Effect of Using Clinical Pathway on Outcomes of Neonates with Jaundice/ or Suspected Hyperbilirubinemia

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Abstract: **Neonatal jaundice is the most common health hazard of neonates which causes serious complications. Clinical pathway is interdisciplinary care maps manage client's arrangement of care through achievement of specific clinical outcome. The use of clinical pathways is requires safe practice from the nurses to achieve optimal health outcomes. Aim: The aim of this study was to assess the effect of using clinical pathway on outcomes of neonates with jaundice or suspected hyperbilirubinemia. Settings: This study was conducted at Neonatal Intensive Care Units in El-Menoufia University Hospital and Shebin El-kom Teaching Hospital- Shebin El-kom city- El-Menoufia Governorate, Egypt. Design: A quasi experimental research design was utilized. Sample: two types of sample were used; Patient's sample and nurse's sample. Sixty neonates with jaundice or suspected hyper-bilirubinemia were selected from previously mention setting and divided into two equal groups and all nurses (30 nurses) working in neonatal intensive care units in El-Menoufia University Hospital and Shebin El-kom Teaching Hospital were included in the sample. Tools: 1) Neonatal Medical Records 2) Observation checklist about neonatal general health status pre and post implementation of clinical pathway 3) Observational checklist for nurse's safety practice to prevent complication of phototherapy and exchange transfusion Results: The study revealed that there was significant improvement in clinical outcomes of neonates after implementation of a clinical pathway. Neonates in the study group had short duration of hospital stay than those in control group. Conclusion: Clinical pathway was effective in improving the clinical outcome of neonates with jaundice or suspected hyperbilirubinemia and contributed to duration reduction of neonatal hospitalization. Recommendation: Clinical pathway should be applied for neonates with Jaundice or suspected hyperbilirubinemia and provision of in-service training program for nurses about clinical pathway.**

Keywords: **Clinical Pathway, Neonatal Jaundice / hyperbilirubinemia, Clinical Outcome**.

1. INTRODUCTION

Neonatal jaundice is the most common health problem among neonates; mainly in the first week of life. It occurs in about 60% of full-term neonates and in about 80% of preterm neonates; about 10% of breastfed babies show jaundice during the first month after birth [1,2]. Features of neonatal jaundice include yellowish discoloration of the skin, sclera and mucous membranes resulting from accumulation of bilirubin in the skin and mucous membranes [3,4]. Jaundice is a result of the increased breakdown of red blood cells and/or decreased hepatic excretion of bilirubin. 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 [5,6]. 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 [7,8,9] .

Neonatal jaundice is generally considered a benign self-limiting condition [10, 11]. However, severe neonatal jaundice can lead to irreversible brain damage and kernicterus [12]. Perhaps due to a greater awareness of its risks and the concerted efforts from professional societies [13, 14], the reported incidence of hazardous hyperbilirubinemia (bilirubin level > 510 mmol/L) is very low. Surveys show an incidence of 7.1/100 000 in the UK and Ireland over a period of 2 years [15] with 0.9/100 000 incidence of acute bilirubin encephalopathy [8], while in the USA the reported incidence of hazardous hyperbilirubinemia is 1/10 000 and reported incidence of kernicterus is 1.5/100 000 [16, 17].

A different picture is seen in resource-limited countries [18]. Acute bilirubin encephalopathy remains a common clinical finding in Nigeria with an incidence of between 2.5%–3.4% of hospital admissions in the neonatal period [19]. In Cairo University Children's Hospital, severe neonatal hyperbilirubinemia accounted for 33% of total admission diagnoses to the out born neonatal intensive care unit (NICU) in 2006 [20] with about 10 cases of kernicterus occurring each year [21] . The interesting finding in the previous study was that almost half of those infants were admitted after the fifth day of life, often with signs of acute bilirubin encephalopathy [20].

Clinical pathways- also known as critical pathways, multidisciplinary, collaborative paths, or care maps to name a few utilize evidence-based practice and apply it to structured care tracts to provide guidelines for protocols and best practice. Clinical pathways are widely regarded as providing valuable knowledge about specific types of patients and their care, as well as providing direct guidance in clinical practice. These pathways give caregivers guidance when developing a patient's care plan and assist in determining length of stay and outcomes. It was reported that clinical pathways had been implemented in more than 80% of hospitals in the USA [22]. In Australia, the use of care pathways has occurred with minimal professional nursing debate as to their benefits in practice. Comments supporting the introduction of pathways into clinical practice have focused on assistance to decision making, facilitation of clinical judgements about care, assistance in improving practice and utility as educational tools, particularly for new staff, new graduates and casual employees [23].

Clinical pathways have grown in popularity within UK health care. They are primarily used to enhance quality of care within the National Health Service, rather than managing the cost of care as in the United States. The key features of clinical pathways are a combined individual record of care with a decision-making protocol; an emphasis on coordination of services and multidisciplinary working; specification of each stage in the care process; and minimal documentation, unless there is deviation from the norm [24].

The clinical pathway on management of jaundice in term and late-pre-term infants will improve patient outcomes by ensuring universal screening of all newborns, standardizing the timing of repeat testing, improving the understanding of patient risk and subsequently ensuring that the appropriate risk line is used to determine the need for phototherapy, encouraging creative resource use to facilitate community follow-up after discharge, improving communication between in hospital and community care providers and reminding health care providers when consultation with a pediatrician or neonatologist may be required [25] .

Clinicians and multi-disciplinary teams will be critical in implementing the clinical Pathway. Their role is to determine the best way to implement the clinical pathway in their unique environment, comparing current practice to the ideal and ensuring optimal environments for care. Team members can include "but are not limited to", perinatal nurses, lactation consultants, midwives and physicians. Much of the screening can be done by nursing staff (provided they have medical directives to order bilirubin screening) until the infant can be seen by a physician [26].

The implementation of clinical pathway may be a significant change in clinical practice and may require change management strategies and education regarding the use of the nomograph and treatment graphs in order for it to be successful. There may also be changes to documentation following the recommendation for screening information to be provided to the patient's parent [27]. Despite the implementation of evaluation and treatment guidelines for neonatal hyperbilirubinemia by the American Academy of Pediatrics (AAP) [28,29] and others to "reduce the incidence of severe hyperbilirubinemia and bilirubin encephalopathy," cases of kernicterus are still occurring in the United States, Canada, Europe, and elsewhere.[30] In developed countries, population-based estimates for kernicterus in term infants range from 1 in 30,000 to 1 in 200,000 live births.17 Severe neonatal jaundice is not only the major cause for the hospital readmissions of neonates but also represents a significant cause of neonatal morbidity and mortality [31]. Clinical pathways are tools used to guide evidence-based healthcare that have been implemented internationally since the 1980s. Enhancement of the

pediatric intensive care nurses' knowledge and practical skills related to the management of neonatal jaundice to preventing the death from progressing to an emergency situation. Therefore, the nurse's knowledge and performance about the neonatal jaundice is very important.

Nurses working in an acute pediatric setting sought to gain their views about pathways of care with regard to satisfaction with use, content of pathway, ability to use in practice, effect on practice and commitment to use. While the most positive findings to emerge from the research indicated that nurses liked clinical pathways because they saved time and reduced documentation requirements, issues were also raised about the need for a broader, more inclusive development process for pathways, and an improved education program for staff use [22]. The implications to arise from these findings are important for senior staff and educators who are responsible for staff orientation programs and ongoing staff development as well as for those responsible for the development and implementation of clinical pathways into practice [27].
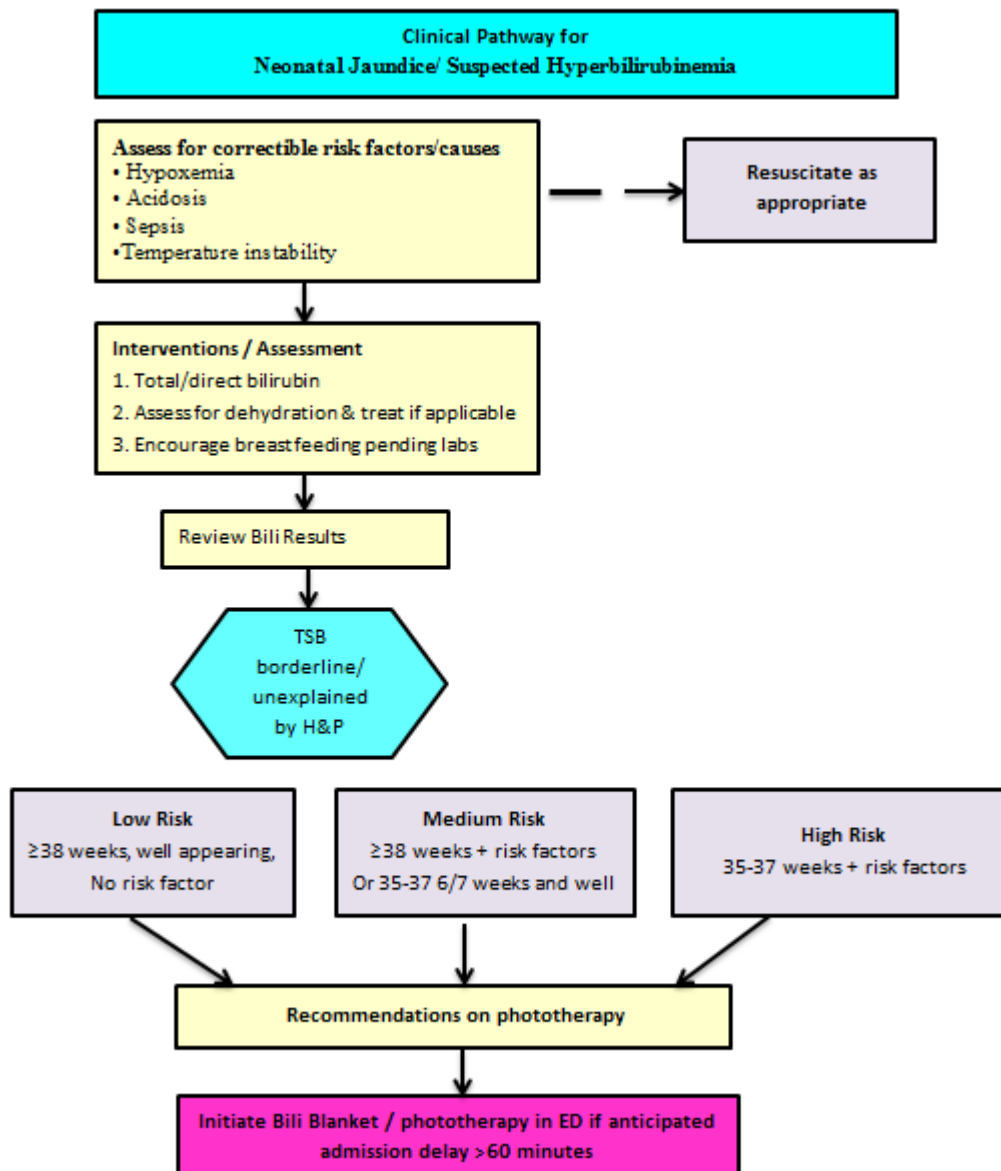

Figure 1: Conceptual Framework for Clinical Pathway of Neonatal Jaundice/ or Suspected Hyperbilirubinemia [32]

AIM OF THE STUDY:

The aim of this study was to assess the effect of using clinical pathway on outcomes of neonatal with jaundice or suspected hyperbilirubinemia.

RESEARCH HYPOTHESES:

1. Neonates who will expose to the clinical pathway will have improvement in clinical outcomes than neonates in the control group.

2. Nurses who will follow the guidelines of clinical pathway will have improvement in safety practice for prevention of complication related to phototherapy on post than pre intervention.

3. Nurses who will follow the guidelines of clinical pathway will have improvement in safety practice for prevention of complication related to exchange transfusion on post than pre intervention.

4. Neonates who will expose to the clinical pathway will have less hospital stay than neonates in the control group.

2. SUBJECTS AND METHOD

DESIGN:

A quasi experimental research design was utilized.

SETTING:

The study was conducted at Neonatal Intensive Care Units in El-Menoufia University Hospital and Shebin El-kom Teaching Hospital, Shebin El-kom city- El- Menoufia Governorate, Egypt.

SAMPLE:

- **Neonates Sample:** Sixty neonates with jaundice or suspected hyperbilirubinemia were selected from previously mention setting. The sample was randomly selected and divided into two equal groups.

Study Group: Consist of thirty neonates were exposed to clinical pathway by the researchers.

Control Group: Consist of thirty neonates were exposed to routine hospital care.

Sample calculation:

Determination of the sample was calculated according statistical procedure known as power analysis of the sample according to phenomenon of neonates jaundice and power analysis, the size of the sample has been calculated by using the following equation: $N= (z2 \times p \times q)/D2$ at CI 95% and power 80%. The sample size will be 60 neonates.

- **Nurse's Sample:** All nurses (30 nurses) working in neonatal intensive care units in El-Menoufia University Hospital and Shebin El-kom Teaching Hospital were included in the sample.

Inclusion Criteria:

- Both sexes

- No other medical problems

- Nurses who did not attend any previous training program about clinical pathway

Exclusion criteria:

- Exchange transfusion done for other causes rather than jaundice

DATA COLLECTION TOOLS:

Three tools were utilized for data collection

1. Neonatal Medical Records:

It was divided into two parts as the following:

Part 1: Bio-socio-demographic data related to neonates: such as gestational age, postnatal age, birth weight, gender and causes of jaundice or suspected hyperbilirubinemia.

Part II. Correctable risk factors data for developing neonates jaundice.

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2. **Neonatal General Health Status Observation Checklist:**

It included three parts

Part 1: Assess neonatal general health status: The researchers observed Neonates general health status, it included seven items (clinical status, skin color, eye color, urine color, stool color, suckling and neonatal weight) to assessed the effect of using clinical pathway.

Scoring system for Neonatal General Health Status:

Score	Neonatal General Health Condition
0	Abnormal
1	Normal

Part II: Assess level of dehydration: it consisted from five items such as general condition, eye, mouth and tongue, urine output and skin turgor.

Scoring system for level of dehydration:

Score	level of dehydration
1	Mild dehydration
2	Moderate dehydration
3	Severe dehydration

Part III: Assess Degree of Neonatal Risk:

Score	Degree of Neonatal Risk
1	Low Risk
2	Moderate Risk
3	Sever Risk

Part IV: Neonatal Jaundice Follow up: it involved four items to assess and record the neonate's investigation after clinical pathway such as Total Serum Bilirubin (TSB), PaO_2, $PaCo_2$ and SpO_2. The calculation of total length of hospital stay was done at discharge time.

3. **Observational checklist for nurse's safety practice to prevent complication of phototherapy and exchange transfusion:**

It was developed by the researcher based on review of related literature.

Scoring system for nurse's safety practice:

Score	Nurse's Safety Practice
0	No
1	Yes

DATA COLLECTION PROCEDURE:

- Approval: an official permission was obtained from the responsible authorities; faculty of Nursing, Menoufia University, to carry out the study to the administrators of El-Menoufia University Hospital and Shebin El-kom Teaching Hospital where the data were collected to conduct the study after an explanation of the purpose of the study.

- **Study period:** This study was conducted during the period starting from July2017 to the end of December 2017.

- **Ethical considerations:** written and verbal explanations about the nature of the study were given to all parents of neonates and all nurses in the study. The study was voluntary, harmless, and anonymous and confidentiality of responses would be respected. Parents had the full right to refuse to participate in the study at any time without any effect on their neonatal care. For research ethical consideration data was collected firstly from the control group then the study group.

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- **Tools development:**

Validity: All tools were reviewed and tested for content Validity by a panel of five experts in the field of pediatric medicine and pediatric nursing - Menoufia University. The modification was done accordingly to ascertain relevance and completeness.

Reliability: The internal consistency of the questionnaires was calculated using Cronbach's alpha coefficients. Test-retest was used. The Cronbach's alpha of the Observation checklist about neonatal general health status was 0.91 indicate good reliability. The test and retest reliability of tool three "Observational checklist for nurse's safety practice to prevent complication of phototherapy and exchange transfusion Scale" was 0.93 indicate good reliability.

Pilot Study: was performed to test the practicality and applicability of the tools to detect the obstacles and problems that may be encountered during data collection. It also helped to estimate the time needed to fill in the tools. It was conducted on 10% of the nurses and neonates. The pilot sample was not included in the total sample**.**

- Data collection was done daily according to the availability of cases at the mooring shift from 8.00 Am to 2.00 PM. The researchers introduced themselves to all hospital staff members and parents of neonates in the two hospitals settings. The researchers explained the aim of the study for them and asked for the hospital team for cooperation.

- **For both study and control group:** assessment of socio demographic data, causes of jaundice, correctable risk factors, level of dehydration, general health status, neonatal investigations Pre- implementation of clinical pathway.

- **For the study group:** the researchers implemented the clinical pathway step by step for the neonates and their parents, and nurses, those who will be responsible for providing clinical pathway.

- The implementation of clinical pathway was divided into 4 sessions. Each session lasted for 30 - 45 minutes.

The first session: It was focus on assess the neonates for correctable risk factors (hypoxemia, acidosis, sepsis and temperature instability), neonatal weight and neonate's investigation, general health condition and level of dehydration in the study and control group.

The second session: Application of clinical pathway for study group and all nursing staff deal with the neonates by the researchers only.

The third session: Assess nurses' safety practice to prevent complication of phototherapy.

The fourth session: Assess nurses' safety practice to prevent complication of exchange transfusion.

- Evaluate the effect of clinical pathway outcome on study group and compare them with control group who received routine care after clinical pathway implementation through neonatal follow up tool, general health condition, dehydration level, neonatal weight, degree of risk, number of breast feeding, duration of phototherapy , exchange transfusion andestimate the hospital stay .

Statistical Analysis:

Data were coded, analyzed, tabulated, and percentage distribution was determined by using a computerized statistical analysis SPSS version 21. Test of significance were applied (Chi square and t- test) to test significance of differences. P-value less than 0.05 and 0.001 were considered as statistically significant

3. RESULT

Table (1) clarifies characteristics of neonates in study and control groups on admission. More than half of neonates in study and control groups were male (60% and 53.3% respectively). Most of neonates in study and control groups (53.3% and 46.7% respectively) their gestational age ranged between 36-38 weeks. On the other hand the highest percentages of their postnatal age were one day. Also, it was found there were no significant differences between study and control group regarding their birth weight.

Figure (2) represents percentages of neonates in the study and control groups according to causes of jaundice or suspected hyperbilirubinemia. In most of neonates in study and control groups (74% and 78% respectively) the main causes of jaundice or suspected hyperbilirubinemia was ABO incompatibility.

Table (2) clarifies correctable risk factors for developing jaundice. This study represented that there were no statistical significant differences between study and control groups regarding correctable risk factors for developing jaundice on pre-clinical pathway (p = >0.05). On the other hand, there were statistical significant differences between study and control groups regarding hypoxemia, acidosis and temperature instability on post clinical pathway (p = <0.05).

Table (3) represents general health status for neonates in study and control group on pre and post clinical pathway. It was found that there was significant improvement regarding general health status of neonates in the study group after clinical pathway. For these reason, there were significant difference between neonates in study and control groups on post clinical pathway (p = <0.05). On contrary, there were no statistically significant differences between neonates in both groups on pre-clinical pathway (p = >0.05). It was evident from the study findings that neonates in the study group showed a higher level of health status than neonates in the control group on post clinical pathway.

Table (4) shows level of dehydration between study and control group on pre and post clinical pathway. There was highly statistically significant difference between neonates in both groups concerning level of dehydration on post clinical pathway (p = <0.001). On contrary, there were no statistically significant differences between neonates in both groups concerning level of dehydration on pre-clinical pathway (p = >0.05). It was evident from the study results that neonates in the control group showed a higher level of dehydration than neonates in the study group on post clinical pathway.

Table (5) represents means of neonates' investigation between study and control groups on pre and post clinical pathway. It was found there were statistical significant differences at 5% and 1% level of statistical significance in the study and control groups on post clinical pathway. While, there were no statistical significant differences between both groups regarding their investigations on pre-clinical pathway.

Table (6) represents neonatal health problems among study and control groups. It was found that the neonatal health problems were decreased on study group than control group. For these reason, there were significant difference between neonates in study and control groups (p = <0.05). While, there was no significant difference between study and control group regarding hyperkalemia.

Figure (3) it was found the more than half of neonates (60%) in the study group were at low risk compared to 40% in the control group. On the other hand, only 10% of neonates in the study group were at high risk compared to 15% in the control group. It was evidence from the study findings that neonates in the study group showed a lower level of risk than neonates in the control group.

Table (7) clarifies nurse's safety practice to prevent complication of phototherapy. In general, Nurses' practices were improved on post-test. On the other hand, there was no significant difference between pre and post -test regarding eye care.

Table (8) represents complication of phototherapy intervention in study and control groups. This study showed that the complication which caused by phototherapy was decreased on study group than control group. For these reason, there were significant difference between neonates in study and control groups (p = <0.05).

Table (9) shows nurse's safety practice to prevent complication of exchange transfusion. In general, Nurses' practices were improved on post-test. On the other hand, there was no significant difference between pre and post-test regarding keep the newborn nil orally for 2-4 hours before exchange, cheek neonate's blood group and check donor blood incompatibility.

Table (10) shows the number of breast/bottle feeding in more than half of neonates (56.6%) in the study group were taken more than daily requirements compare to 20% in the control group. Also, the highest percentages 63.3% in the study group required 1-2 days phototherapy compared to 36.7 % in the control group required more than 4 days phototherapy. On the other hand, the majority neonates in study and control group (96.7% and 93.3% respectively) not required exchange transfusion.

Table (11) shows that the duration of hospitalization of neonates was shorter in the study group than control group.

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Table (1): Characteristics of neonates in study and control groups on admission.

| Neonatal Characteristics	Study Group (N=30)		Control Group (N=30)		Statistics Test	P
	No.	%	No.	%		
Sex						
Male	18	60	16	53.3	$\chi^2 = 0.271$	$> 0.05^{ns}$
Female	12	40	14	46.7		
Gestational age per weeks						
30-32	2	6.7	1	3.3	$\chi^2 = 0.810$	$> 0.05^{ns}$
33-35	3	10	4	13.3		
36-38	16	53.3	14	46.7		
39-41	9	30	11	36.7		
Postnatal age per days						
One day	11	36.7	12	40	$\chi^2 = 2.998$	$> 0.05^{ns}$
Two days	5	16.7	7	33.3		
Three days	3	10	4	13.3		
Four days	4	13.3	2	6.7		
Five days	4	13.3	3	10		
More than five days	3	10	2	6.7		
Birth weight per grams $\overline{X} \pm SD$	2313±44.79		2383±36.97		t= 0.671	$> 0.05^{ns}$
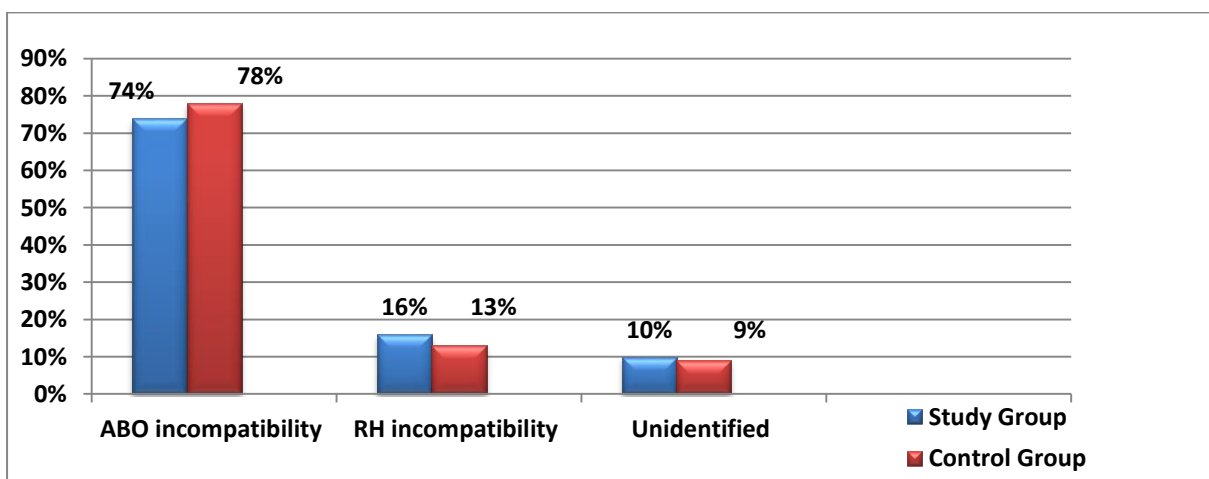
Figure 2: Percentages distribution of neonates in the study and control groups according to causes of jaundice or suspected hyperbilirubinemia.

Table (2) Correctable risk factors for developing jaundice among study and control group on pre and post clinical pathway.

Items	Pre-Clinical Pathway				χ^2	P	Post Clinical Pathway				χ^2	P
	Study Group (N=30)		Control Group (N=30)				Study Group (N=30)		Control Group (N=30)			
	No.	%	No.	%			No.	%	No.	%		
Hypoxemia					0.077	$> 0.05^{ns}$					4.32	< 0.05
-Yes	9	30	10	33.3			2	6.7	8	26.7		
-No	21	70	20	66.7			28	93.3	22	73.3		
Acidosis					0.271	$> 0.05^{ns}$					3.07	< 0.05
-Yes	12	40	14	46.7			5	16.7	11	36.7		
-No	18	60	16	53.3			25	83.3	19	63.3		
Sepsis					0.351	$> 0.05^{ns}$					1.02	$> 0.05^{ns}$
-Yes	2	6.7	1	3.3			0	0.0	1	3.3		
-No	28	93.3	29	96.7			30	100	29	96.7		
Temperature instability					1.200	$> 0.05^{ns}$					5.71	< 0.05
-Yes	22	73.3	18	60			7	23.3	13	43.3		
-No	8	26.7	12	40			23	76.7	17	56.7		

Answer Research Hypothesis Number One:-

Neonates who will expose to the clinical pathway will have improvement in clinical outcomes than neonates in the control group.

Table (3) General health status for neonates in the study and control group on pre and post clinical pathway.

Items	Pre-Clinical Pathway				χ^2	P	Post Clinical Pathway				χ^2	P
	Study Group (N=30)		Control Group (N=30)				Study Group (N=30)		Control Group (N=30)			
	No.	%	No.	%			No.	%	No.	%		
Clinical Status					0.111	> 0.05 ns					6.70	< 0.05
- Normal	6	20	5	16.7			21	70	11	36.7		
- Abnormal	24	80	25	83.3			9	30	19	63.3		
Skin Color					0.131	> 0.05 ns					3.27	< 0.05
- Normal	4	13.3	5	16.7			18	60	11	36.7		
- Abnormal	26	86.7	25	83.3			12	40	19	63.3		
Eye Color					0.577	> 0.05 ns					3.30	< 0.05
- Normal	3	10	5	16.7			17	56.7	10	33.3		
- Abnormal	27	90	25	83.3			13	43.3	20	66.7		
Urine Color					2.07	> 0.05 ns					4.44	< 0.05
- Normal	0	0.0	2	6.7			16	53.3	8	26.7		
- Abnormal	30	100	28	93.3			14	46.7	22	73.3		
Stool Color					2.07	> 0.05 ns					3.36	< 0.05
- Normal	0	0.0	2	6.7			16	53.3	9	30		
- Abnormal	30	100	28	93.3			14		21	70		
Neonatal weight					2.90	> 0.05 ns					7.64	< 0.05
- Normal Weight	8	26.7	11	36.7			21	70	13	50		
-Over Weight	2	6.7	0	0.0			2	6.7	0	0.0		
-Under Weigh**t**	20	66.7	19	63.3			7	23.3	17	46.7		

Table (4) Level of dehydration between study and control group on pre and post clinical pathway.

Items	Pre-Clinical Pathway				χ^2	P	Post Clinical Pathway				χ^2	P
	Study Group (N=30)		Control Group (N=30)				Study Group (N=30)		Control Group (N=30)			
	No.	%	No.	%			No.	%	No.	%		
General condition					0.178	> 0.05 ns					10.80	< 0.001
- Alert	4	13.3	5	16.7			26	86.7	14	46.7		
-Irritable	18	60	18	60			4	13.3	16	53.3		
- Lethargic	8	26.7	7	23.3			0	0.0	0	0.0		
Eye					1.17	> 0.05 ns					11.55	< 0.001
- Normal	1	3.3	0	0.0			27	90	15	50		
- Sunken	22	73.3	24	80			3	10	14	46.7		
- Very Sunken and dry	7	23.3	6	20			0	0.0	1	3.3		
Mouth and tongue					2.22	> 0.05 ns					11.16	< 0.001
- Moist	2	6.7	1	3.3			26	86.7	14	46.7		
- Dry	26	86.7	23	76.7			4	13.3	14	46.7		
- Very dry	2	6.7	6	20			0	0.0	2	6.7		
Urine Output					2.52	> 0.05 ns					7.94	< 0.001
-Normal	2	6.7	3	10			26	86.7	16	46.7		
- Oliguria	26	86.7	27	90			4	13.3	14	53.3		
- Anuria	2	6.7	0	0.0			0	0.0	0	0.0		
Skin turgor:					0.131	> 0.05 ns					10.76	< 0.001
- Normal	5	16.7	4	13.3			28	93.3	17	56.7		
- Abnormal	25	83.3	26	86.7			2	6.7	13	43.3		

Table (5) Neonates investigation between study and control groups on pre and post clinical pathway.

Neonates Investigations	Study Group	Control Group	t test
	$\overline{X} \pm SD$	$\overline{X} \pm SD$	
Pre Clinical Pathway			
1-Total Serum Bilirubin (TSB)	20.23±3.78	19.47±2.46	0.28 ns
2-SpO_2	85.20 ± 1.75	84.90± 1.32	0.75 ns
3-PaO_2	46.43 ± 3.12	45.20 ± 2.11	1.2 ns
4-$PaCo_2$	81.25± 8.14	80.18± 5.32	1.4 ns
Post Clinical Pathway			
1-Total Serum Bilirubin (TSB)	8.90±2.73	11.37±1.83	5.77 **
2-SpO_2	91.87 ± 3.36	86.37± 7.84	3.52 **
3-PaO_2	48.13 ± 2.34	45.25± 3.10	3.5*
4-$PaCo_2$	80.73 ± 8.92	84.03 ± 11.58	2.3*

Table (6) Distribution for neonatal health problems among study and control group.

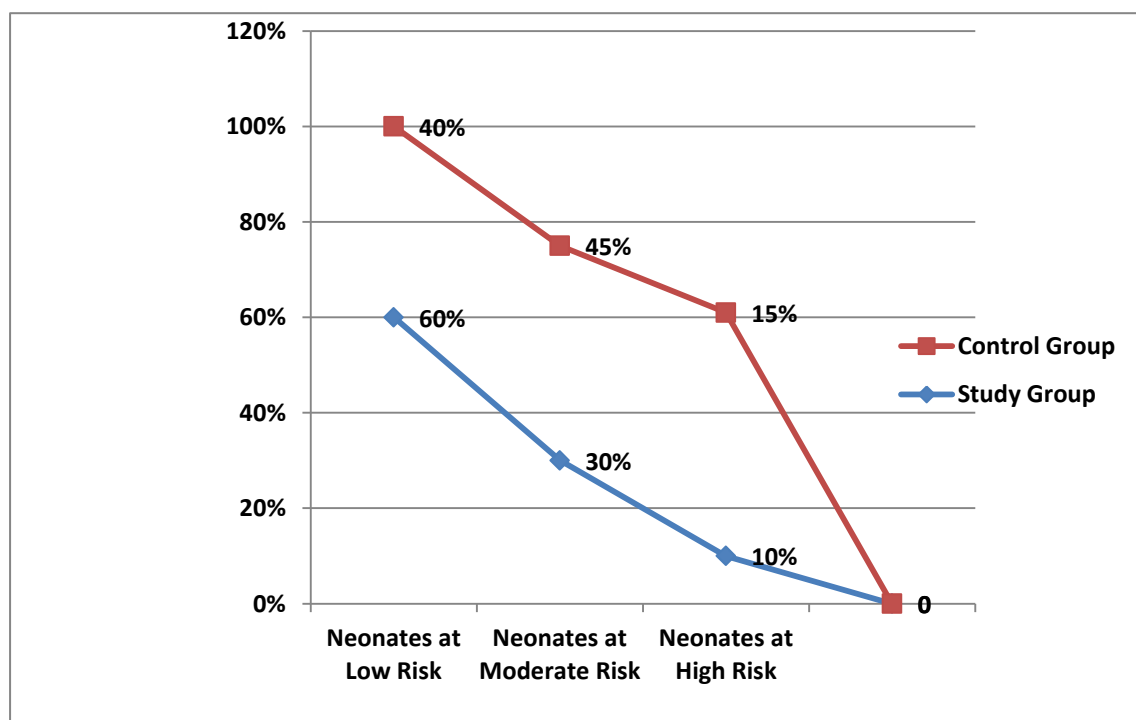| Items	Study Group (N=30)		Control Group (N=30)		χ^2	P
	No.	%	No.	%		
Hypothermia						
-Yes	8	26.7	16	53.3	5.28	< 0.05
- No	22	73.3	14	46.7		
Hypoglycemia						
-Yes	7	23.3	14	46.7	4.44	< 0.05
-No	23	76.7	16	53.3		
Hyperkalemia						
-Yes	0	0.0	2	6.7	2.00	> 0.05 ns
-No	30	100	28	93.3		
Hypocalcaemia						
-Yes	2	6.7	8	26.7	4.32	< 0.05
-No	28	93.3	22	73.3		
Metabolic acidosis						
-Yes	5	16.7	11	36.7	3.07	< 0.05
-No	25	83.3	19	63.3		

Figure 3: Percentages distribution of neonates in the control and study groups according to their risk degree.

Answer Research Hypothesis Number Two:-

Nurses who will follow the guidelines of clinical pathway will have improvement in safety practice for prevention of complication related to phototherapy on post than pre intervention.

Table (7) Nurse's safety practice to prevent complication of phototherapy on pre and post intervention.

Items	Pre intervention (N=30)		Post intervention (N=30)		χ^2	P
	No.	%	No.	%		
Keep baby at least 45cm from light -Yes - No	11 19	36.7 63.3	27 3	90 10	21.56	< 0.001
Cover the eyes with appropriate opaque eye covers -Yes - No	28 2	93.3 6.7	30 0	100 0.0	2.14	> 0.05[ns]
Ensure eye covers are removed 4-6 hourly for eye care -Yes - No	14 16	46.7 53.3	28 2	93.3 6.7	18.36	< 0.001
Observe for eye discharge infection/damage -Yes - No	3 27	10 90	27 3	90 10	40.75	< 0.001
Periodic change of body position -Yes - No	14 16	46.7 53.3	28 2	93.3 6.7	18.36	< 0.001
Maintain a strict fluid balance chart -Yes - No	0 30	0.0 100	18 12	60 40	25.04	< 0.001
Frequent extra breast feeding every 2 hourly -Yes - No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Monitor vital signs and temperature at least 4 hourly -Yes - No	12 18	40 60	28 2	93.3 6.7	20.20	< 0.001
Weight record daily -Yes - No	14 16	46.7 53.3	28 2	93.3 6.7	18.36	< 0.001
Observe for signs of potential side effects -Yes - No	9 21	30 70	17 13	56.7 43.3	5.11	< 0.05

Table (8) Complication of phototherapy intervention in study and control groups.

Items	Study Group (N=30)		Control Group (N=30)		χ^2	P
	No.	%	No.	%		
Hyperthermia - Yes - No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Diarrhea - Yes - No	9 21	30 70	15 15	50 50	4.11	< 0.05
Skin Rash - Yes - No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Eye discharge/infection/damage - Yes - No	7 23	23.3 76.7	14 16	46.7 53.3	4.44	< 0.05

Answer Research Hypothesis Number Three:

Nurses who will follow the guidelines of clinical pathway will have improvement in safety practice for prevention of complication related to exchange transfusion on post than pre intervention.

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Table (9) Nurse's safety practice to prevent complication of exchange transfusion.

Items	Pre intervention (N=30)		Post intervention (N=30)		χ^2	P
	No.	%	No.	%		
Keep the newborn nil orally for 2-4 hours before exchange -Yes -No	27 3	90 10	30 0	100 0.0	2.11	> 0.05[ns]
Cheek blood group -Yes -No	28 2	93.3 6.7	30 0	100 0.0	2.14	> 0.05[ns]
Check donor blood incompatibility -Yes -No	28 2	93.3 6.7	30 0	100 0.0	2.14	> 0.05[ns]
Keep resuscitation equipment beside the baby -Yes -No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Keep Ensure resuscitation equipment -Yes -No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Ensure infant is comfortable and settled -Yes -No	11 19	36.7 63.3	27 3	90 10	21.56	< 0.001
Ensure blood warming -Yes -No	14 16	46.7 53.3	28 2	93.3 6.7	18.36	< 0.001
Track amount of blood withdrawn and transfused to maintain balanced blood volume -Yes -No	8 22	26.7 73.3	16 14	53.3 46.7	5.28	< 0.05
Using aseptic technique throughout procedure -Yes -No	11 19	36.7 63.3	27 3	90 10	21.56	< 0.001
Maintain body temperature to avoid hypothermia -Yes -No	14 16	46.7 53.3	28 2	93.3 6.7	18.36	< 0.001
Check umbilical cord for bleeding and signs of infection -Yes -No	11 19	36.7 63.3	27 3	90 10	21.56	< 0.001

Table (10) Management modalities in study and control groups.

Items	Study Group (N=30)		Control Group (N=30)		χ^2	P
	No.	%	No.	%		
Number of breast/ bottle feeding - Less than daily requirements - Daily requirements - More than daily requirements	5 8 17	16.7 26.7 56.6	13 11 6	43.3 36.7 20	9.75	< 0.001
Phototherapy 1-2days 3-4 days More than 4 days	19 8 3	63.3 26.7 10	10 9 11	33.3 30 36.7	12.03	< 0.001
Exchange Transfusion Not Done Done	29 1	96.7 3.3	28 2	93.3 6.7	0.094	> 0.05[ns]

Answer research hypothesis Number four:-

Neonates who will expose to the clinical pathway will have less hospital stay than neonates in the control group.

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Table (11): mean of the duration of neonatal hospitalization in experimental and control groups.

Duration of neonatal hospitalization /days	Study Group	Control Group	
	$\overline{X}\pm$ SD	$\overline{X}\pm$ SD	t
	5.48±2.18	10.69±4.80	5.32[**]

4. DISCUSSION

Clinical pathways are structured multidisciplinary care plans containing detailed essential steps in the care of patients with specific clinical problems. It is one of the main tools used to manage the quality in health care concerning the standardization of care processes [33,34]. It has been shown that their implementation reduces the variability in clinical practice and improves outcomes. The most appropriate nursing intervention for neonates with jaundice is to monitor bilirubin level, identify infants at risk for developing severe form of hyperbilirubinemia and implement prescribed treatment effectively when indicated [35]. This study was designed to assess the effect of clinical pathway on outcomes of neonatal with jaundice or suspected hyperbilirubinemia. The finding of current study showed that more than half of neonates 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 [36,37]. This finding was consistent with Scrafford (2014) [38] who reported that the incidence of hyperbilirubinemia was higher among males than regarding their birth weight. This result is consistent with Tioseco et al., (2005) and Olusanya et al.,(2009) [36,39] who confirmed the importance of several known risk factors for jaundice in neonates including male sex and birthweight. It was clear from the result of the study that most of neonates in study and control groups their gestational age ranged between 36-38 weeks. Newman et al., (2012) [3] illustrated that there was an increasing risk of significant hyperbilirubinemia with decreasing gestational age.

The present study revealed that most of neonates in study and control group their postnatal age were in the first five days. These results come in agreement with [17,18] who reported that jaundice usually appears in the first 5 days of life. Many babies have left the hospital by the time jaundice starts. So the doctor may want to do a follow-up exam when the baby is 3 to 5 days old.

Regarding causes of neonatal jaundice, the majority of neonates in study and control groups the main causes of jaundice or suspected hyperbilirubinemia were ABO incompatibility. This findings come in the line with (Hashem, et al., 2009) [40] who represented that the causes of severe hyperbilirubinemia included ABO incompatibility in 52%, Rh incompatibility in 20.6% and no cause can be determined in 27.4%, although G6PD deficiency represents a significant importance in cases of severe neonatal hyperbilirubinemia. The incidence of ABO incompatibility was 23%, Rh incompatibility 10.9% and G6PD 3.2% and the cause of jaundice was undetermined in more than 40% of cases in the study of Seoud, (2007) [20]. In another study Aletayeb, (2017) [21] ABO incompatibility accounted for 30% and G6PD deficiency in 34.4%.

Concerning correctable risk factors, the findings of the current study showed that there were statistical significant differences between study and control groups regarding hypoxemia, acidosis and temperature instability on post clinical pathway. This might be attributed to the fact that phototherapy was associated with a potential risk of temperature instability. However, this risk could be prevented by close attention to body temperature and correct of hypoxemia and acidosis as clarified by Wolff et al., (2012) [25].

The findings of this study revealed that there was significant improvement regarding general health condition and level of hydration of neonates in the study group after exposed to clinical pathway. This could reflect the proper nursing care enhances the effectiveness of phototherapy, carefully monitoring thermoregulation, minimizes complications and maintaining adequate hydration. For this reason the nurses should demonstrate standardized clinical pathway technique to improve health status of neonates. This finding came in agreement with WHO, (2010) [41] which reported that the complication of neonatal jaundice were measured in five studies and all reported improvements associated with the use of a clinical pathways.

Regarding total serum bilirubin (TSB), it was found that total serum bilirubin level was reduced in study group than control group on post clinical pathway. This finding agreed with Stokowski (2011) [42] who mentioned that phototherapy achieved a decline in serum bilirubin level when neonates received appropriate nursing care. This result could be attributed to the adherence of nurses to the implementation of clinical pathway for neonates with jaundice.

The findings of this study revealed that nurse's safety practice to prevent complication of phototherapy and exchange transfusion was improved on posttest. This results come in the same line with Carol (2009) [43] who mentioned that formal training program play an important role in enhancing and updating nurses' performance and improving the quality of care given to neonates. The National Association of Neonatal Nurses (NANN, 2008) [44] identified that neonatal nurses must be proactive in the assessment and management of jaundice 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 neonatal jaundice. The current study illustrated that the most neonates in study group had fewer complications from phototherapy than control group. This result was consistent with (Bhutani, 2013) [45] who found that there were statistical significant differences between study and control groups regarding the occurrence of watery diarrhea, skin rashes and hyperthermia after pathway implementation. 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 skin care. It was found that the neonatal health problems such as hypothermia, hypoglycemia, hypocalcaemia and Metabolic acidosis were decreased on study group than control group. For these reason, there were significant difference between neonates in study and control groups (p = <0.05). This might be attributed to the effect of the implementation of clinical pathway for neonates with jaundice or suspected hyperbilirubinemia.

This study showed that the number of breast feeding in the study group were more than daily requirements compared to control group. Also, the neonates in the study needs shorted duration of phototherapy than control group. The findings showed that neonates who were managed by clinical pathway had less duration of hospital stay than neonates in the control group. This result showed the incremental advantage of implementing the clinical pathway for reducing the neonates' lengths of hospital stay. It also supports the hypothesis of the current study. This underlines the importance of the application of clinical pathway for neonates with jaundice to improve quality of care and reduce the duration of hospital stay. This result was consistent with (Rotter, et al. 2012) and (WHO, 2010) [46,41] who reported that the use of clinical pathways appears to have a favorable impact on length of hospital stay . Reduced duration of hospitalization might be due to the implementation of clinical pathway for neonates jaundice or suspected hyperbilirubinemia.

The Clinical Pathway on Management of Hyperbilirubinemia in Term and Late-Pre-Term Infants will improve patient outcomes by ensuring universal screening of all newborns, standardizing the timing of repeat testing, improving the understanding of patient risk and subsequently ensuring that the appropriate risk line is used to determine the need for phototherapy, encouraging creative resource use to facilitate community follow-up after discharge [47]. The possible explanation of this result could be that the development of clinical pathways should be undertaken by a team of professionals who are involved in all steps of the continuum of care. Each pathway should then be adapted to the local conditions. The implementation process for clinical pathways should ideally involve, making baseline measurements before the introduction of the pathway, identification and documentation of barriers faced during the implementation phase and use of reminders, educational sessions, opinion leaders and audit and feedback to reinforce behavior change.

5. CONCLUSION

Clinical pathway was effective in improving the clinical outcome of neonates with jaundice or suspected hyperbilirubinemia and contributed to duration reduction of neonatal hospitalization.

6. RECOMMENDATIONS

1-Application of clinical pathway for neonates with jaundice is essential for improving clinical outcome, reducing complication and reducing the duration of hospital stay.

2- Ongoing in-service training programs should be designed and implemented at neonatal intensive care units to improve nurses' practices on the basis of nurse's actual needs.

3- A standardized clinical pathway and guidelines about neonatal jaundice should be available in each neonatal intensive care unit.

4. Establish specialized units for developing nurse's knowledge and practices (training unit) based on nurses needs for practices.

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