

## Effect of Instructional Based Nursing Intervention Program on Nurses Performance of Exchange Transfusion for Neonates

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### Abstract

**Background:** Exchange transfusion (ET) is most the commonly done for neonates when the serum bilirubin level exceeds a level that puts the neonates at risk for central nervous system toxicity, this procedure life-saving intervention. **Aim:** was to evaluate the effect of instructional based nursing intervention program on nurses' performance of exchange transfusion for neonates. **Method:** A quasi-experimental (pretest/ posttest) research design was utilized in this study. **Setting:** The study was conducted in the neonatal intensive care unit (NICU) at Misr-El-Hora and General Hospitals. **Sample:** A convenient sample was used in this research (45 nurses). **Tools:** Two tools: (1) Predesigned Questionnaire, (2) Observational checklists were used to collect data of the study. **Results:** Most of the nurses 84% had good knowledge while the highest number of the nurses 87% had competent practices in post-test. Moreover there were highly statistical significant positive correlation between total score level of nurses' knowledge as well as practices regarding exchange transfusion for the neonates. **Conclusion:** The current research's findings, it can be summarized that the most of the nurses had good knowledge while the high number of the nurses had competent practices in the post-test related the care of neonates undergoing exchange transfusion. **Recommendations:** Encourage nurses to enhance their knowledge as well as practices via attending training programs, conferences as well as workshops about care of neonates undergoing ET.

**Keywords:** Exchange transfusion, Instructional based nursing intervention, Nurses Performance & Neonates.

### Introduction

The period of neonatal is possibly the most fragile in a human's lifespan. The neonate moves from intrauterine to extra uterine life and adjusts to a different environment during these few days. During this period, focusing of nursing care is to guard and support the neonates as they go through several physiological fluctuations and adjusts to extra uterine life (Stroustrup, et al., 2018).

As neonatal jaundice affects sixty -percent of full-term infants and eighty -percent of preterm children in the first three days of life, hyperbilirubinemia of the neonatal, described as a total serum level of bilirubin exceeding (5mg/dl), is a common issue (Sharma, 2021). Despite being a temporary issue, the condition is to blame for up to 75% of hospital readmissions in the first week following delivery. If not treated properly, severe newborn hyperbilirubinemia might result in neurological impairment such encephalopathy or death (Watchko & Maisels 2022).

Neonatal jaundice can be divided into physiologic and pathologic jaundice. Physiologic type a prevalent condition is jaundice, occurring frequently after the first twenty-four hours of the life as well as last no longer than one week. Despite the fact that

pathological jaundice typically begins within the primary 24 hours of life of newborn and persists for more than a week when the liver is unable to remove enough bilirubin from the plasma, jaundice develops. When there is a problem, there is too much bilirubin in the blood, and the most common cause of this is neonatal jaundice, or indirect hyperbilirubinemia (Yanli, et al., 2021).

Preventing bilirubin encephalopathy and, as with any blood group incompatibility, reversing the hemolytic process are the main targets of hyperbilirubinemia treatment. The main mode of treatment uses pharmaceutical control; phototherapy and ET are typically utilized to lower hemolytic disease-related dangerously high bilirubin levels (Tinti, et al., 2021). Phototherapy alone is not effective in the management of hyperbilirubinemia when levels are at critical level or are rising rapidly; it is designed primarily for treatment of moderate hyperbilirubinemia. When phototherapy fails to reduce serum bilirubin levels, ET becomes the next line of treatment (Mitra, & Rennie, 2017).

To remove aberrant blood elements as well as circulating toxins while controlling a sufficient blood volume in circulation, ET of a neonate entails withdrawing aliquots of blood as well as replacing

them with blood's donor. This is primarily done in the neonate's instance to get rid of the antibodies and extra bilirubin (Bonner/Jackson 2019).

To stop bilirubin encephalopathy, the two main therapeutic techniques are phototherapy and ET. Particularly in many underdeveloped nations, ET has become a common emergency rescue technique for severe neonatal hyperbilirubinemia. Although ET is effective and generally regarded as a safe technique, it is not without dangers, and a research has revealed fatality rates ranging from 0.5% to 3.3%. Because of this, the current guidelines for doing ET strike a compromise between the risks of encephalopathy and the side effects of the treatment (Zahed Pasha, et al., 2020)

An advanced degree of knowledge, competence, clinical reasoning, and diagnostic abilities will be required of the nurse performing the preparation of newborns for blood component transfusion and delivering written instructions. They will work collaboratively as part of a healthcare team with a high degree of professional autonomy and accountability to carry out their duties (Edward, et al., 2017).

### Significance of the study

Exchange blood is still widely used in the management of severe jaundice at developing countries more than 5% of neonatal admitted into a newborn unit had ET done, while over the world approximately 6/100,000 needs blood exchange (Gottstein, et al., 2016).

Only two percent to sixteen percent of term and eighty percent of preterm infants experience hyperbilirubinemia severely (total bilirubin serum more than twenty-five mg/dl), which is a critical as it may result in neonatal (kernicterus) encephalopathy, which can cause death or irreversible brain damage in survivors. Clinical jaundice affects about sixty-percent of term and eighty-percent of preterm infants in the 1<sup>st</sup> week post the birth. Therefore, it is necessary to change the blood to prevent this complication (Ahmed, et al., 2019).

The ET decreases the mortality of this group of critically ill newborn infants. Newborn infants in NICU, especially those born premature are at particular risk for ET adverse effects. An ET also involves a high risk of morbidity and mortality because of cardiovascular issues, vascular accidents, hematological issues, biochemical issues, and a low incidence of blood-borne infections. Therefore, it should only be started when the advantages of avoiding kernicterus outweigh the risks involved with the operation. When nurses have good knowledge and competent practices about ET lead to ET adverse effects as low incidence of blood-borne infections of

Newborn infants in NICU, so the aim of this study was to evaluate the effect of instructional based nursing intervention program on nurses' performance of ET for Neonates

**Aim of the study:** Was to evaluate the effect of instructional based nursing intervention program on nurses' performance of ET for Neonates

### Research hypotheses

**H1:** Nurses' who receive instructional based nursing intervention program will have higher level of knowledge and practices in post-intervention than pre-intervention.

**H2:** Nurses' who receive instructional based nursing intervention program will have a relation between knowledge and practices regarding ET and their characteristics

### Subjects and Method

**Design of the Research:** A quasi-experimental (pretest as well as posttest) research design was used.

#### Operational definitions:

**Neonatal hyperbilirubinemia:** is a total serum bilirubin level exceeding (5mg/dl), neonatal jaundice can be divided into physiologic and pathologic jaundice if not treated properly, severe newborn hyperbilirubinemia might result in neurological impairment such encephalopathy or death (Sharma, 2021).

**Exchange transfusion (ET):** is a blood transfusion that involves taking donor blood and replacing it with patient blood, to remove aberrant blood elements as well as circulating toxins while controlling a sufficient blood volume in circulation, ET of a neonate entails withdrawing aliquots of blood as well as replacing them with blood's donor. This is primarily done in the neonate's instance to get rid of the antibodies and extra bilirubin (Bonner/Jackson, 2019).

**Setting:** The study was performed in the NICU at Misr-El-Hora and General Hospitals which follow the Ministry of health and population. It accepts high-risk newborns from the Minia Governorate who have reported symptoms of various disorders and offers care levels up to the third level.

**Sample:** A convenient sample was used in this research forty five (45) nurses, different educational approaches represented as well as all must participate voluntarily in the current research.

**Tools:** Two tools was used to collect data including two parts

**Tool (I):** It was developed by the researchers in simple language of Arabic in the light of pertinent researches based on Aly et al., (2023); it was composed of the next parts:

**Part one: Demographic and clinical characteristics data**

- 1- Data of nurses as; age, qualification, gender, attending last training courses about ET as well as years of experience.
- 2- Data of neonates under ET; age, sex, ranking, data of the medical history, Diagnosis, gestational age

**Part two: Nurses' knowledge about neonates and their management.**

Two types of questions were used in this format; the open ended and multiple-choice question: **Neonatal period**, it includes 7 questions such as definition, characteristics of normal neonates, characteristics of premature, complication of procedure, **Diseases require ET for neonates**. It includes 8 questions as definition of jaundice, causes, types, signs and symptom, complication. **Care for neonates under ET**: It includes 26 questions it was involved items regard definition of ET, causes, indication, types, complication, and follow up. **Medication uses for ET**. It includes 6 questions such as uses, dose, and side effect

**Scoring system of nurses' knowledge:**

A scoring system was used to assess nurses' knowledge as the follows: correct response was giving one score, as well as incorrect also doesn't know answers were taking zero. A total nurses knowledge scores were 47 scores. All knowledge scores items were summed up as well as the total classified by the number of items, these scores were turn into a percentage score. Regarding to the nurses' answer, their level of knowledge was classified as the following: Good knowledge: if the score is more than or equal seventy- five percent  $\geq 75\%$ . Average knowledge: if the score is from sixty five percent to less than seventy- five percent  $65\% < 75\%$ . Poor knowledge: if the score is less than sixty- five percent  $< 65\%$

**Tool II: Observational Checklist** was accepted from **Beardsall, et al., (2018), & MacDonald, et al., (2012)**. It was utilized to evaluate nurses practice related care of neonates undergo ET. Included the following parts:

**Part one:** This part included 8 procedures about using practice namely; pulse oximeter 14 steps, emergency medication used for ET 15 steps, flushing an umbilical venous catheter 10 steps, bundle for controlling of infection when keeping a central venous catheter CVC or umbilical catheter (UC) 13 steps, oropharyngeal and nasal suctioning 18 steps, ryle Insertion 19 steps, taking blood sampling 14 steps and blood glucose sampling 15 steps.

**Part two:** This part included 4 procedures namely; standardized procedures needed for neonates under ET namely; preparation for ET 25 steps, procedures before ET 9 steps, procedures during ET 8 steps and procedure after ET 3 steps.

**Practice Scoring System:**

Number of observational checklists overall was 12 and total numbers of steps in the observational checklists were 155 steps, where score one were given for "done" adequately and score 0 for "not done". There were 155 scores total for the practices; these scores were converted to percentage scores by adding together the scores for each step and dividing by the number of steps. Accordingly the practices were considered as Competent if score  $\geq 85\%$ , and Incompetent if score  $< 85\%$  (**Abou Zed, & Mohammed, 2019**).

**Validity and Reliability:**

**Validity:** A panel of three specialists from the pediatric nursing department reviewed the content's validity to guarantee its completeness, accuracy, clarity, and relevance. Accordingly, the necessary adjustments were made.

**Reliability:** The Cronbach Alpha Test was used to determine the tools' reliability, and the results were 0.737 for the questionnaire and 0.860 for the observational Checklists, indicating that the tool was reliable.

**Pilot study:**

In the NICU at Misr-El-Hora and General Hospitals, a pilot study on 10% (4) of nurses was done. A pilot study was conducted to evaluate the study tools' completeness and simplicity and to ascertain needed of time to complete every tool. The needed modifications, omissions, and/or changes were made in response to the pilot's results. Before beginning the actual study, the final forms were approved by the jury, and a pilot study was conducted to evaluate the reliability of the forms by calculating their internal consistency using the Cronbach's alpha coefficient method.

**Ethical consideration:**

The research approval was taken from the Minia University "Scientific Research Ethical Committee" Faculty of Nursing pre the beginning of research. Oral and written approval was taken from each research subject after the researcher explained the aim of the research to take their confidence as well as trust. Also researchers keeping anonymity as well as confidentiality data of subjects, nurses were reported to that their participation is voluntary

**Educational program:**

The researchers prepared educational poster about ET in NICU after assessment of nurses' performance to identify the needs. Information depend on review of pertinent literature as well as resources of internet about ET

**Field work:**

The fieldwork was done over a six-month period, from January 2023 to June 2023, and the researchers were on hand in each study location during the morning and afternoon shifts. The program's execution took 6 months to complete. Pre as well as post-tests took place in one month, while program implementation took five months. Five small groups of five nurses each were formed from the nurses. Each group had a total of 13 sessions, which varied in length from 20 to 30 minutes. Each participant receives a copy of the whole procedure checklist. A recap of the lessons from the last sessions and the goals of the recent one normally come at the beginning of each session. During program execution, the interested nurses were encouraged by being praised or recognized.

The actual research began when the researcher met with the NICU nurses at Misr-El-Hora and General Hospitals. The researcher provided them a thorough topic on the research and its purpose before distributing the format of pre-test get the necessary data. Anytime more data was required, the researcher was on hand to provide it. The program's material was then created using actual assessments of the nurses under study's educational needs. The subject material has therefore been organized in theoretical sessions.

The first session's topics included personal interviews with the study's nurses, discuss of the research's purpose and time frame from the researcher in person, a discussion, as well as a pre-test. The content of 2<sup>nd</sup> session: definition, characteristics of normal neonates, characteristics of premature, complication of procedure. The content of third session: definition of jaundice, causes, types, signs as well as symptom, complication. The content of fourth session: definition of ET, causes, types, indication, complication, and follow up. The session 5, content: Medication uses for ET, dose, side effect.

The session 6, content: pulse oximeter steps, emergency medication used for ET steps. The session 7, content: flushing an umbilical venous catheter steps, bundle for controlling of infection when CVC or umbilical catheter (UC) steps. The session 8, content: Oropharyngeal and nasal suctioning steps, Ryle Insertion steps, The session 9, content: taking blood sampling steps and blood glucose sampling steps. The session 10, content: preparation for ET steps. The session 11, content: procedures before ET steps. The session 12, content: procedures during ET steps and procedure after ET steps. Revision is the topic of session 13. Different media, including posters, instructive photos, and films, were utilized in conjunction with instructional techniques including demonstration and re-demonstration. To gather the

necessary data, a format of post-test was at last divided.

**Data analysis**

To enter the data, appropriate personal computer was utilized. The statistical software suite SPSS-20 was used to conduct the statistical analysis. The information in each tool was analyzed, categorized, and coded. Descriptive statistics based on number as well as percentages were employed variable's qualitative; while means and the standard deviations were utilized for data were quantitative. Chi-square analysis was utilized to evaluate qualitative variables of the research when comparing the mean of the 2 studied groups with a P. value of 0.05 was employed to detect statistically significant differences.

**Results of the study:****Table (1): Distribution of studied nurses according to their personal characteristics (N=45)**

| Characteristics of nurses              | (n=45)     |      |
|--|------------|------|
|  | N          | %    |
| <b>Age / years</b>                     |            |      |
| <20yrs.                                | 4          | 9    |
| 20<30 yrs                              | 20         | 44   |
| 30-40 yrs                              | 12         | 27   |
| More than 40 yrs.                      | 9          | 20   |
| <b>Mean ± SD</b>                       | 29.12± 6.5 |      |
| <b>Qualification</b>                   |            |      |
| Diploma Technical Institute in Nursing | 14         | 31   |
| Bachelor in Nursing Science            | 11         | 24.4 |
| Diploma of Schools in Nursing          | 20         | 44.4 |
| <b>Years of Experience</b>             |            |      |
| <3 yrs                                 | 10         | 22.2 |
| 3-6 yrs                                | 16         | 35.6 |
| >6yrs                                  | 19         | 42.2 |
| <b>Marital Status</b>                  |            |      |
| Married                                | 40         | 89   |
| Divorced                               | 3          | 6.6  |
| Widow                                  | 2          | 4.4  |
| <b>Residence</b>                       |            |      |
| Rural                                  | 15         | 33.3 |
| Urban                                  | 30         | 66.7 |
| <b>Training Courses</b>                |            |      |
| Yes                                    | 5          | 11   |
| No                                     | 40         | 89   |

**Table (2): Distribution of neonates demographic and clinical characteristics (N=45)**

| Items                              | No           | %    |
|------------------------------------|--------------|------|
| <b>Age of neonates</b>             |              |      |
| 1<7 days                           | 38           | 84.4 |
| 7-15 days                          | 7            | 15.6 |
| <b>Mean ± SD of child age</b>      | 3.22 ± 2.36  |      |
| <b>Gestation age (wks)</b>         |              |      |
| Fullterm                           | 20           | 44.4 |
| Preterm                            | 25           | 55.6 |
| <b>Mean±SD</b>                     | 36.32 ± 2.30 |      |
| <b>Birth weight (kg)</b>           |              |      |
| Normal birth weight                | 8            | 17.7 |
| Low birth weight                   | 37           | 82.3 |
| <b>Mean±SD</b>                     | 2.18 ± 0.40  |      |
| <b>Reason for the ET</b>           |              |      |
| Failure to respond to phototherapy | 30           | 66.6 |
| Bilirubin continues to rise        | 8            | 18   |
| The emergency of symptoms of acute | 7            | 15.4 |

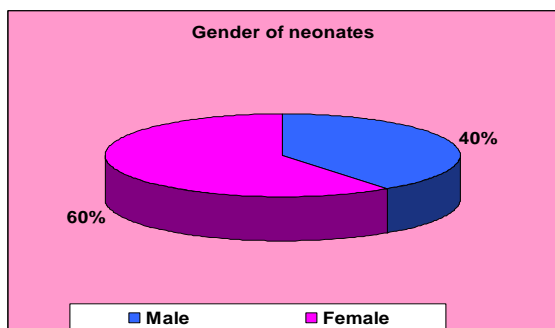


Figure (1): Distribution of neonates gender

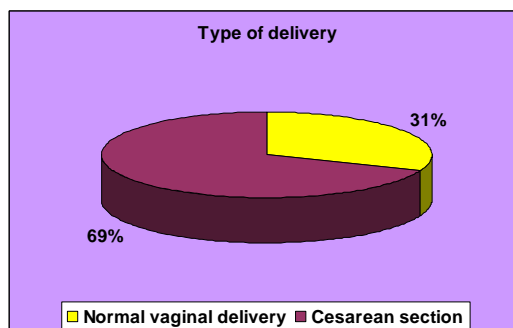


Figure (1): Distribution of neonates type of delivery

Table (3): Comparison of nurses knowledge in pre-and post-test about neonatal period and jaundice (N=45)

| Questions   | Test pre |      | Test post |       | P. value                     |
|---|----------|------|-----------|-------|------------------------------|
|   | No       | %    | No        | %     |                              |
| <b>Knowledge about describe of neonatal period</b>        |          |      |           |       |                              |
| Correct   | 28       | 62   | 42        | 93.3  | X <sup>2</sup> =5.22<br>0.21 |
| Incorrect   | 17       | 38   | 3         | 6.7   |                              |
| <b>Knowledge about characteristics of normal neonates</b> |          |      |           |       |                              |
| Correct   | 37       | 82.3 | 45        | 100.0 | X <sup>2</sup> =4.15<br>0.26 |
| Incorrect   | 8        | 17.7 | 0         | 0.00  |                              |
| <b>Knowledge about characteristics of premature</b>       |          |      |           |       |                              |
| Correct   | 26       | 57.7 | 45        | 100.0 | X <sup>2</sup> =3.12<br>0.06 |
| Incorrect   | 19       | 42.3 | 0         | 0.00  |                              |
| <b>Knowledge about definition of jaundice</b>             |          |      |           |       |                              |
| Correct   | 30       | 66.6 | 42        | 93.3  | X <sup>2</sup> =5.16<br>0.06 |
| Incorrect   | 15       | 33.4 | 3         | 6.7   |                              |
| <b>Knowledge about causes of jaundice</b>                 |          |      |           |       |                              |
| Correct   | 23       | 51.2 | 40        | 89    | X <sup>2</sup> =2.15<br>0.45 |
| Incorrect   | 22       | 48.8 | 5         | 11    |                              |
| <b>Knowledge about types of jaundice</b>                  |          |      |           |       |                              |
| Correct   | 27       | 60   | 42        | 93.3  | X <sup>2</sup> =2.12<br>0.32 |
| Incorrect   | 12       | 26.6 | 3         | 6.7   |                              |
| <b>Knowledge about signs and symptom of jaundice</b>      |          |      |           |       |                              |
| Correct   | 35       | 77.7 | 43        | 95.5  | X <sup>2</sup> =3.32<br>0.24 |
| Incorrect   | 10       | 22.3 | 2         | 4.5   |                              |
| <b>Knowledge about complication of jaundice</b>           |          |      |           |       |                              |
| Correct   | 36       | 80   | 45        | 100.0 | X <sup>2</sup> =4.22<br>0.34 |
| Incorrect   | 9        | 20   | 0         | 0.00  |                              |

Table (4): Comparison knowledge of nurses in pre-and post-test about ET (N=45)

| Questions                               | Test pre |      | Test post |       | P. value                      |
|---|----------|------|-----------|-------|-------------------------------|
|   | No       | %    | No        | %     |                               |
| <b>Knowledge about describe of ET</b>   |          |      |           |       |                               |
| Correct                                 | 32       | 71.2 | 42        | 93.3  | X <sup>2</sup> =2.12<br>0.03* |
| Incorrect                               | 13       | 28.8 | 3         | 6.7   |                               |
| <b>Knowledge about causes of ET</b>     |          |      |           |       |                               |
| Correct                                 | 26       | 57.7 | 40        | 89    | X <sup>2</sup> =5.15<br>0.05* |
| Incorrect                               | 19       | 42.3 | 5         | 11    |                               |
| <b>Knowledge about types of ET</b>      |          |      |           |       |                               |
| Correct                                 | 22       | 49   | 43        | 95.6  | X <sup>2</sup> =3.12<br>0.05* |
| Incorrect                               | 23       | 51   | 2         | 4.4   |                               |
| <b>Knowledge about indication of ET</b> |          |      |           |       |                               |
| Correct                                 | 24       | 53.3 | 45        | 100.0 | X <sup>2</sup> =5.13<br>0.01* |
| Incorrect                               | 21       | 46.7 | 0         | 0.00  |                               |



| Questions   | Test pre |      | Test post |      | P. value                      |
|---|----------|------|-----------|------|-------------------------------|
|   | No       | %    | No        | %    |                               |
| <b>Knowledge about complication of ET</b>               |          |      |           |      | X <sup>2</sup> =2.22<br>0.02* |
| Correct   | 30       | 66.6 | 44        | 97.7 |                               |
| Incorrect   | 15       | 33.4 | 1         | 2.3  |                               |
| <b>Knowledge about follow up of ET</b>                  |          |      |           |      | X <sup>2</sup> =3.20<br>0.05* |
| Correct   | 24       | 53.3 | 43        | 95.5 |                               |
| Incorrect   | 21       | 46.7 | 2         | 4.5  |                               |
| <b>Knowledge about medication uses during ET</b>        |          |      |           |      | X <sup>2</sup> =0.22<br>0.05* |
| Correct   | 33       | 73.4 | 43        | 95.5 |                               |
| Incorrect   | 12       | 26.6 | 2         | 4.5  |                               |
| <b>knowledge about medication dose during ET</b>        |          |      |           |      | X <sup>2</sup> =2.34<br>0.01* |
| Correct   | 35       | 78   | 45        | 100  |                               |
| Incorrect   | 10       | 22   | 0         | 0.00 |                               |
| <b>Knowledge about medication side effect during ET</b> |          |      |           |      | X <sup>2</sup> =4.20<br>0.05* |
| Correct   | 30       | 66.7 | 42        | 93.3 |                               |
| Incorrect   | 15       | 33.3 | 3         | 6.7  |                               |

\*Statistically Significant Difference

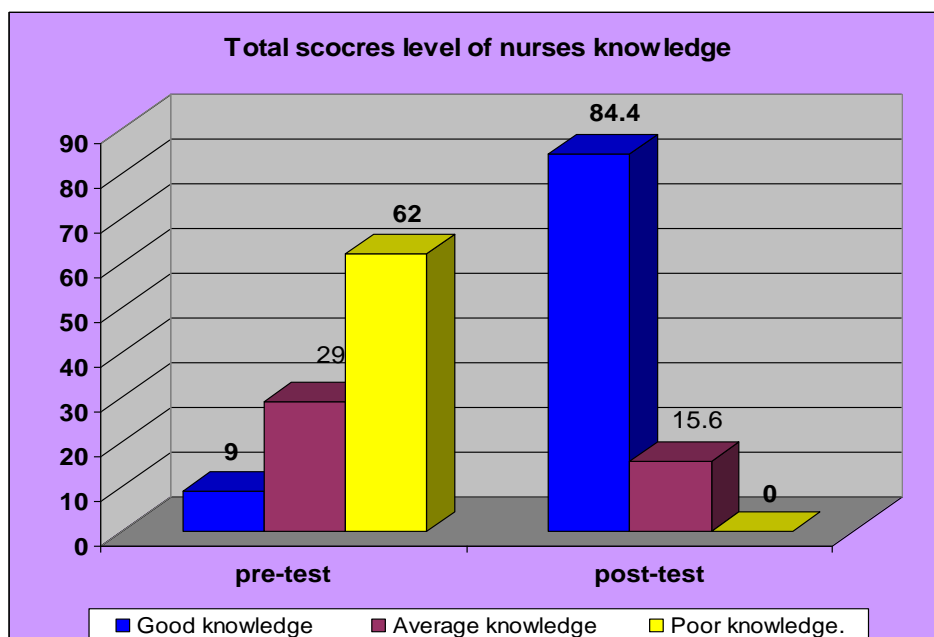


Figure (3): Comparison of total scores level of nurses' knowledge in pre-as well as post-test about ET (N=45)

Table (5): Comparison practices of nurses in pre-as well as post-test about ET (N=45)

| Questions   | Test pre |      | Test post |       | P. value                      |
|---|----------|------|-----------|-------|-------------------------------|
|   | No       | %    | No        | %     |                               |
| <b>Practice about pulse oximeter before ET</b>  |          |      |           |       | X <sup>2</sup> =0.12<br>0.02* |
| Competent   | 12       | 26.6 | 40        | 89    |                               |
| Incompetent   | 33       | 73.4 | 5         | 11    |                               |
| <b>Practice about flushing an umbilical venous catheter for ET</b>  |          |      |           |       | X <sup>2</sup> =0.16<br>0.07  |
| Competent   | 45       | 100  | 45        | 100   |                               |
| Incompetent   | 0        | 0.00 | 0         | 0.00  |                               |
| <b>Practice about bundle for prevention of infection when maintaining a central venous catheter CVC during ET</b> |          |      |           |       | X <sup>2</sup> =0.13<br>0.02* |
| Competent   | 22       | 49   | 45        | 100.0 |                               |
| Incompetent   | 23       | 51   | 0         | 0.00  |                               |

| Questions  | Test pre |       | Test post |       | P. value                      |
|--|----------|-------|-----------|-------|-------------------------------|
|  | No       | %     | No        | %     |                               |
| <b>Practice about oropharyngeal and nasal suctioning before ET</b> |          |       |           |       |                               |
| Competent  | 12       | 26.6  | 38        | 84.4  | X <sup>2</sup> =0.23<br>0.02* |
| Incompetent  | 33       | 73.4  | 7         | 15.6  |                               |
| <b>Practice about ryle Insertion before ET</b>                     |          |       |           |       |                               |
| Competent  | 14       | 31    | 37        | 82    | X <sup>2</sup> =0.18<br>0.03* |
| Incompetent  | 31       | 69    | 8         | 18    |                               |
| <b>Practice about blood sampling before ET</b>                     |          |       |           |       |                               |
| Competent  | 45       | 100.0 | 45        | 100.0 | X <sup>2</sup> =0.22<br>0.03* |
| Incompetent  | 0        | 0.00  | 0         | 0.00  |                               |
| <b>Practice about blood glucose sampling before ET</b>             |          |       |           |       |                               |
| Competent  | 8        | 18    | 40        | 89    | X <sup>2</sup> =0.13<br>0.04* |
| Incompetent  | 37       | 82    | 5         | 11    |                               |

\*Statistically Significant Difference

Table (6): Comparison practices of nurses in pre-as well as post-test about ET (N=45)

| Questions                                  | Test pre |    | Test post |      | P. value                      |
|--|----------|----|-----------|------|-------------------------------|
|  | No       | %  | No        | %    |                               |
| <b>Practice about preparation for ET</b>   |          |    |           |      |                               |
| Competent                                  | 17       | 38 | 37        | 82   | X <sup>2</sup> =5.14<br>0.05* |
| Incompetent                                | 28       | 62 | 8         | 18   |                               |
| <b>Practice about procedures before ET</b> |          |    |           |      |                               |
| Competent                                  | 14       | 31 | 36        | 80   | X <sup>2</sup> =3.12<br>0.01* |
| Incompetent                                | 31       | 69 | 9         | 20   |                               |
| <b>Practice about procedures during ET</b> |          |    |           |      |                               |
| Competent                                  | 22       | 49 | 45        | 100  | X <sup>2</sup> =4.18<br>0.05* |
| Incompetent                                | 23       | 51 | 0         | 0.00 |                               |
| <b>Practice about procedure after ET</b>   |          |    |           |      |                               |
| Competent                                  | 14       | 31 | 42        | 93.4 | X <sup>2</sup> =5.16<br>0.03* |
| Incompetent                                | 31       | 69 | 3         | 6.6  |                               |

\*Statistically Significant Difference

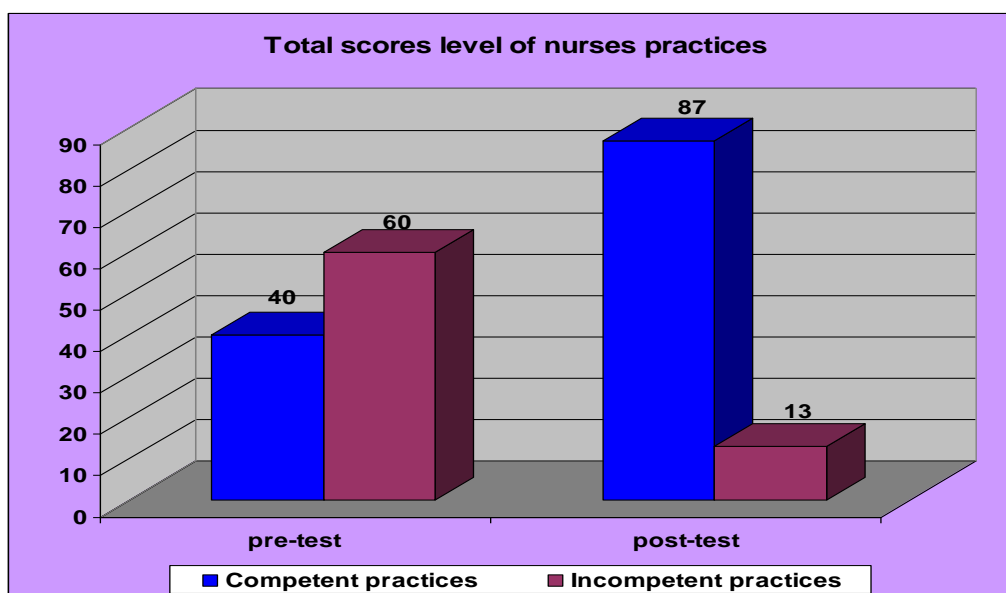


Figure (4): Comparison of total scores level of nurses' practices in pre-as well as post-test about ET (N=45)



**Table (7): Relation between personal characteristics and total score of nurses knowledge in the Post-test (N=45)**

| Items                                  | Good knowledge |       | Average knowledge |      | Poor knowledge |      | Fisher/ x2<br>P-value                |
|--|----------------|-------|-------------------|------|----------------|------|--------------------------------------|
|  | N              | %     | N                 | %    | N              | %    |                                      |
| <b>Age / years</b>                     |                |       |                   |      |                |      |                                      |
| <20                                    | 2              | 50    | 2                 | 50   | 0              | 0.00 | X <sup>2</sup> =5.21<br>P=0.56<br>NS |
| 20<30yrs.                              | 12             | 60    | 6                 | 30   | 2              | 10   |                                      |
| 33-40yrs.                              | 8              | 67    | 4                 | 33   | 0              | 0.00 |                                      |
| More than 40 yrs.                      | 6              | 66.6  | 3                 | 33.4 | 0              | 0.00 |                                      |
| <b>Qualification</b>                   |                |       |                   |      |                |      |                                      |
| Bachelor in Nursing Science            | 7              | 64    | 3                 | 27   | 1              | 9    | X <sup>2</sup> =7.10<br>P=0.03*      |
| Diploma Technical Institute in Nursing | 10             | 71.4  | 2                 | 14.3 | 2              | 14.3 |                                      |
| Diploma of Schools in Nursing          | 14             | 70    | 4                 | 20   | 2              | 10   |                                      |
| <b>Years of Experience</b>             |                |       |                   |      |                |      |                                      |
| <3 yrs                                 | 6              | 60    | 3                 | 30   | 1              | 10   | X <sup>2</sup> =6.15<br>P=0.05*      |
| 3:6 yrs                                | 12             | 75    | 2                 | 12.5 | 2              | 12.5 |                                      |
| >6yrs                                  | 16             | 84    | 2                 | 10.5 | 1              | 5.5  |                                      |
| <b>Training Courses</b>                |                |       |                   |      |                |      |                                      |
| Yes                                    | 5              | 100.0 | 0                 | 0.00 | 0              | 0.00 | X <sup>2</sup> =0.16<br>P=0.78<br>NS |
| No                                     | 26             | 65    | 10                | 25   | 4              | 10   |                                      |

NS= No statistical significant difference

\*Statistically Significant Difference

**Table (8): Relation between personal characteristics and total score of nurses practices in the Post-test (N=45)**

| Items                                  | Competent practices |       | Incompetent practices |      | Fisher/ x2<br>P-value                |
|--|---------------------|-------|-----------------------|------|--------------------------------------|
|  | N                   | %     | N                     | %    |                                      |
| <b>Age / years</b>                     |                     |       |                       |      |                                      |
| <20                                    | 3                   | 75    | 1                     | 25   | X <sup>2</sup> =2.12<br>P=0.46<br>NS |
| 20<30yrs.                              | 18                  | 90    | 2                     | 10   |                                      |
| 30-40yrs.                              | 10                  | 83.7  | 2                     | 16.3 |                                      |
| More than 40 yrs.                      | 9                   | 100.0 | 0                     | 0.00 |                                      |
| <b>Qualification</b>                   |                     |       |                       |      |                                      |
| Bachelor in Nursing Science            | 10                  | 91    | 1                     | 9    | X <sup>2</sup> =4.14<br>P=0.03*      |
| Diploma Technical Institute in Nursing | 12                  | 86    | 2                     | 14   |                                      |
| Diploma of Schools in Nursing          | 17                  | 85    | 3                     | 15   |                                      |
| <b>Years of Experience</b>             |                     |       |                       |      |                                      |
| <3 yrs                                 | 7                   | 70    | 3                     | 30   | X <sup>2</sup> =1.10<br>P=0.04*      |
| 3:6 yrs                                | 14                  | 87.5  | 2                     | 12.5 |                                      |
| >6yrs                                  | 17                  | 89.4  | 2                     | 10.6 |                                      |
| <b>Training Courses</b>                |                     |       |                       |      |                                      |
| Yes                                    | 5                   | 100   | 0                     | 0.00 | X <sup>2</sup> =2.12<br>P=0.58<br>NS |
| No                                     | 37                  | 92.5  | 3                     | 7.5  |                                      |

NS= No statistical significant difference

\*Statistically Significant Difference

**Table (9): Correlation between total scores of nurses' knowledge and practices regarding care of neonates undergoing ET (N=45)**

|                  | Performance |          |
|------------------|-------------|----------|
|                  | R           | P. value |
| <b>Knowledge</b> | 0.68        | 0.001*   |

\*Statistically Significant Difference

**Table (1):** Clears, that 44% of nurses age from 20<30 yrs, mean age of the nurses was  $29.12 \pm 6.5$ . 44.4 % of them had diploma of schools in nursing, and 42.2% of them their experience were > 6 years. Also, 89% of nurses were married. Regarding the residence was 66.7% of nurses from urban area, as well as 89% of them were not attending training courses related ET.

**Table (2):** Shows that 84.4% of neonate's ages were from 1-4 days with the mean age of the neonates was  $3.22 \pm 2.36$ , regarding gender 60% of them were female. Regarding gestational age (wks) 55.6% of them were preterm with the Mean $\pm$ SD  $36.32 \pm 2.30$ , and 82.3% of neonates were low birth weight with the Mean $\pm$ SD  $2.18 \pm 0.40$ , While 66.6% of neonates have the common reason for ET was failure to respond to phototherapy

**Figure (1):** Demonstrates 60% of neonates were females

**Figure (2):** Shows also 69% of them delivered by cesarean section.

**Table (3):** Clear that 93.3% of the most nurses had correct knowledge about definition of neonatal period in post-test, while 62% in pre-test. 89% of the most nurses had correct knowledge about causes of jaundice in post –test while 51.2% in pre-test. 95.5% of the most nurses had correct knowledge about signs and symptom of jaundice in post –test, while 77.7% in pre-test.

**Table (4):** Clear that 71.2% of the nurses had correct knowledge about ET in pre–test, while 93.3% in post-test. 53.3% of the most nurses had correct knowledge about indication of ET in pre-test while 100.0 % in post-test. 53.3% of the most nurses had correct knowledge about follow up of ET in pre –test, while 95.5% in post-test.

**Figure (3):** Reveals that, 9% of the nurses had good knowledge in pre-test while in post-test was 84.4% regarding ET for the neonates. 29% of them had average knowledge in pre-test while 15.5% in post-test, while more than half of nurses (62%) of them had poor knowledge in pre-test while no nurses had poor knowledge in post-test. However, this increase reached statistically significant difference between the nurses' knowledge in pre-test and post-test with (P. 0.02).

**Table (5):** Presents that, 26.6% of the nurses had competent practices about pulse oximeter before ET in pre-test while in post-test was 89%. 49% of the nurses had competent practices about Practice about bundle for prevention of infection when maintaining a central venous catheter CVC during ET in pre-test while in post-test was 100%. 18% of the nurses had competent practices about blood glucose sampling before ET in pre-test while in post-test was 89%.

**Table (6):** Presents that, 38% of the nurses had competent practices about preparation for ET in pre-

test while in post-test was 82%. Also 31% of the nurses had competent practices about procedures before ET in pre-test while in post-test was 80%. As well as 31% of the nurses had competent practices about procedure after ET in pre-test while in post-test was 93.4%.

**Figure (4):** Clears that, 40% of the nurses had competent practices: if score  $\geq 85\%$ , practices in pre-test while in post-test was 87% regarding ET for the neonates. 60% of them had incompetent practices: if score  $<85\%$  in pre-test while 13% in post-test. However, this increase reached statistically significant difference between the nurses' practices in pre-test and post-test.

**Table (7):** Clears that, there were statistically significant relation between total score level of nurses' knowledge regarding ET and their qualification and years of experience (P. 0.03, and 0.05); respectively. While there were no significant relation between nurses' age and training courses of nurses and their total score level of their knowledge.

**Table (8):** Clears that, there were statistically significant relation between total score level of nurses' practices regarding ET and their qualification and years of experience (P. 0.03, and 0.04); respectively. While there were no significant relation between nurses' age and training courses of nurses and their total score level of their practices.

**Table (9):** Shows that there were positive correlation between total score level of nurses' knowledge and practices regarding care of neonates undergoing ET ( $r = 0.68$  &  $P < .001$ )

## Discussion

To produce appropriate patient outcomes during the ET, knowledge is needed. Although the number of newborns who need this technique is currently declining due to controlling efforts and the widespread adoption from guidelines of management, it is still a technique that every pediatrician must be able to apply competently as well as for which it is impossible to achieve an adequate learning curve given the current low degree of exposure in the environment of hospital. Simulated practice is a cutting-edge educational technique that encourages interest in learning for health as well as enhances learning chances. It enables the development of practice, the enlargement of information, and the readiness for critical circumstances (María, et al., 2020).

ET being a vital life-saving operation in many emergency circumstances, there is relatively little clinical experience in administering this technique. The ET is a unique type of blood transfusion that may have both general unfavorable effects and its

particular adverse effects, especially when administered to newborns (Wolf, et al., 2020).

The actually research justified that less than fifty-percent of studied sample their age among 21<30 years with mean  $29.12 \pm 6.5$  years. Aly, et al., (2023) mentioned that the more than fifty-percent of nurses their age among 20-<30 years with mean  $29.15 \pm 7.12$  years. From the perspective of the researcher, the advantages of nurses in this age that they were full of experiences, which is always required in such critical departments as NICU. This age category can easily achieve high quality nursing care and increase the ability to tolerate the working load.

Less than fifty percent of the nurses in this research held nursing degrees, as this study's findings demonstrated. This conclusion was consistent with a research by Aly et al. (2023), which found that more than fifty percent of the nurses in the study received a diploma from a secondary nursing school. According to the researcher, the wide base of nursing education in Egypt is a diploma, as well as nursing secondary schools supply hospitals with a greater number of diploma-trained nurses than other organizations like nursing faculties as well as technical nursing institutes.

The actually research illustrated that the highest number of nurses who didn't attending any training courses related to ET, this discovery was confirmed by research on Wolf, et al., (2020) who stated that the high number of nurses did not take any specific training about neonatal jaundice and blood exchange.

In this study presents that all of studied neonates' age 1:7days with the mean  $3.22 \pm 2.36$  days. Aly et al., (2023) who stat that all of studied neonates' age < 15 days with the mean  $3.83 \pm 2.33$  days, also Kotwal et al., (2017) who mentioned that the most (91.6%) of the studied neonates' age < 15 days.

Regarding to gestational age (weeks) in the present study clear that 55.6% of the studied neonates were preterm, this finding was matched with study of Raikwar, et al., (2018) who documented that 49% of the studied neonates were preterm and 51% was full term.

The current study revealed that the neonates were diagnosed as jaundice. This finding was harmony with study of Akintan et al., (2019) who proved that the major reason for ET among neonates was jaundice.

Finding of the actually research revealed that the reason for the ET, more than fifty-percent of the studied neonates was failure to respond to phototherapy, this finding was matched with study of Bujandric & Grujic (2016) who reported that the major reason for the ET was failure to respond to phototherapy among the studied neonates.

The result of the actually research clarified that all the nurses had correct knowledge related characteristics of premature in post-test, while more than half in pre-test. The high number of nurses had correct knowledge about causes of jaundice in post-test while the half in pre-test. The most of the most nurses had correct knowledge about signs as well as symptom of jaundice in post-test. Also these results were parallel with Issa, et al., (2018) who stated that most of the nurses had knowledge about the characteristics of premature. This result disagreement with Ibrahim, et al., (2019) who cleared that about seventy-five percent of nurses had poor knowledge as regards definition, signs as well as symptoms of Jaundice.

The actually research illustrated that the most of the nurses had correct knowledge about ET meaning in post-test. All the nurses had correct knowledge about indication of ET in post-test. The most nurses had correct knowledge about follow up of ET in post-test. The most of nurses had correct knowledge regarding the medication used for ET in post-test. These results were matched with Aydin et al., (2021) who discovered that most of the nurses under study had sufficient understanding of suitable transfusion observation and what to do in the event of a transfusion response.

The total scores level of nurse's knowledge regarding ET for the neonates, in this research displayed that the most of the studied nurses had good knowledge related ET for the neonates in post-test while in pre-test 9%. Also, half of the nurses had average knowledge in post-test, while no nurses had poor knowledge in post-test. These findings were supported with study of Aly, et al., (2023) who state that the total score level of nurse's knowledge related ET for the neonates, that one quarter of the nurses had good knowledge, approximately less than fifty-percent of them had mean knowledge, while more than thirty-three percent of them had bad knowledge.

The actually research illustrated that the high number of the nurses had competent skills about preparation for ET in post-test while in pre-test was less than fifty-percent. Also the high number of the nurses had competent practices about procedures before ET in post-test while in pre-test was less than fifty-percent. As well as the most of the nurses had competent practices about procedure after ET in post-test while in pre-test was less than fifty-percent. Aly, et al., (2023) justified that the nurses had enough level of skills regarding preparation needed for ET. While more than sixty-six percent of them had inadequate level of skills regarding record of ET. Also this disagreement with Salia et al., (2021) who presented that lowest percentage of the nurses had good practices related preparation before ET.

Regarding to nurses had competent practices of blood sampling before ET. This actually research revealed that all the nurses had competent skills in pre-test and in post-test. This result matched with study of **Salia et al., (2021)** who mention that less than sixty-six percent of the nurses had good practices for blood specimens as ordered and document.

The actually research finding mentioned that the total scores level of nurse's skills regarding ET for the neonates, in this research displayed that the high number of the nurses had competent practices in post-test while in pre-test less than half. These agree with **Aly, et al., (2023)** who state that more than sixty-six percent of the studied nurses had competent practices related care of neonates undergoing ET, while more than thirty- three percent of them had incompetent practices, this result disagreement with study by **Mukhlif & Neamah (2021)** who revealed that the high number of the nurses had fair practices regarding ET.

The actually research results revealed that, there were statistically significant relation among total score level of nurses' knowledge regarding ET and their qualification as well as experience years (P. 0.03, and 0.05); respectively. While there were no relation between nurses' age and training courses of nurses and their total score degree of their knowledge. These results matched with **Jain & Transfus (2018)** they demonstrated a statistically relationship (P 0.05) between the nurses' training and their knowledge of the analyzed sample.

The results of actually research clarified that, there were statistically significant relation among total score degree of nurses' skills related ET and their qualification and experience years (P. 0.03, and 0.04); respectively. While there were no significant connection among nurses' age and training courses of nurses and their total score degree of their practices, this result in same line with study of **Santhi, (2020)** who found a highly connection between the mean degree of knowledge as well as skills of nurses related to the care of neonates undergoing ET.

The actually research finding clarified that, there were positive correlation among total score level of nurses' knowledge as well as practices regarding care of neonates undergoing ET ( $r= .68$  &  $P<.001$ ). This result in same line with **Abdel-Gafour et al., (2020)** who displayed that there were positive correlation among total score degree of nurses' knowledge blood exchange and total score degree of nurses' performance at (p-value <0.001).

#### Conclusions of this study:

Were the total scores level of nurse's knowledge as well as practices related ET for the neonates, the most of the nurses had good knowledge in post-test while the majority of the nurses had competent practices in

post-test. There were statistically significant relation among total score level of nurses' knowledge and practices regarding ET and their qualification as well as years of experience. Also, there were positive correlation among total score level of nurses' knowledge as well as practices regarding ET for the neonates.

#### Recommendations of this study:

Were Encourage nurses to enhance and refresh their knowledge as well as practices via attending training programs, conference as well as workshops about care of neonates undergoing ET, Periodic assessment of nurses' performance related caring of neonates undergoing ET in NICU, Procedure book must be present at NICU as unified as a guide for all nurses who providing care for neonates undergoing ET, also Further studies with a larger sample of the nurses' working at NICU at different Hospitals.

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