more than one thirds of them aged 25-30 years. This reflects that more than one third of nurses had few years of experience in NICU.

Also, this study showed that more than half of nurses were diploma nurses. This finding was in line with ***El- Shahat (2014)*** who conducted a research about" assessment of nurses' knowledge and practice about care needed for newborn under phototherapy in neonatal intensive care unit (NICU)". It was found that less than half of studied nurses had nursing diploma. Meanwhile, such finding was inconsistent with ***Mohamed (2015)*** who conducted a research about "effect of clinical pathway on care of neonates having hyperbilirubinemia" and reported that three fifths of studied neonates had secondary school of nursing diploma. The National Association of Neonatal Nurses ***(NANN) (2005)*** recommended that nurses who work in NICUs must be graduates from baccalaureate degree programs to be prepared as highly qualified nurses and to be more mature in age.

For years of experience, the current study showed that approximately one third of studied nurses had <5 years of experience in NICU. This finding was in agreement with ***Mohamed (2010)*** who conducted a research about "assessment of nurses' knowledge and practice regarding care given for neonates with hyper-bilirubinemia". It was found that the highest percentages of studied nurses had 1<10 years of experience. "***NANN" (2008)*** recommended that, nurses who work in NICU must receive professional training to become qualified neonatal nursing practitioners. Also, they need life- long training to be able to identify new trends in neonatal nursing. In USA, The neonatal nurse practitioner must have two years' experience in caring for neonates in order to be practitioners in NICU. It is assumed that years of experience have a significant positive effect on the nurses' knowledge and performance which result in improving quality of care provided.

The findings of the current study revealed that the majority of studied nurses did not attend any previous training courses. This finding may be due to the shortage of nurses' number, absence of continuing education department in the hospital, lack of motivation for training as well as increased work load in Neonatal Intensive Care Units. These findings were in the same line with a study done by ***El-Shahat (2015)*** about "assessment of nurses' knowledge and practices about care needed for newborn under phototherapy in neonatal intensive care units (NICU) in Ismailia city". Also, it was found that majority of nurses did not attend any training sessions related to neonatal jaundice.

As well, these findings were in agreement with ***El Sayed (2007)*** who conducted a research about "pain management practices used by nurses working at neonatal care units" and found that the majority of studied nurses did not receive previous training courses. This may be one of the leading causes for lack of knowledge and skills among nurses caring for neonates having hyperbilirubinemia. So, neonatal nurses were in need for training to improve the quality of care. Additionally, ***Carol (2009)*** mentioned that formal training courses play an important role in enhancing and updating nurses' knowledge,

performance and improving the quality of care given to neonates.

Regarding characteristics of studied neonates, the present study illustrated that more than half of studied neonates were males. It was clearly stated by several authors that male infants were at higher risk for developing severe jaundice than female infants ***(Zoubir et al., 2011).*** This finding was consistent with a study done by ***El Mazzahy (2013)*** about "neurological outcome of neonates with severe hyperbilirubinemia with different modalities of treatment". It was found that the ratio of attending males to females was 1.4 to 1. Also, these results were in agreement with ***Sabry (2014)*** in his study "The nurse's role in the prevention of acute bilirubin toxicity among neonates undergoing exchange transfusion". He reported that the incidence of hyperbilirubinemia was higher among males than females.

Regarding type of feeding, the current study represented that the majority of studied neonates had artificial feeding. This finding was consistent with ***El-Sayed et al., (2013)*** who conducted a research about "Effect of phototherapy on behavior of jaundiced neonates" and revealed that the majority of studied neonates (80%) were fed by bottle.

For gestational age of studied neonates, the present study revealed that more than half of studied neonates were preterm This finding was in line with ***Mohamed (2008)*** who conducted a research about " Prevalence of glucose-6-phosphate dehydro-genase deficiency among newborns with indirect hyperbilirubinemia". who reported that the age of the neonates ranged from after birth to day 10 with a mean age 4.5±2 days. Also, these results came in agreement with ***Sabry: (2013)*** who revealed that mean age on admission was 4.56 ± 1.59.

In the current study, more than half of the neonates were delivered cesarean section (CS) and less than third were delivered by vaginally. This finding was disagree with study carried out by ***Seoud et al., (2007),*** which reported that 73.9% were delivered vaginally and 26.1% were delivered by CS. Some studies postulated that the higher risk of neonatal jaundice with CS delivery may be attributed to the effect of drugs or anesthetics given to the mother, while others suggested that infusions with concentrated dextrose water to mothers prior to cesarean delivery increased the risk of hypoglycemia in the newborn, and was associated with increased incidence of neonatal jaundice.

Results of the current study presented that nurses' knowledge about BIND score in pretest was unsatisfactory but their knowledge was improved after provision of instructional guidelines in posttest and there was a statistically significant difference between mean scores of nurses' knowledge in pretest and posttest The result of current study is in agree with what was reported by ***Teles*** as the findings of their studies revealed that during pretest, the majority of the staff nurses had average knowledge regarding the neurological assessment of patients and minority of them had poor knowledge. After the administration of self-instructional module in posttest the majority of the staff nurses had good knowledge and' minority of them had average knowledge Unsatisfactory nurses' knowledge about BIND score from point of view of researcher may be return to that the majority of nurses their level of education only diploma in addition and though, the students are exposed to pediatric critical care nursing in their studying curriculum, but they are not prepared or knowledgeable enough to provide care for children in NICUs. Besides that lack of training educational programs for staff nurses about appropriate care for NICUs patients in general and BIND score specifically, its benefits and applicability and also reflects the lack of responsibility of nursing director and management staff in providing such training

programs for staff nurses in NICUs. Regarding to increasing nurses" knowledge in posttest, this reflects nurses' readiness and interest toward increase their knowledge and consequently improve care provided to NICUS neonates This proved the positive effect of instructional guidelines upon nurses as increased their knowledge and achieved aim of current study.

Regarding mean score of nurses' knowledge about neonatal hyperbilirubinemia as illustrated from the results, the mean and standard deviation of knowledge scores on pre intervention were low as 24.14 ± 7.1 compared to 48.3 ± 3.1 after. This illustrated that on pre intervention level of nurses' knowledge was lower than after. This finding came in agreement with ***WHO (2006).*** They stated that there was inadequate nurses' knowledge and performance and attributed this deficiency to one or more of the following reasons lack of orientation program prior to work, lack of nursing care conference during work and lack of supervision.

However, this finding was in consistent with ***Shrestha (2013)*** who conducted a research about "Knowledge and practices of nursing personnel regarding the care of neonates under phototherapy". This study showed that on pretest, the majority of nurses (92%) had knowledge about not to use lotions or ointment on the skin of baby during the time of phototherapy, changing the position of neonates during the phototherapy and covering the eyes of baby during the phototherapy. The National Association of Neonatal Nurses ***(NANN) (2008)*** identified that neonatal nurses must be proactive in the assessment and management of hyperbilirubinemia in the newborn. They added that neonatal nurses must take steps to increase awareness and identify strategies within their institutions and practice to enhance the processes of diagnosis and management of hyperbilirubinemia.

Regarding mean scores of nurses' knowledge about nursing care of neonates with hyper-bilirubinemia about phototherapy. As illustrated That highly statistical significant difference between total score level of nurse's knowledge pre and post regarding knowledge about phototherapy. This was attributed to the effect of training and instructions that were provided by the researcher. This was in line with ***Devi & Jena (2015)*** who conducted research about "Effectiveness of Video Assisted Teaching Module (VATM) on Knowledge Regarding Care of Newborn Baby under Phototherapy among Female Health Workers". They observed that the overall mean score during posttest was 35.364 ± 1.58 revealed the effectiveness of the module.

Regarding mean scores of nurses' knowledge about nursing care of neonates with hyper-bilirubinemia about ways to infection control on pre intervention and after The present study showed that a highly statistical significant difference between total score level of nurse's knowledge pre and post regarding knowledge nurse's knowledge on ways to infection in neonatal with Hyperbilirubinemia, x^2= 30.942, with p-value <0.001 regarding following the aseptic technique. These results agreed with ***Abo-Zaid (2008)*** who conducted a research about "Quality of nursing care for high risk neonates receiving total parental nutrition". They found that the majority of nurses had incompetent level of hand washing performance. This might be due to hand washing was not followed routinely by the majority of nursing procedures due to insufficient or lack of training and knowledge about measures of infection control at NICU and improper application of infection control standards at NICU. This could reflect the importance of conducting a training program for nurses regarding infection control. Simultaneously,

Regarding mean scores of total nurses' practices about neonatal hyperbilirubinemia

on pre intervention and after. The results illustrated that nurses had the highest mean score after. This could be due to the implementation of Instructional guidelines to enhance neonatal nurses' performance regarding early detection of neurological dysfunction among neonates having hyperbilirubinemia.

Concerning correlation between total knowledge and total practices. The present study reflected that there were highly statistical significant positive correlations between total knowledge and total practices. This finding agreed with ***Abd-El Galil (2007)*** who proved that, there were a statistical significant correlation between nurses' knowledge and their performance. On the contrary, ***Fathy (2004)*** who conducted study about "Intervention nursing program for care of high risk neonates at Mansoura Hospitals" and found that there was no statistically significant differences between nurses' knowledge and performance.

Regarding distribution of neonates according to occurrence of phototherapy related side effects on pre intervention and after. The current study illustrated that and after of application of nursing care most neonates had fewer side effects of phototherapy than before the application of this Instructional guideline. This result was consistent with ***Mohamed (2015)*** who conducted study about "Effect of clinical pathway on care of neonates having hyper-bilirubinemia" and found that there were statistical significant differences between study and control groups regarding the occurrence of watery diarrhea, transient skin rashes and hyperthermia. The current results were attributed to increased knowledge of nurses as well as their adherence to the practical guidelines of the designed Instructional guidelines for neonates with hyperbilirubinemia.

For correlation between total nurses' practices and occurrence of side effects of phototherapy, it was found that the higher level of nursing practices, the fewer the frequency of side effects of phototherapy. This could be attributed to nurse's adherence to guidelines related to reducing side effects of phototherapy such as monitoring temperature, performing eye care and performing skin care.

The current study reported that majority of cases of newborns with mild BIND score had abnormal neurological examination (subtle neurological examination).ten of cases of newborns with moderate BIND score had abnormal neurological examination and another one progressed to death. Three case with severe BIND score. This finding agreed with ***Ragab (2012)*** who proved that three cases out of 12 newborns with normal BIND score had pre-discharge abnormal neurological examination. As well, 3 cases out of 28 newborns with mild BIND score had pre discharge abnormal neurological examination, and 8 cases had subtle neurological examination. One case of the nine newborns with moderate BIND score had abnormal neurological examination and another one progressed to death.

As regard relation between personal & socio-demographic data and nurses' knowledge regarding hyperbilirubinemia, it is shown that age, years of experience in NICU and training have high significant. Finally, it can be concluded that the majority of nurses have unsatisfactory level of knowledge about neonatal hyperbilirubinemia.

Conclusion

Based on the finding of the present study one can conclude that the highest percentage of nurses had unsatisfactory knowledge, while minority of nurses' had satisfactory score regarding Early Detection

of Neurological Dysfunction among Neonates Having Hyperbilirubinemia neonates. Also the majority of nurses' were incompetent regarding practices related to Regarding Early Detection of Neurological Dysfunction among Neonates Having Hyperbilirubinemia

Recommendations

Accordingly, the following important recommendations are proposed:

- A standardized clinical nursing guidelines about neonatal hyperbilirubinemia should be available in each neonatal intensive care unit.

- A designed protocol about hyperbilirubinemia and BINDs should be provided to all NICUs nurses and being a routine for nurses to apply BIND tool.

- Newly staff nursing members who provide care for newborns with hyperbilirubinemia in neonatal intensive care units should be well oriented with each standardized international nursing care protocols to ensure competent nursing care.

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