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Assessment of Nurses' Performance Regarding Care of Children Undergoing Liver Transplantation

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Abstract

Background: *Liver transplantation has become a common surgical procedure worldwide. Children with end stage liver disease or acute liver failure as well as, who suffering from hepatitis C virus and has not responded to conventional medical or surgical intervention, liver transplantation may be the best hope for those children Egypt has the highest hepatitis C virus (HCV) prevalence in the world, whereas, those children have difficulty for responding to conventional medical or surgical intervention.* ***Aim:*** *This study aims to assess nurses' performance regarding care of children undergoing liver transplantation.* ***Design:*** *Descriptive study was be utilized to conduct the study.* ***Sample:*** *Number and percentage distribution of the studied nurses' according to their characteristics (n=35).* ***Tools:*** *Two tools were used to collect data. Tool I: A structured interviewing questionnaire. Tool II: Observation Checklist.* ***Result:*** *The current study showed that less than one third of studied nurses age range from 25 to less than 30 years old, three fifth have Bachelor degree, and more than half (51.4%) range from 1 to 5 years. In addition, 57.1% did not receive training about liver transplantation. The majority of studied nurses (94.3%) have correct knowledge regarding the liver' location. less than half of studied nurses (42.9%) had correct knowledge regard the conditions that must be met. The more than half of studied nurses (57.1%) had competent practice of immediate care after liver transplantation (ABC).* ***Conclusion:*** *Most of studied nurses had satisfactory knowledge regarding anatomy and function of the liver but had unsatisfactory knowledge regarding liver transplantation donors' types and conditions. So, the study answered the research question relation between nurses' knowledge and practices and their characteristics regarding care of children undergoing liver transplantation.* ***Recommendation:*** *Develop an educational program to meet the actual need of nurses regarding care of children undergoing Liver Transplantation.*

Keywords: *Surgical Liver Transplantation, Pediatric Care, Nurse Performance*

1. Introduction

The first human liver transplant was performed in 1963 by surgical team led by Thomas Starzl of Denver, USA. The initial attempts at human liver transplant produced short term survival and only in 1967 the same group reported the first series of liver transplants with improved outcomes and one survival of almost 1 year. In Egypt in 1991 by the surgical team at the National liver institute, Menoufiya University. Thereafter, the surgical team at the National Cancer Institute in Cairo performed two cadaveric liver transplant procedures **(Gavara et al., 2019).**

Indications for liver transplantation in infants and children include acute liver failure, chronic liver failure with pruritus, complications of cholestasis and failure to thrive. In young children, the most

common liver disease leading to transplantation is biliary atresia **.** Biliary atresia accounts for at least 50 percent of all liver transplants in children and is characterized by the failure of the bile ducts to develop normally and drain bile from the liver ***(Ravikumar, 2019).***

The care of the liver transplant children presents the critical care team with one of the more complex and challenging endeavors. Proper management and early recognition of complications and communication of these findings allow for prompt intervention and progress toward optimal outcomes for these children who underwent liver transplant ***(Mancuso & Cuenca, 2019).*** All nursing care is directed toward promoting, maintaining, restoring health, preventing complications and helping children adapt to the residual effect of illness.

Pediatric nurses as a member of the multidisciplinary team, plays a vital role in the success of the transplant program and needs to continually update their knowledge, skills and attitudes in this very specific and complex area to enable nurses to act in an appropriate manner ***(Cui, Xue & Sheng, 2019).*** Pediatric nurses can play an integral role in early identification of graft dysfunction, rejection, or infection. Because of the intimate and large amount of time that the nurse is at the children's bedside, they often in a position to monitor for potential risks to the children and take corrective action ***(Mohamed, Mohamed & Abdel Hafez, 2019).***

Significance of the study:
Over the world 2,615 Pediatric Liver Transplants performed during last year May 2018 to August 2019; 27 cases of them at Africa, 526 cases at Europe, 1.279 cases at ASIA, **736**cases at America and 47 cases at Australia (***International Liver Transplantation Society (ILTS), 2019).*** In Egypt, there is no doubt that chronic liver diseases are a major disease by the end of 2014, the total number of liver transplantation children reached 2140; the number comprised 1980 adult cases and 160 pediatric cases ***(Shaker et al., 2018)***.

Early postoperative complications may result in graft loss and reoperations, Pulmonary and hemodynamic complications which may increase mortality after liver transplantation. A significant rate of mortality was determined during the early postoperative period of the liver transplantations. **(Mohamed, Mohamed & Abdel Hafez, 2019).**

It is necessary to assess nursing performance for critical ill children undergoing liver transplantation. Children and graft outcomes are closely monitored on a national level and 1- year survival is between 80-92% **(Rozenfeld& Harris, 2018).** So that, this study aims to assess nurse's performance toward care of children undergoing liver transplantation.

Aim of the study: This study aims to assess nurses' performance regarding care of children undergoing liver transplantation.

Research Question: What is the nurses' knowledge and practices regarding care of children undergoing liver transplantation? Is there relation between nurses' knowledge and practices and their characteristics regarding care of children undergoing liver transplantation?

2. Materials and Methods

Research Design
A descriptive design was used to conduct this study.

Research Settings
The current study was conducted at pediatric intensive care units at Saudi German Hospital and Air Force Specialized Hospital.

Research Subject
A purposive sample of critical nurses working at pediatric intensive care units at the previously mention setting that were willing to participate in the study regardless their age, gender and residence.

Inclusion criteria
- Nurses who are willing to participate in the study.
- Nurses are ranges from 20-40 years.
- Male/Female nurses

-All levels of nursing qualifications.
- Nurses years of experience at least one year in liver transplantation unit and outpatient clinic for liver transplantation.

Exclusion criteria
Nurses less than one year in liver transplantation.

Tools for data collection:

Tool I: An Interviewing questionnaire sheet
It was designed by the researcher in simple Arabic language based on extensive review of relevant and recent literatures to assess nurses' knowledge related to liver transplantation. It includes the followings parts:
Part 1: Characteristics of nurses as age, gender, educational level and residence.
Part 2: Characteristics of children as age, gender and diagnosis.
Part 3: Nurse's knowledge related to liver transplantation such as definition, causes of liver transplantation, complication, indication and care of children after transplantation.

Tool II: Observation Checklist
It was adapted from **Morris et al., 2020** and it was used to assess nurse's practice regarding care of children undergoing liver transplantation, such as physical examination, vital signs, Isolation precaution, care of the central venous pressure (CVP), Suctioning, Ryle Insertion, care of mechanical ventilation.

Validity
The tools were be exposed for the group of experts (3) in field of pediatric nursing to test its content validity.

Reliability
Cronbach's Alpha was used to determine the internal reliability of the tool.

Ethical considerations
An official permission to conduct the proposed study was obtained from the Scientific Research Ethics Committee. Participation in the study is voluntary and study subjects was be given complete full information about the study and their role before giving the informed consent. The ethical considerations were include explaining the purpose and nature of the study, stating the possibility to withdraw from the study at any time, confidentiality of the information where it was not be accessed by any other party without taking permission of the participants. Ethics, values, culture and beliefs was be respected.

Operational Design

Preparatory phase
It included reviewing of related literature and theoretical knowledge of varies aspects of the study using books, articles, internet and periodical.

Pilot study
A pilot study was carrying out on 10% of the studied subjects to test the content, effectiveness and time consumed to fill in study tools. Based on the results of the pilot study the necessary modifications were be done.

Field work
The researcher was started by introducing herself to studied subjects, giving a clear and brief idea about the aim of the study and its expectations, then collect the data by using previous mentioned tools was written in simple Arabic language. The investigator was be available in the study setting 2 days/week to collect data. The studied subjects were be interviewed individually for a period of time 30-40minutes.

Administrative design
Approval was obtained through an issued letter from the Dean of Faculty of Nursing, Helwan University to directors of the previously mentioned setting.

Statistical Item

Upon completion of data collection, data was computed and analyzed using Statistical Package for the Social Science (SPSS), version 24 for analysis. The P value was set at 0.05. Descriptive statistics tests as numbers, percentage, mean ± standard deviation (± SD), was used to describe the results. Appropriate inferential statistics such as "F" test or "t" test was used as well.

3. Results and Discussion

Table (1): This table showed that, less than one third (31.4%) of studied nurses age range from 25 < 30 years old with mean x±SD 29.20±1.36. Also, less than three quarters (71.4%) are females. As regard nurses' educational level more than half of them (60.0%) have Bachelor degree, more over as regard experience years, more than half (51.4%) of them range from 1 to 5 years.

Figure (1): Represents that, more than half of the studied nurses (57.1%) did not attend previous training courses about liver transplantation.

Table (2): Illustrates that the majority of studied nurses (94.3%) have correct knowledge regarding the liver is located, while less than one third of them (31.4%) have correct knowledge as regard one of the functions of the liver.

Table (3): Illustrates that moreover their Knowledge regarding causes and contraindications for liver transplantation, more than half of them (54.3%) have correct knowledge related to liver transplantation but more than two thirds of them (68.6%) have in correct knowledge regarding to conditions in which liver transplantation is prohibited.

Table (4): Reveals that more than two thirds of them (68.6%) had incorrect knowledge as regard the conditions that must be met by the donor.

***Table (5*)**: Clarifies that, more than half of them (54.3%) have correct knowledge regard causes high blood sugar after liver transplantation, while less than two thirds of them (62.9%) had incorrect knowledge as regard "Causes of pneumonia immediately after a liver transplant. As well their Knowledge regarding symptoms of the body's rejection of the liver transplantation, more than half of them (54.3%) had correct knowledge about body temperature, but 57.1% of had incorrect knowledge related to Yellowing around the eyes and skin.

***Table (6*)**: Reveals that furthermore their knowledge regarding postoperative nursing care for a liver transplant child, less than two thirds of them (60.0%) have correct knowledge related to "Vital signs should be observed in the first six hours after the operation, also 60.0% of them had incorrect knowledge related to instruction should be do when cases of chest infection appear.

Table (7): Revealed that, most of studied nurses (82.9%) had satisfactory knowledge regarding anatomy and function of the liver. As well, nearly two thirds (65.7%) had unsatisfactory knowledge regarding liver transplantation donors' types and conditions.

Figure (2): Showed that, more than half of the studied nurses (57.1%) had unsatisfactory knowledge.

Table (8): Revealed that, most of studied nurses (88.6%) monitor vital signs. Whilst more than half (57.1%) don't check all tubes and connections. Furthermore, 88.6% administer medication as doctor order, but less than half (45.7%) don't monitor intake and output hourly. In addition, more than two thirds (65.7%) assess AVPU scale, while 57.1% do not monitor blood glucose level. Regarding to exposure, 51.4% check tubes for obstruction or displacement and 62.9% do not observe any abnormality in skin color

Table (9): Represents that, most of studied nurses (82.9%) attach mechanical ventilator to endotracheal tube and observe for proper functioning of mechanical ventilator and 65.7% set up suction equipment, while (85.7%) do not perform hand hygiene and more than two third (68.6%) do not perform frequent mouth care.

Table (10): It showed that, most of studied nurses (88.6%) secure dressing with tape, (62.9%) apply antiseptic ointment if ordered and (60.0%) apply loose gauze as contact layer to incision or wound site, while (71.4 %) do not wash hand after finish procedure, (54.3%) do not observe appearance and drainage on dressing, (71.4) do not inspect wound for appearance, drains, drainage and integrity and

(62.9%) do not clean wound from least contaminated area to most contaminated area by using separate swab.

Table (11): It reveals that, most of studied nurses (82.9%) wear clean gloves, (62.9) apply label to dressing with date, time (77.1%) remove catheter stabilization device and (51.4) Clean catheter and insertion site with antiseptic swab and allow to dry completely. While nearly two third (65.7) do not apply skin protectant to entire area to allow to dry completely.

Table (12): Showed that, all of studied nurses document the systolic, diastolic and mean blood pressure and remove the thermometer and read, but most of them (88.6%) don't perform hand hygiene.

Table (13): Revealed that, more than half of studied nurses (57.1%) had competent practice of immediate care undergoing liver transplantation (ABC). As well, less than three quarters (71.4%) have incompetent practice regarding physical examination.

***Figure (3)*:** Indicates that, less than two thirds of the studied nurses' (60.0%) had incompetent practices, while 40.0% of them have competent practices regarding care for children undergoing liver transplantation.

Table (14): Illustrated that, there was statistically significant relation between the studied nurses' total knowledge and their age, educational level and attendant of training course about liver transplantation with (X^2=10.325, p <0.003**), (X^2=9.021, p <0.005**) and (X^2=15.39, p <0.002*) respectively. As well, a statistically significant relation was found with studied nurses experience years (X^2=4.897, p <0.012*). No statistically significant relation exists with their gender (X^2=1.120, p <0.085).

Table (15): Showed that, there was statistically significant relation between the studied nurses' total practices and their age and experience years. Also, a statistically significant relation was found with their gender and receiving training about liver transplantation with (p=0.015*) and (p=0.038*) respectively. There was no statistically significant relation with their educational level (p >0.05).

Table (16): Illustrated that, there were a highly statistically significant positive correlation between total knowledge and total practice of the studied nurses (r=0. 615, p<0.000**).

Table (1): Percentage distribution of the studied nurses according to their characteristics (n=35).

Item	No	%
Age		
20 - < 25	7	20.0
25 - < 30	11	**31.4**
30 - < 35	8	22.9
≥ 35	9	25.7
$\bar{X}$ ±SD	**29.20±1.36**	
Gender		
Male	10	28.6
Female	25	**71.4**
Educational level		
Nursing diploma	2	5.7
Technical institution	9	25.7
Bachelor degree	21	**60.0**
Post graduate education	3	8.6
Number of experience years		
1 <5 years	18	**51.4**
5 <10 years	7	20.0
More than 10 years	10	28.6
$\bar{X}$ ±SD	**6.57±3.25**	

Figure (1): Percentage distribution of the studied nurses' regarding to their receiving training about liver transplantation (n=35).

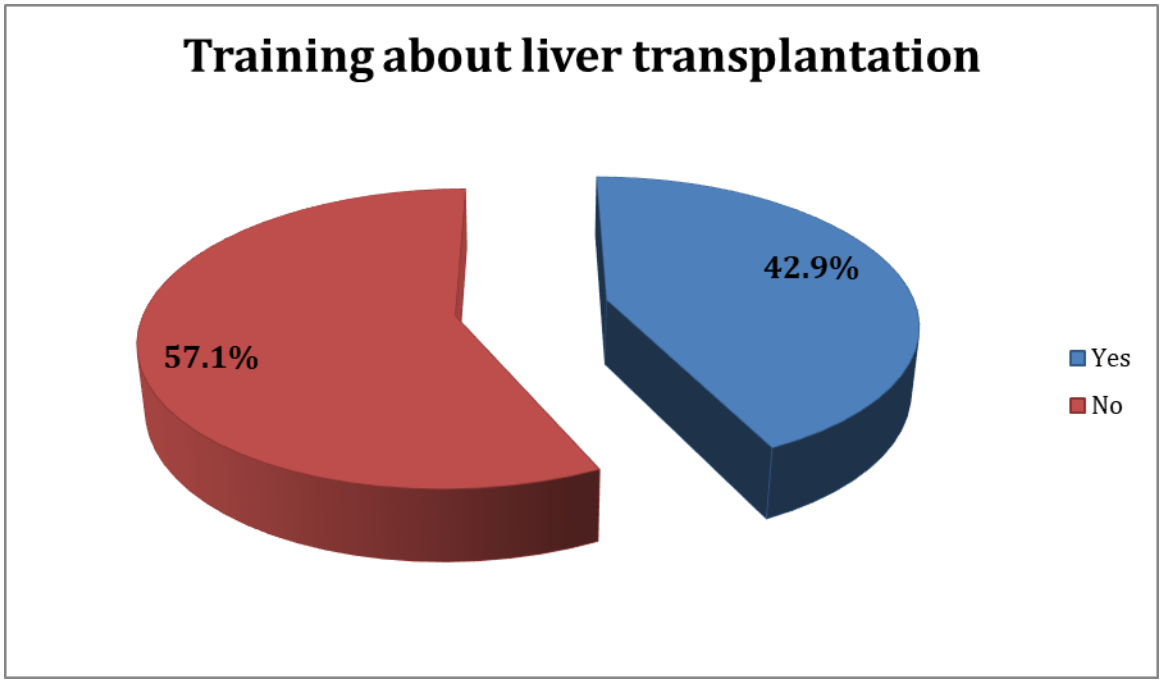

Table (2): Percentage distribution of the studied nurses' knowledge regarding anatomy, physiology of the liver, causes and contraindications for liver transplantation (n=35).

Item	Correct		Incorrect	
	No	%	No	%
Knowledge regarding anatomy and physiology of the liver				
Liver weighs about 900 g to 1200 g.	25	71.4	10	28.6
The liver is located in the upper left part of the abdominal cavity.	33	**94.3**	2	5.7
The liver consists of 3 lobes.	28	80.0	7	20.0
One of the functions of the liver is to manufacture hemoglobin.	24	68.6	11	**31.4**
The bile is stored inside the liver cells after its manufacture.	28	80.0	7	20.0
The liver breaks down blood clotting factors to prevent clots from forming in the body.	29	82.9	6	17.1

Table (3): Percentage distribution of the studied nurses' knowledge regarding for liver transplantation.

Item	Correct		Incorrect	
	No	%	No	%
Knowledge regarding for liver transplantation				
Definition of liver transplantation	19	**54.3**	16	45.7
Causes for a liver transplant	15	42.9	20	57.1
The contraindications in which liver transplantation is Spread of benign tumors in the liver.	11	31.4	24	**68.6**
Hours a liver transplant operation.	16	45.7	19	54.3
The liver regenerates its cells and returns to its normal size again after transplantation within 6-8 weeks.	13	37.1	22	62.9

Table (4): Percentage distribution of the studied nurses' knowledge regarding liver transplantation donors' types (n=35).

Item	Correct		Incorrect	
	No	%	No	%
Knowledge regarding liver transplantation donors' types				
The liver lobe transplanted from donors who are relative the children.	12	34.3	23	65.7
The conditions of the donor.	11	31.4	24	**68.6**
Conditions of deceased donor.	13	37.1	22	62.9

Table (5): Percentage distribution of the studied nurses' knowledge regarding complications of liver transplantation and symptoms of the body's rejection (n=35).

Item	Correct		Incorrect	
	No	%	No	%
Complications of liver transplantation				
Pneumonia immediately after a liver transplant	13	37.1	22	62.9
Signs of acute kidney failure	14	40.0	21	60.0
When will the platelet count improves after a liver transplant	18	51.4	17	48.6
Causes high blood sugar after liver transplantation	19	54.3	16	45.7
Complications that affect the patient's nervous system after liver transplantation	15	42.9	20	57.1
An increase in the patient's temperature after the operation is an indication of the occurrence of	17	48.6	18	51.4
Knowledge regarding symptoms of the body's rejection of the liver transplant				
Yellowing around the eyes and skin	15	42.9	20	57.1
Body temperature	19	54.3	16	45.7
Scratcher	16	**45.7**	19	54.3
Swelling in the stomach	17	48.6	18	51.4
Headache and feeling tired	16	45.7	19	54.3

Table (6): Percentage distribution of the studied nurses' knowledge regarding preoperative and postoperative nursing care for a liver transplant child (n=35).

Item	Correct		Incorrect	
	No	%	No	%
Knowledge regarding preoperative and postoperative nursing care for a liver transplant child				
Vital signs should be observed in the first six hours after the operation every	21	**60.0**	14	40.0
Ensure that the laryngeal tube is still in place by	15	42.9	20	57.1
Before lifting the laryngeal tube, the nurse must do	19	54.3	16	45.7
Instruction should be do when cases of chest infection appear	14	40.0	21	**60.0**
Nursing care after weaning the patient from the ventilator includes the following except	15	42.9	20	57.1
The nurse must make sure that the gastric tube is inserted into the stomach through	18	51.4	17	48.6
It is preferable to elevate the gastric tube when	16	45.7	19	54.3
The efficiency of the kidney functions is measured by calculating any of the following	16	45.7	19	54.3
The nurses should consider the following when noticing the cloudy color of urine inside the urine collection bag	17	48.6	18	51.4

Table (7): Percentage distribution of the studied nurses' regarding to knowledge regarding about liver transplantation (n=35).

Item	Satisfactory		Unsatisfactory	
	No	%	No	%
Total Knowledge anatomy and function of the liver	29	**82.9**	6	17.1
Total knowledge about reasons and contraindications for liver transplantation	14	40.0	21	60.0
Knowledge about liver transplantation donors' types and conditions	12	34.3	23	**65.7**
Knowledge about complications of liver transplantation	15	42.9	20	57.1
Knowledge regarding symptoms of the body's rejection of the liver transplant	16	45.7	19	54.3
Knowledge about preoperative and postoperative nursing care for a liver transplant patient	16	45.7	19	54.3
Total	**15**	**42.9**	**20**	**57.1**

Figure (2): Percentage distribution of the studied nurses' according to their total level of nurses' knowledge regarding liver transplantation (n=35).

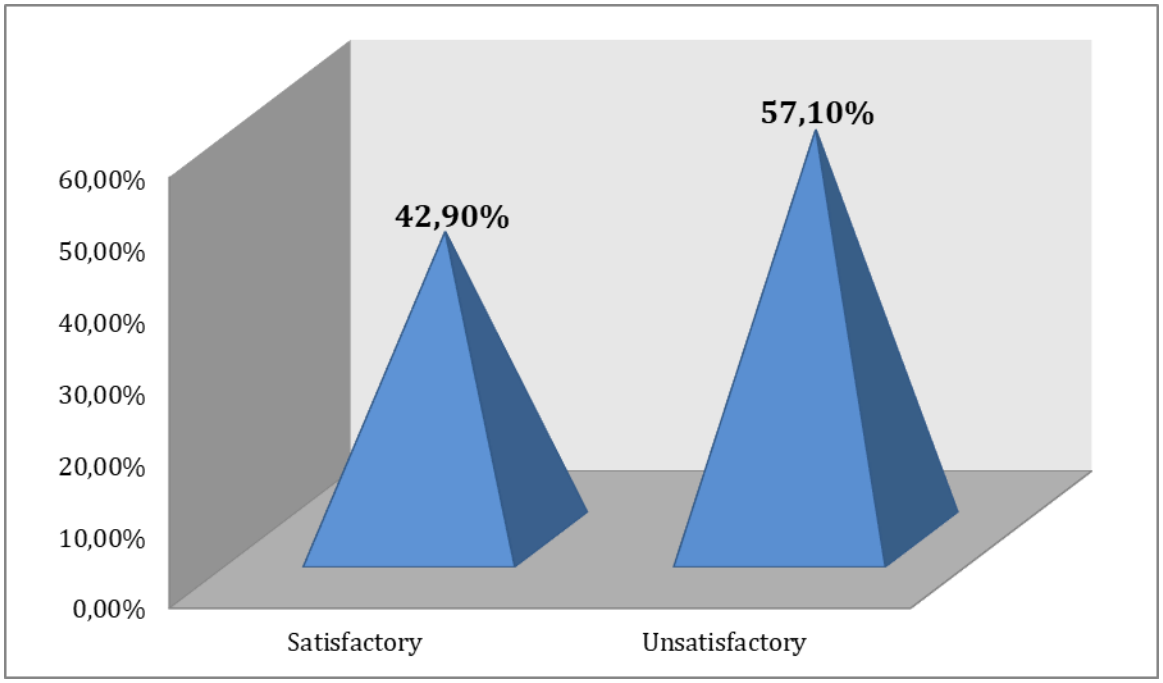

Table (8): Percentage distribution of the studied nurses' practices regarding to immediate care after liver transplantation (ABC) (n=35).

Steps	Done		Not done	
	No	%	No	%
A) Air way &Breathing.				
Keep patent air way.	29	82.9	6	17.1
Put child in comfortable position.	22	62.9	13	37.1
Check all tubes and connections.	15	42.9	20	57.1
Monitor vital signs.	31	**88.6**	4	11.4
Monitor ABG.	27	77.1	8	22.9
Make endotracheal tube suction.	26	74.3	9	25.7
B) Circulation.				
Start IV infusion and observe flow rate.	27	77.1	8	22.9
Check CVP reading and report any change.	21	60.0	14	40.0
Administer medication as doctor order.	31	88.6	4	11.4
Record medication (time, dose, name, route).	24	68.6	11	31.4

Monitor intake and output hourly.	19	54.3	16	**45.7**
Monitor electrolytes level and report any abnormality.	24	**68.6**	11	31.4
C) Disability.				
Assess **AVPU** scale.	23	**65.7**	12	34.3
Monitor blood glucose level.	15	42.9	20	**57.1**
D) Exposure.				
Check tubes for obstruction or displacement	18	51.4	17	48.6
Observe any abnormality in skin color.	13	37.1	22	62.9

Table (9): Percentage distribution of the studied nurses' practices regarding to care of children under mechanical ventilator (n=35).

Steps	Done		Not done	
	No	%	No	%
Perform hand hygiene.	5	14.3	30	**85.7**
Wear protective clothes.	11	31.4	24	68.6
Attach mechanical ventilator to endotracheal tube.	29	82.9	6	17.1
Observe for proper functioning of mechanical ventilator.	29	**82.9**	6	17.1
Verify that endotracheal tube is positioned properly.	25	71.4	10	28.6
Observe for child respiration in synchronization with mechanical ventilation and response to therapy.	16	45.7	19	54.3
Monitor vital signs and cardiac rhythm.	21	60.0	14	40.0
Mark level of endotracheal tube at lips/nares.	19	54.3	16	45.7
Set up suction equipment.	23	**65.7**	12	34.3
Position child to promote best oxygenation.	15	42.9	20	57.1
Frequently follow up with health care provider about child status and response to therapy.	17	48.6	18	51.4
Conduct hourly safety checks on child and ventilator system.	20	57.1	15	42.9
Perform frequent mouth care.	11	31.4	24	**68.6**
Implement actions to prevent hazards of immobility.	13	37.1	22	62.9
Keep child and family inform of progress	10	28.6	25	71.4
Remove gloves.	22	62.9	13	37.1
Perform hand hygiene.	9	25.7	26	74.3
Record and report.	23	65.7	12	34.3

Table (10): Percentage distribution of the studied nurses' practices regarding to wound dressing under aseptic technique (n=35).

Steps	Done		Not done	
	No	%	No	%
Wash hands.	12	34.3	23	65.7
Lower side rails on working side of bed.	10	28.6	25	71.4
Position child comfortably and drape to expose only wound site.	17	48.6	18	51.4
Remove tape, pull parallel to skin.	29	82.9	6	17.1
Put on clean gloves.	8	22.9	27	77.1
Remove dressings with gloved hand and keep soiled surface far from child's sight.	14	40.0	21	60.0
Observe appearance and drainage on dressing.	16	45.7	19	**54.3**
Dispose soiled dressings in disposable bag.	22	62.9	13	37.1
Remove gloves.	6	17.1	29	82.9
Open sterile dressing tray or individually wrapped sterile supplies.	14	40.0	21	60.0
Open cleansing solution and pour over sterile gauze.	18	51.4	17	48.6
Put on gloves, (clean or sterile).	6	17.1	29	82.9
Inspect wound for appearance, drains, drainage, and integrity.	10	28.6	25	**71.4**
Clean wound from least contaminated area to most contaminated area by using separate swab.	13	37.1	22	**62.9**

Use dry gauze to swab in the same manner to dry wound.	20	57.1	15	42.9
Apply antiseptic ointment if ordered.	22	**62.9**	13	37.1
Apply loose gauze as contact layer to incision or wound site.	21	**60.0**	14	40.0
Apply second layer of gauze.	14	40.0	21	60.0
Apply thicker layer of dressings.	29	82.9	6	17.1
Cut 4x4 gauze flat to fit around drain if present.	16	45.7	19	54.3
Remove gloves.	10	28.6	25	**71.4**
Secure dressing with tape, montogmery ties or binder.	31	**88.6**	4	11.4
Dispose of all supplies.	17	48.6	18	51.4
Put child to comfortable position.	11	31.4	24	68.6
Wash hands.	10	28.6	25	**71.4**
Recording and report	29	82.9	6	17.1

Table (11): Percentage distribution of the studied nurses' practices regarding to central venous catheter care (n=35).

Steps	Done		Not done	
	No	%	No	%
Position child comfortably with head elevated.	24	68.6	11	31.4
Provide dressing care on a schedule appropriate to dressing type in use.	18	51.4	17	48.6
Perform hand hygiene.	8	22.9	27	77.1
Wear mask.	11	31.4	24	68.6
Wear clean gloves.	29	**82.9**	6	17.1
Remove old dressing carefully and discard in appropriate container.	35	100	0	0
Remove catheter stabilization device.	27	**77.1**	8	22.9
Inspect insertion site and surrounding skin.	20	57.1	15	42.9
Remove and discard gloves.	4	11.4	31	88.6
Perform hand hygiene.	1	2.9	34	97.1
Wear sterile gloves.	4	11.4	31	88.6
Clean catheter and insertion site with antiseptic swab and allow to dry completely	18	**51.4**	17	48.6
Apply skin protectant to entire area. Allow to dry completely.	12	34.3	23	**65.7**
Apply new catheter stabilization device, if needed.	10	28.6	25	71.4
Apply transparent dressing over insertion site.	19	54.3	16	45.7
Apply label to dressing with date, time.	22	**62.9**	13	37.1
Dispose of soiled supplies and used equipment appropriately.	27	77.1	8	22.9
Discard gloves.	19	54.3	16	45.7
Perform hand hygiene.	5	14.3	30	85.7
Record and report.	11	31.4	24	68.6

Table (12): Percentage distribution of the studied nurses' practices regarding to vital signs measurements (n=35).

Steps	Done		Not done	
	No	%	No	%
Performed hand hygiene.	4	11.4	31	**88.6**
Explain procedure to parent	14	40.0	21	60.0
Measuring Blood pressure				
Measuring blood pressure, palpated the brachial pulse.	14	40.0	21	60.0
Selected the appropriate cuff size.	22	62.9	13	37.1
Wrapped cuff around arm so that it fit sung, but not too tight.	28	80.0	7	20.0
Pressed the start button on the machine.	35	100	0	0
Documented the systolic, diastolic and mean blood pressure.	35	**100**	0	0
Measuring Heart Rate				
Placed the cleaned stethoscope on anterior chest at the fifth intercostal space in a midclavicular position.	8	22.9	27	77.1

Counted the beats (each lub-dub sound) for 1full minute, or counted for 30 seconds and multiplied by 2.	8	22.9	27	77.1
While auscultating the heart area, noted if the rhythm was regular or irregular.	7	20.0	28	80.0
Compared the brachial pulses in an extremity for strength.	10	28.6	25	71.4
Recorded if the pulsation was normal, bounding or thread.	11	31.4	24	68.6
Measuring oral temperature				
Donned gloves and carefully place the tip of the thermometer under child tongue.	28	80.0	7	20.0
With child mouth closed, leave the thermometer in place for about 1 minute until hear the beep.	28	80.0	7	20.0
Remove the thermometer and read.	35	100	0	0

Table (13): Percentage distribution of the studied nurses' total practices about undergoing liver transplantation (n=35).

Variables	Competent		Incompetent	
	No	%	No	%
Immediate care after liver transplantation (ABC)	20	57.1	15	42.9
Care of the child under mechanical ventilator	16	45.7	19	54.3
Dressing under aseptic technique	14	40.0	21	60.0
Central venous catheter care	15	42.9	20	57.1
Urinary catheter care	12	34.3	23	65.7
Nasogastric tube care	16	45.7	19	54.3
Arterial blood gas sampling from an indwelling arterial catheter	14	40.0	21	60.0
Vital signs measurements	19	54.3	16	45.7
Physical examination	10	28.6	25	**71.4**
Suction	11	31.4	24	68.6

Figure (3): Distribution of the studied nurses' total practices about undergoing liver transplantation (n=35).

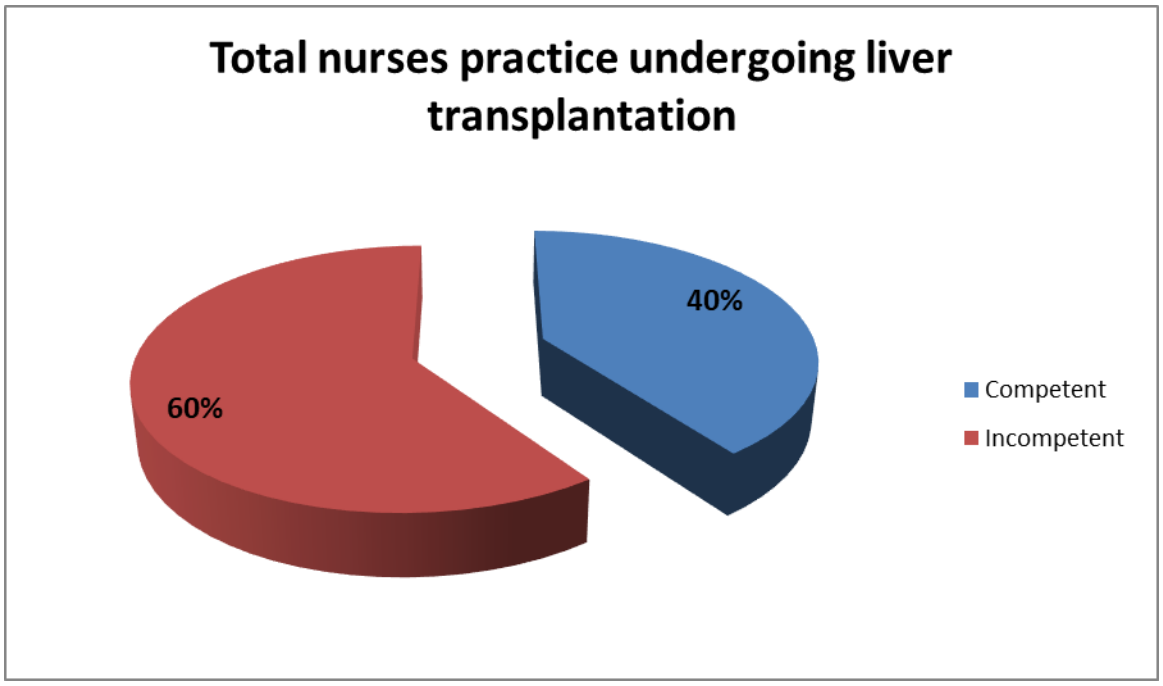

Table (14): Relation between characteristics of studied nurses' and their total knowledge about liver transplantation (n=35).

Items	Total knowledge				X^2	P-Value
	Satisfactory N=15		Unsatisfactory N=20			
	N	%	N	%		
Age						
20 - < 25	6	40.0	1	5.0	10.325	.003*
25 - < 30	5	33.4	6	30.0		
30 - < 35	2	13.3	6	30.0		
Over 35	2	13.3	7	35.0		
Gender						
Male	6	40.0	4	20.0	1.120	.085
Female	9	60.0	16	80.0		
Educational level						
Nursing diploma	0	0	2	10.0	9.021	.005*
Technical institution	2	13.3	7	35.0		
Bachelor degree	11	73.4	10	50.0		
Post graduate education	2	13.3	1	5.0		
Experience years						
1 < 5	10	66.7	8	40.0	4.897	.012
5 < 10	3	20.0	4	20.0		
More than 10	2	13.3	8	40.0		
Attendance of training courses about liver transplantation						
Yes	13	86.7	2	10.0	15.39	.002*
No	2	13.3	18	90.0		

***Significant at p ‹ 0.05. Not significant at p>0.05**

Table (15): Relation between characteristics of studied nurses' and their total practices undergoing liver transplantation (n=35).

Items	Total practice				X^2	P-Value
	Competent N=14		Incompetent N=21			
	N	%	N	%		
Age						
20 - < 25	1	7.1	6	28.6	17.91	.000**
25 - < 30	1	7.1	10	47.6		
30 - < 35	5	35.8	3	14.3		
More than 35	7	50.0	2	9.5		
Gender						
Male	7	50.0	3	14.3	6.320	.015*
Female	7	50.0	18	85.7		
Educational level						
Nursing diploma	1	7.1	1	4.8	1.507	.061
Technical institution	3	21.4	6	28.6		
Bachelor degree	8	57.2	13	61.8		
Post graduate education	2	14.3	1	4.8		
Experience years						
1 < 5	2	14.3	16	76.2	6.879	.009**
5 <10	3	21.4	4	19.0		
More than 10	9	64.3	1	4.8		

Attendance training course about liver transplantation						
Yes	10	71.4	5	23.8	7.715	0.038*
No	4	28.6	16	76.2		

***Significant at p ‹0.05. **Highly significant at p ‹0.01. Not significant at p>0.05**

Table (16): Correlation between the studied variable between total level of nurse's knowledge and total of nurse's practices regarding care of children undergoing liver transplantation (n=35).

		Total practices
Total knowledge	**r**	.615
	p	.000**

(**) Statistically significant at p<0.01. r Pearson correlation

Liver transplantation has become the standard treatment for acute liver failure or the last stages of liver disease in childhood **(Baumann et al., 2022).** Long-term outcomes in pediatric liver transplantation have improved in recent decades, through advances in healthcare technology, changes in organ allocation and procurement, refinements in surgical technique, availability of safer and more effective medications, and increased experience in caring for children who have undergone transplantation **(Stevens et al., 2021)**.

Specialized nurses are responsible for providing appropriate care and education to children and their relatives until they are discharged from the hospital **(Moayed et al., 2018).** Regarding socio-demographic characteristics of the studied nurses, the current study revealed that, almost one third of them ranged in age from 25 to less than 30 years old with mean 29.20±1.36. This could be due to the fact that this age range lies within the productive age in the workforce in the hospital.

This result was similar to **Imtiaz et al. (2022)** who conducted a study entitled "Role of Educational Intervention Regarding Liver Transplant Care on Nurse's Performance for Post-Liver Transplant" and found that the mean age of the studied nurses was 29.00±5.34 years, On the other hand a study carried out by **Hamed et al. (2021)** to assess Nurses 'knowledge and Practices Regarding Children Undergoing Gastrointestinal Surgery, and stated that nearly half (45.0%) of the studied nurses were in the age group 20 > 25 years old. This discrepancy may be due to difference between the studied sample characteristics and different settings.

As well, the present study results showed that nearly three quarters of the studied nurses were females. This can be interpreted as the high percentage of female nurses in this study revealed nursing as a female dominated profession in Egypt. This result was in the same line with **Karaly & Elfetoh, (2020).**

Moreover, the current study findings indicated that more than half of the studied nurses had experience years ranged from 1 to 5 years. Similarly, **Mohamed et al. (2019)** whose study entitled "Effect of teaching program on nurses' performance about hypoalbuminemia after liver transplantation", they found that more than half of the studied children had equal or less than 5 years of experience. This may be related to hospital regulations that require nurses to have experience.

Conversely, **Pearson et al. (2018)** who conducted a study about "Registered nurse intent to promote physical activity for hospitalized liver transplant recipients. Journal of Nursing Management" and reported that nearly one third of the studied nurses (33%) had 6-10 years of overall working experience. This discrepancy might be due to the variations in the study population's characteristics and settings.

Additionally, the current study results reflected that more than half of the studied nurses didn't receive training about liver transplantation. This result agreed with **Abo El Ata et al. (2021)** who carried out a study to assess "Nurses' Knowledge and Practice Regarding Nursing Care of children with Liver Cirrhosis", they found that the largest proportion of the studied nurses were not attending programs or courses in this field.

Concerning the studied nurses' knowledge regarding anatomy, function of the liver & reasons and contraindications for liver transplantation, the present study displayed that the majority of them had

correct knowledge as regard "The liver is located in the upper left part of the abdominal cavity", while almost one third of them had incorrect knowledge as regard "One of the functions of the liver is to manufacture hemoglobin".

Likewise, **Abdrabo et al. (2021)** who carried out a study about "Effect of implementing nursing care of children post liver transplantation on nurses' performance" and mentioned that the largest proportion of the studied nurses had poor level of knowledge regarding anatomy and physiology of liver.

Moreover, the present study demonstrated that, more than half of the studied nurses had correct knowledge related to "Liver transplantation is known as a surgical procedure in which", but more than two thirds of them had incorrect knowledge related to "The conditions in which liver transplantation is prohibited are". This result was congruent with that of **Leena et al. (2022)**, to evaluate "Effect of Educational Intervention on Knowledge and Attitude Regarding Liver Transplantation among Nursing Students at College X" and they reported that most of the studied student had poor knowledge level before intervention.

This result against **Sachdeva & Josephine, (2022)** who carried out study to assess "Knowledge and attitude towards organ donation among the students of undergraduate health sciences" and reported that more than half of nursing students had adequate knowledge for organ donation compared to medical and paramedical students. This discrepancy may be related to adequate theoretical education

Furthermore, the present study portrayed that almost two thirds of the studied nurses had correct knowledge related to "Vital signs should be observed in the first six hours after the operation every", but also nearly two thirds of them had incorrect knowledge related to "When cases of chest infection appear, it should".

This result was consistent with **Abdrabo et al. (2021)** whose results highlighted that most of the studied nurses had unsatisfactory level of knowledge regarding management of children post liver transplantation. Also, a study carried out by **Sarıtaş & Kapıkıran, (2018)** about "Surgical nurses' views on organ transplantation and donation: A sample from Turkey" and declared that the highest percentage of studied nurses had satisfactory knowledge about postoperative care of children with organ transplantation.

Related to the studied nurses' knowledge about complications of liver transplantation & symptoms of the body's rejection of the liver transplant, the current study reflected that more than half of them had correct knowledge as regard "High blood sugar after liver transplantation is a result", while almost two thirds of them had in correct knowledge as regard "Causes of pneumonia immediately after a liver transplant include".

This result disagreed with **Smith et al. (2019)** who carried out a study about "Australian perioperative nurses' attitudes, levels of knowledge, education and support needs related to organ donation and procurement surgery". It presented that more than three quarters of nurses had good level of knowledge regarding organ transplantation. This discrepancy may be due to attaining training courses and ongoing education among nurses.

As well, the present study showed that, more than half of the studied nurses had correct knowledge related to "Low temperature", but also more than half of them of them had incorrect knowledge related to "Yellowing around the eyes and skin". In the same context, a study carried out by Martínez-Alarcón et al., (2019) to assess "Nursing students' knowledge about organ donation and transplantation" and found that the largest proportion of the studied nurses their knowledge about organ transplantation was inadequate.

Conversely, a study by **Sidhu & Kaur, (2019)** about "Knowledge and Attitude Regarding Organ Donation among Nursing Students" and stated that there was no significant association between knowledge level of nursing students and the demographic variables like year of study and age. This inconsistency may due to difference between both study sample characteristics and setting.

4. Conclusion

On the light on the finding of the current study, it can be concluded that most of studied nurses had satisfactory knowledge regarding anatomy and function of the liver but had unsatisfactory knowledge regarding liver transplantation donors' types and conditions. There was highly statistical significance relation between total knowledge of nurses and their age and years of experience. In addition, there was positive significance correlation between total nurse's knowledge and practices. So, the study answered the research question relation between nurses' knowledge and practices and their characteristics regarding care of children undergoing liver transplantation.

Based on the findings of the study results, the following recommendations were suggested: Develop an educational program to meet the actual need of nurses regarding care of children undergoing Liver Transplantation. Continuous training and assessment for nurses about knowledge and practices regarding care of children undergoing liver transplantation. Provide nurses with instruction booklet regarding care of children undergoing liver transplantation and should be available as references for all nurses. Assess obstacles that effect nurses' performance regarding care of children undergoing liver transplantation.

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