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Effect of nursing intervention on nurses' performance regarding care for neonates with spina bifida

Maha El sayed El Araby[1]&Mai Hassan Hassan El sharkawy[2]
[1.] Lecturer of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt
[2.] Lecturer of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt

Abstract:
Spina bifida is a birth condition that results in an improperly formed portion of the spinal column, which exposes a portion the spinal nerves and spinal cord through a hole at the back. The nurse is crucial in immediate assessment of neonates after birth, positioning, and lesion stabilization. **The study aimed to** evaluate the effect of nursing intervention on the performance of nurses regarding care for newborns with spina bifida. **Design:** a quasi-experimental design was used. **Setting:** Neonatal intensive care unit at Tanta University Main Hospital. **Subject:** a convenience sampling of 70 nurses participated in the study. **Two tools were** utilized: **Tool I:** Structured interview schedule that comprised of two parts and **Tool II:** Nurses, performance Observational checklist related to preoperative and postoperative care for neonates with spina bifida. **The results** revealed that the study group's means of total knowledge and mean of total practice regarding the pre- and postoperative care of newborns with spina bifida improved immediately after and one month after the execution of the educational program. **The study concluded** that the implementation of the program resulted in significant improvements in nurses' knowledge and practice, so that the program successfully corrected the nurses' lack of knowledge and performance. **The study recommended that** holding in-service training sessions regularly to maintain nurses' skills and knowledge current.

Keywords: Nursing intervention, Spina bifida, Nurses' knowledge & practice & Neonates.

Introduction
Spina bifida is caused by the incomplete development of the fetal spine during the first month of pregnancy. The level of this defect varies, from mild without symptoms to severe with nerve damage. The incidence is 1 in every 2,000 live births in the United States. Africa had a spina bifida prevalence of 0.13%, with a range of 0.12% to 0.14%. In Africa, Algeria (0,43%), Ethiopia (0,32%), Tanzania (0,26%), Cameron (0,12%), Egypt (0,10%), and South Africa (0,10%) had the greatest rates of this defect. The most sever and variant type of spina bifida is known as myelomeningocele, develops when a part of the spinal cord and its accompanying nerves protrude from the back of the developing fetus and through the spine's open vertebrae.(**Oumer et al., 2020**; **Choi et al., 2022**)

The exposed spinal cord and nerves are frequently encased in a sac that is exposed to the amniotic fluid. Ongoing amniotic fluid exposure to the developing spinal cord throughout pregnancy is thought to cause gradual neurologic damage. Spina bifida treatment up until recently was limited to postpartum incision, after destruction from persistent contact with the amniotic fluid. Myeloschisis, lipomeningocele, and myelocystocele are other forms of spina bifida. Fetal repair is a viable option for treating open neural tube disorders including myelomeningocele and myeloschisis. Fetal repair cannot be used to address closed neural tube anomalies like lipomeningocele and myelocystocele. **(Szymanski et al., 2016; Uhm et al., 2022**)

The lesion of myelomeningocele can form at any site along the growing vertebral column; however, it commonly frequently affects the Lumbar-sacral region. Myelomeningocele can result in a variety of symptoms, depending on where the lesion is located, including sexual dysfunction, incontinence, weakness, and a loss of feeling below the defect, paralysis of the lower body parts, cognitive deficits and additional orthopedic anomalies like clubfoot or issues with the knees or hips. In general, the danger of the complications increases with the height of the spinal defect. In many newborns, the hindbrain herniates into the upper region of the spinal canal in the neck, causing the brain to develop an Arnold-Chiari II malformation. This herniation prevents the flow of cerebrospinal fluid, leading to hydrocephalus (a buildup of fluid in the brain), that can harm the growing brain. Hydrocephalus may be treated via ventricular shunting, which involves inserting a small tube that leads to the brain's ventricles **(Logan et al., 2020; Strömfors et al., 2017; Lidal, et al., 2021**)

The gestational age, the degree of the myelomeningocele lesion on the spine, the presentation of the Chiari II malformation, and other maternal health concerns all have a role in the decision to undergo prenatal or postnatal spina bifida

surgery. Ultrasonography can be used to detect open spina bifida in utero, and elevated serum maternal alpha-fetoprotein levels and amniotic fluid can also be a sign. Often, a lesion appears on the back soon after delivery. Surgery is usually performed 24–48 hours after delivery as the main form of spina bifida treatment. Anesthesia will be administered to the newborn. In order to safeguard the spinal cord, a pediatric neurosurgeon will remove any myelomeningocele sacs that are present and then heal the surrounding skin and tissue defects. The newborn will be looked for in the neonatal intensive care unit following surgery (**Huegel, et al., 2019; Hopson et al., 2018**)

Nurses perform a curial role in evaluating newborns with spina bifida and pre-operative preparation for surgical repair, which includes physical assessment, nothing through mouth before surgery, laboratory investigation, administering fluids intravenously, positioning and handling, lesion stabilization and monitoring, infection control to prevent cerebrospinal fluid contamination, latex sensitivity measures, and thermoregulation measures. Additionally, the nurse's role is vital in receiving the newborns following surgery and providing post-operative care, which includes immediate post-operative assessment, wound care, and handling. The nurse also plays a crucial role in monitoring any potential postoperative problems, such as the following: preventing complications with the urinary system, the intestine, and nutrition are all ways to avoid Chiari malformation and hydrocephalus (parenteral nutrition and oral feeding) **(Potter et al., 2017; Khedr et al., 2021)**

Significance of the study

Spina bifida is one of the most complex congenital disorders affecting multiple body systems. It is among the most common birth defects that lead to permanent disability. About 1,427 newborns are born with spina bifida each year, according to the Centers of Disease Control and Prevention. Spina bifida means that the neural tube does not develop or close during embryonic development, resulting in defects in the spinal cord and bones of the spine. Types of spina bifida include spina bifida occulta, meningocele, and myelomeningocele. Identifying the type of spina bifida is critical to determining a treatment plan. Therefore, early diagnosis and a multidisciplinary approach are important to prevent severe morbidity.

However, most newborns with spina bifida occulta do not need treatment. Procedures include placing the infant in the prone position and covering the sac with a moist sterile bandage to minimize the risk of infection. Since increased intracranial pressure can lead to hydrocephalus, measuring the infant's head circumference is important for early intervention. Particular considerations include the management of neurogenic bladder and bowel control. A number of surgeries can be performed to prevent spinal cord exposure and to correct deformities. Spina bifida can also occur with other congenital malformations, such as scoliosis and clubfoot. (**Mai et al., 2019**; **Leslie et al., 2017**) so the study aimed to evaluate the effect of the nursing intervention on nurses' performance regarding care for newborns with spina bifida.

Aim of the study: To evaluate the effect of the nursing intervention on nurses' performance regarding care for newborns with spina bifida

Research Hypotheses: Nurses' performance who received educational program related to care of neonate with spina bifida will expected to have better knowledge and practice than nurses' performance in the control group

Subjects and Methods

Research Design: A quasi-experimental design was utilized for this study

Setting: The study was carried out at Neonatal intensive care unit at Tanta University Main Hospital (NICU). It is divided into three rooms, room 1 contains five incubators, room 3 contains twelve, and room 4 contains seven. A phototherapy device, monitor, pulse oximeter, syringe pump, and mechanical ventilators are all included in the room's equipment.

Subjects: The present study included a convenience sampling of (70 nurses) who offered care to newborns. On the Epi info software, the sample size was estimated utilizing a power analysis with a 5% error margin, by significance level (95%) and research strength (80%).They were split into two equal groups, each with 35 nurses as follows:

Group (1): Study Group: Nurses who received the nursing intervention for neonates with spina bifida

Group (2): Control group: Nurses who not received nursing intervention for neonates with spina bifida

Tools of data collection:

The following two tools were used to gather the data:

Tool I: Structured interview schedule: It was constructed by the research after reviewing the related and recent literature to asses sociodemographic characteristics of the studied nurses and nurse's knowledge regarding spina bifida **Puri P 2018**.

It includes two parts:

Part I: Sociodemographic characteristics of the studied nurses: such as age, educational level, residence, experience years at neonatal intensive care unit, marital status and attendance relevant training courses

Part II: It covered nurses' knowledge about spina bifida that includes 22 multiple choice question covering; definition, causes, kinds, clinical manifestations, diagnosis, and surgical treatment for newborns with spina bifida. There were three levels

of scoring for the questions: the correct and complete answer was scored as two, the correct and incomplete response as one, and the incorrect answer and not known as zero. The knowledge of nurses was graded as follows:

- Correct and complete answer was scored (2)
- In complete answer was scored (1)
- Wrong answer or don't know was scored (0)

The nurses' knowledge total score according to the nurses' answers was scored as following

- Less than 60% was regarded low level of knowledge.
- 60 to less than 80 % was regarded moderate level of knowledge.
- 80 to 100 % was regarded high level of knowledge.

Tool II: Nurses' performance Observational checklist concerning preoperative and postoperative care for neonates with spina bifida Hopson et al., 2019

Pre- operative nursing interventions

a- Following standard pre-operative care
  - Physical assessment
  - Prior to operation, nothing by mouth
  - Laboratory investigation
  - Administering fluids intravenously

b- Positioning and handling
c- Lesion stabilization and monitoring
d- Infection Control to prevent cerebrospinal fluid contamination
e- Latex sensitivity measures
f- Thermoregulation measures

Post-operative nursing interventions

a- Immediate post-operative assessment
b- Wound care and handling
c- Observe any of these problems that may occur post-operative:
d- Chiari Malformation and Hydrocephalus
e- Prevent urinary tract complication
f- Prevent bowel complication
g- Nutrition (parenteral nutrition and oral feeding)

The following scoring system was used for nursing practice:

- Correctly done and complete was scored (1)
- In correctly done or not done was scored (0)

Nurses total practice scores was categorized as follows:

- 60 to less than 75% were considered unsatisfactory
- 75-100% was considered satisfactory

Method

1. **Administrative process:** Administrators in charge of the Neonatal Intensive Care Unit at Tanta University Main Hospital gave their approval for the data collecting.
2. **Obtaining ethical committee permission** from the faculty of nursing ethical committee before conducting the study with number of approval 84-9-2022

Ethical and legal considerations:

a. The complete sample wasn't harmed or inconvenienced in any way by the study's nature.
b. Privacy and confidentiality were considered when gathering the data.
c. Nurses gave their informed consent to participate in the study the opportunity to stop at any moment.

Content validity: The validity of the study tool was evaluated by a jury of five expert professors in pediatric field to check the relevance, coverage and uniqueness of the questions and the calculated content validity index (%) of each item, was 94%.

Content reliability: The study tool was put to the test by the pilot subjects in the first session to determine Cronbach's alpha which came out to be 0.891, which was used to evaluate reliability.

A pilot study: Before data collection began, a pilot study was conducted on 10% of nurses to test the clarity, applicability and feasibility to modify the sheet tools and also to determine the approximate time required for each intervention. The pilot study is the most important step in the whole research process to discover problems. The results of the pilot study were not included in the total study sample.

Tools development: The researcher created and changed the study's tools in light of the literature review. The study employed two tools.

Phases of the study: The study was done in four stages:

Assessment Phase:

The researcher conducted it for all study participants in order to gather baseline data, evaluate newborns who met the inclusion criteria for the study, and evaluate nurses' knowledge in caring for spina bifida neonates. **(Tool I).**

The researcher was available in the study setting two days a week to evaluate the actual performance of the nurses prior to, immediately following, and one month after the implementation of nursing intervention (Tool II). As all of nurses were observed pre- and post-operative nursing interventions for newborns with spina bifida at the entirety of the morning shift.

Planning phase comprised the following steps:

- Establishing goals
- Preparing content that covered the rationale for using the session; and preparing content.
- Seven nurses were included in each of the five groups made up of the study's nurses.

Implementation phase composed of the following steps

- The Study Nurses performed the nursing intervention for each group separately by conducting the following sessions in accordance

with their assessment of the study nurses' actual needs.

- The nursing intervention consisted of six sessions, two session/week. Each session lasted about 30 minutes, which included discussion times depending on the nurses' feedback and progress.
- A variety of teaching techniques and media were employed, comprising lectures, group discussions, and demonstrations.
- Data was gathered on the course of six months.

Each group attended the following sessions:

The first session: It focused on: definition, causes and pathophysiology of Spina bifida.

The Second Session: It focused on clinical manifestation, diagnosis. Nurses were given the information through talking about similar ideas.

The Third session: It focused on spina bifida types and surgical management for each type.

The Fourth Session: It focused on demonstration and redemonstration of pre-operative nursing intervention steps for neonates with spina bifida.

The Fifth Session: It focused on demonstrating and redemonstration of post-operative nursing intervention steps for neonates with spina bifida.

The Sixth Session:

It focused on demonstration and remonstration of pre- and postoperative care of newborns with spina bifida.

Evaluation Phase:

The same assessment methods were used to reassess nurses' knowledge and practice immediately after and one month after implementation of the nursing intervention and these results were compared to pre-test values. At the same time periods, the control group was evaluated

Statistical Analysis

The data collected were sorted, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, Version 26, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean, and standard deviation were calculated. The chi-square test (2) was used to compare two and more groups for qualitative data characterizing a categorical dataset by frequency, percentage, or proportion of each category. The t-test was used to compare the means of two sets of parametric data from independent samples. The ANOVA test F-value was generated to compare parametric data that had more than two means. Pearson's correlation coefficient was used to examine the correlation between the variables. (r) P 0.05 was set as the significance limit for the interpretation of significance tests, strong **White 2019.**

Result:

Table (1): Percentage distribution of the studied nurses according to their socio–demographic characteristics among the studied groups (n=70)

Socio–demographic characteristics	The studied nursing (n=70)				
	Control group (n=35)		Study group (n=35)		χ2 P
	No.	%	No.	%	
Age (in years)					
< 30	16	45.7	15	42.9	0.263
30 - < 40	12	34.3	14	40.0	0.877
≥40	7	20.0	6	17.1	
Range	**24 - 46**		**25 - 46**		**t-test** = 0.141
Mean ± SD	**32.971 ± 6.701**		**32.742 ± 6.874**		0.888
Level of education					
Nursing Diploma	12	34.3	14	40.0	0.321
Technical Institute	13	37.1	11	31.4	0.852
Baccalaureate Degree	10	28.6	10	28.6	
Residence					
Rural	19	54.3	19	54.3	0.000
Urban	16	45.7	16	45.7	1.000
Years of experience inside pediatric surgical unit					
< 5 years	8	22.9	15	42.9	3.571
5 - < 10 years	13	37.1	8	22.9	0.312
10 - < 15 years	9	25.7	7	20.0	
≥ 15	5	14.3	5	14.3	
Range	**1 – 21**		**1 – 20**		**t-test** =1.020
Mean ± SD	**8.657 ± 4.702**		**7.371 ± 5.791**		0.312
Marital status					
Single	3	8.6	4	11.4	0.694
Married	27	77.1	28	80.0	0.875
Divorced	2	5.7	1	2.9	
Widow	3	8.6	2	5.7	
Attendance of training courses and conferences about nursing care for neonate with spina bifida					
Yes	0	0.0	0	0.0	--
No	35	100.0	35	100.0	

Table (2): Levels of total knowledge scores of the studied nurses regarding spina bifida (n=70)

Knowledge levels	The studied nursing (n=70)													
	Control group (n=35)						χ^2 P	Study group (n=35)						χ^2 P
	Preprogram		Immediately after		After one month			Preprogram		Immediately after		After one month		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Total knowledge levels:														
Low level of knowledge (0 – 13)	20	57.1	23	65.7	25	71.4	**10.809 0.029***	19	54.3	0	0.0	0	0.0	**74.989 0.0001****
Moderate level of knowledge (14 – 17)	10	28.6	12	34.2	10	28.6		12	34.2	1	2.9	3	8.6	
High level of knowledge (18 -22)	5	14.3	0	0.0	0	0.0		4	11.5	34	97.1	32	91.4	
χ2 (control group Vs study group)	0.319		**66.308**		**60.769**									
P	0.853		**0.0001****		**0.0001****									
Mean score of total knowledge scores:														
Range	0 – 14		1 - 14		0 - 14		**F value** = 0.075 **P=** 0.928	0 - 14		17 - 22		17 - 22		**F value = 444.195 P= 0.0001****
Mean ± SD	4.400 ± 3.851		4.743 ± 3.696		4.514 ± 3.768			4.485 ± 4.002		20.914 ± 1.221		19.68 ± 1.510		
t-test (control group Vs study group)	0.091		**24.572**		**22.110**									
P	0.928		**0.0001****		**0.0001****									

*** Highly Statistically significant difference at (P<0.05)*

Table (3): Percentage distribution of nurses' performance scores related to preoperative care for neonates with spina bifida (n=70)

Performance levels	The studied nursing (n=70)													
	Control group (n=35)						χ^2 P	Study group (n=35)						χ^2 P
	Preprogram		Immediately after		After one month			Preprogram		Immediately after		After one month		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Physical assessment														
A-Anthropometrical measurements (Infant's Weight)														
Unsatisfactory performance (0 – 11)	16	45.7	15	42.8	16	45.7	0.077 0.962	15	42.8	3	8.6	3	8.6	**17.143 0.0001****
Satisfactory performance (12 – 16)	19	54.3	20	57.2	19	54.3		20	57.2	32	91.4	32	91.4	
χ^2 (control group *Vs* study group)	0.058		**10.769**		**12.208**									
P	0.810		**0.001****		**0.0001****									
B-Physiological measurement (Axillary Temperature)														
Unsatisfactory performance (0 – 11)	19	54.3	16	45.7	18	51.4	0.533 0.766	17	48.6	0	0.0	0	0.0	**40.568 0.0001****
Satisfactory performance (12 – 16)	16	45.7	19	54.3	17	48.6		18	51.4	35	100.0	35	100.0	
χ^2 (control group *Vs* study group)	0.933		**20.741**		**24.231**									
P	0.334		**0.0001****		**0.0001****									
B-Physiological measurement (Apical Pulse)														
Unsatisfactory performance (0 – 8)	13	37.1	18	51.4	18	51.4	1.913 0.384	17	48.6	0	0.0	0	0.0	**40.568 0.0001****
Satisfactory performance (9 – 11)	22	62.9	17	48.6	17	48.6		18	51.4	35	100.0	35	100.0	
χ2 (control group *Vs* study group)	0.933		**24.231**		**24.231**									
P	0.334		**0.0001****		**0.0001****									
B-Physiological measurement (Respiratory Rate)														
Unsatisfactory performance (0 – 7)	16	45.7	15	42.8	15	42.8	0.077 0.962	13	37.1	0	0.0	0	0.0	**29.674 0.0001****
Satisfactory performance (8 – 10)	19	54.3	20	57.2	20	57.2		22	62.9	35	100.0	35	100.0	
χ2 (control group *Vs* study group)	0.530		**10.091**		**10.091**									
P	0.467		**0.0001****		**0.0001****									

Performance levels	The studied nursing (n=70)													
	Control group (n=35)						χ^2 P	Study group (n=35)						χ^2 P
	Preprogram		Immediately after		After one month			Preprogram		Immediately after		After one month		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Laboratory investigation (Collection of blood specimens)														
Unsatisfactory performance (0 – 16)	15	42.8	13	37.1	14	40.0	0.238	12	34.3	0	0.0	0	0.0	**27.097**
Satisfactory performance (17 – 22)	20	57.2	22	62.9	21	60.0	0.888	23	65.7	35	100.0	35	100.0	**0.0001****
χ2 (control group Vs study group)	0.543		**15.965**		**17.500**									
P	0.461		**0.0001****		**0.0001****									
Nothing per month prior to surgery														
Satisfactory performance (1)	35	100.0	35	100.0	35	100.0	---	35	100.0	35	100.0	35	100.0	--
χ^2 (control group Vs study group)	--		--		--									
P														
Administration of intravenous fluids														
Unsatisfactory performance (0 – 26)	6	17.1	5	14.2	5	14.2	0.147	5	14.2	0	0.0	0	0.0	**5.385**
Satisfactory performance (27 – 36)	29	82.9	30	85.8	30	85.8	0.929	30	85.8	35	100.0	35	100.0	**0.0001****
χ2 (control group Vs study group)	0.108		**5.385**		**5.385**									
P	0.743		**0.0001****		**0.0001****									
Positioning and handling														
Unsatisfactory performance (0 – 3)	22	62.9	22	62.9	22	62.9	0.000	23	65.7	0	0.0	2	5.7	**51.135**
Satisfactory performance (4 – 5)	13	37.1	13	37.1	13	37.1	1.000	12	34.3	35	100.0	33	94.3	**0.0001****
χ2 (control group Vs study group)	0.062		**32.082**		**25.362**									
P	0.803		**0.0001****		**0.0001****									
Lesion Stabilization and Monitoring														
Unsatisfactory performance (0 – 2)	23	65.7	20	57.2	22	62.9	0.565	24	68.6	0	0.0	1	2.9	**58.065**
Satisfactory performance (3 – 4)	12	34.3	15	42.8	13	37.1	0.754	11	31.4	35	100.0	34	97.1	**0.0001****
χ2 (control group Vs study group)	0.065		**28.000**		**28.557**									
P	0.799		**0.0001****		**0.0001****									
Infection Control to prevent cerebrospinal fluid contamination														
Unsatisfactory performance (0 – 2)	12	34.3	12	34.3	15	42.9	0.734	13	37.1	1	2.9	4	11.4	**15.690**
Satisfactory performance (3 – 4)	23	65.7	23	65.7	20	57.1	0.693	22	62.9	34	97.1	31	88.6	**0.0001****
χ2 (control group Vs study group)	0.062		**11.430**		**8.741**									
P	0.803		**0.001****		**0.003****									
Latex Sensitivity														
Unsatisfactory performance (0 – 2)	32	91.5	32	91.5	32	91.5	0.000	31	88.6	11	31.4	12	34.3	**29.052**
Satisfactory performance (3 – 4)	3	8.5	3	8.5	3	8.5	1.000	4	11.4	24	68.6	23	65.7	**0.0001****
χ2 (control group Vs study group)	**0.159**		**26.589**		**24.476**									
P	**0.690**		**0.0001****		**0.0001****									
Thermoregulation														
Unsatisfactory performance (0 – 2)	24	68.6	24	68.6	24	68.6	0.000	23	65.7	13	37.1	15	42.8	**6.405**
Satisfactory performance (3)	11	31.4	11	31.4	11	31.4	1.000	12	34.3	22	62.9	20	57.2	**0.041***
χ2 (control group Vs study group)	0.065		**6.937**		**4.690**									
P	0.799		**0.008****		**0.030***									

*** Highly Statistically significant difference at (P<0.05)* **Statistically significant difference at (P<0.05)*

NB: All the nurses in the study group and control group ensure that there was nothing per mouth prior to surgery.

Table (4): Percentage distribution of nurses' performance scores related to postoperative care for neonates with spina bifida. (n=70)

Performance levels	The studied nursing (n=70)													
	Control group (n=35)							Study group (n=35)						
	Preprogram		Immediately after		After one month		χ^2 P	Preprogram		Immediately after		After one month		χ^2 P
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Immediate Post-operative Assessment														
Unsatisfactory performance (0 – 3)	22	62.9	23	65.7	23	65.7	0.083	20	57.2	0	0.0	2	5.7	**41.862**
Satisfactory performance (4 – 5)	13	37.1	12	34.3	12	34.3	0.959	15	42.8	35	100.0	33	94.3	**0.0001****
χ2 (control group Vs study group)	0.230		**34.255**		**27.440**									
P	0.626		**0.0001****		**0.0001****									
Wound Care and Handling														
Unsatisfactory performance (0 – 2)	24	68.6	22	62.9	24	68.6	0.343	23	65.7	0	0.0	0	0.0	**58.902**
Satisfactory performance (3 – 4)	11	31.4	13	37.1	11	31.4	0.842	12	34.3	35	100.0	35	100.0	**0.0001****
χ^2 (control group *Vs* study group)	**0.065**		**32.083**		**36.522**									
P	**0.799**		**0.0001****		**0.0001****									
Observe any of these problems that may occur post-operative: 1-Chiari Malformation manifestation														
Unsatisfactory performance (0 – 2)	20	57.1	18	51.4	19	54.3	0.230	17	48.6	0	0.0	0	0.0	**40.568**
Satisfactory performance (3 – 4)	15	42.9	17	48.8	16	45.7	0.891	18	51.4	35	100.0	35	100.0	**0.0001****
χ2 (control group *Vs* study group)	0.516		**24.231**		**26.078**									
P	0.473		**0.0001****		**0.0001****									
Observe any of these problems that may occur post-operative: 2-Hydrocephalus														
Unsatisfactory performance (0 – 2)	35	100.0	35	100.0	35	100.0	--	35	100.0	0	0.0	3	8.5	**93.123**
Satisfactory performance (3)	0	0.0	0	0.0	0	0.0	--	0	0.0	35	100.0	32	91.5	**0.0001****
χ2 (control group *Vs* study group)	---		**70.000**		**58.947**									
P			**0.0001****		**0.0001****									
Urinary Tract Complications														
Unsatisfactory performance (0 – 2)	27	77.1	25	41.5	27	77.1	0.409	25	41.5	0	0.0	0	0.0	**65.625**
Satisfactory performance (3)	8	22.9	10	28.5	8	22.9	0.815	10	28.5	35	100.0	35	100.0	**0.0001****
χ2 (control group *Vs* study group)	0.299		**38.889**		**43.953**									
P	0.584		**0.0001****		**0.0001****									
Bowel Complications														
Unsatisfactory performance (0 – 3)	26	74.3	25	41.5	25	41.5	0.095	26	74.3	1	2.9	1	2.9	**60.877**
Satisfactory performance (4 – 5)	9	15.7	10	28.5	10	28.5	0.953	9	15.7	34	97.1	34	97.1	**0.0001****
χ2 (control group Vs study group)	0.000		**35.245**		**35.245**									
P	1.000		**0.0001****		**0.0001****									
Nutrition														
Unsatisfactory performance (0 – 6)	25	41.5	25	41.5	25	41.5	0.000	24	68.6	1	2.9	1	2.9	**54.085**
Satisfactory performance (7 – 9)	10	28.5	10	28.5	10	28.5	1.000	11	31.4	34	97.1	34	97.1	**0.0001****
χ2 (control group *Vs* study group)	0.068		**35.245**		**35.245**									
P	0.794		**0.0001****		**0.0001****									

Statistically significant difference at (P<0.05)* * Highly Statistically significant difference at (P<0.05)*

Table (5): Levels of total performance scores of the studied nurses regarding pre and post operative care for neonates with spina bifida (n=70)

Total performance levels	The studied nursing (n=70)						χ^2 P						χ^2 P
	Control group (n=35)							Study group (n=35)					
	Preprogram		Immediately after		After one month			Preprogram		Immediately after		After one month	
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
Total performance levels														
Unsatisfactory performance (0 – 122)	20	57.2	19	54.3	20	57.2	0.077	21	60.0	0	0.0	1	2.9	**48.714**
Satisfactory performance (123 – 164)	15	42.8	16	45.7	15	42.8	0.952	14	40.0	35	100.0	34	97.1	**0.0001****
χ2 (control group Vs study group)	0.059		**28.078**		**24.558**									
P	0.808		**0.0001****		**0.0001****									
Mean of total performance scores:														
Range	83 – 110		84 - 111		83 - 110		**F value =** 0.173	83 - 103		144 - 153		135 - 150		**F value = 3262.16**
Mean ± SD	96.43 ± 3.60		96.91 ± 3.52		96.17 ± 3.79		**P=** 0.951	98.40 ± 3.942		148.22 ± 2.21		142.57 ± 2.99		**P= 0.0001****
t-test (control group Vs study group)	0.252		**77.776**		**61.114**									
P	0.802		**0.0001****		**0.0001****									

*** Highly Statistically significant difference at (P<0.05)*

Table (6): Correlation between total nurses' knowledge and total performance of nursing care for neonates with spina bifida before, immediately after and one month after the program implementation in study group (n =35)

Total nurses' performance	Levels of total nurses' knowledge Before, immediate after and one month after the program implementation (n =35)													
	Preprogram (n=35)						Immediate after (n=35)				One month after (n=35)			
	Low knowledge (n=19)		Moderate knowledge (n=12)		High knowledge (n=4)		Moderate knowledge (n=1)		High knowledge (n=34)		Moderate knowledge (n=3)		High knowledge (n=32)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Unsatisfactory performance	19	54.3	2	5.8	0	0.0	0	0.0	0	0.0	1	2.9	0	0.0
Satisfactory performance	0	0.0	10	28.6	4	11.4	1	2.9	34	97.1	2	5.7	32	91.4
r	**0.328**						**0.547**				**0.908**			
P	**0.055**						**0.007****				**0.020***			

** Statistically Significant difference at (P<0.05).*

Table (7): Correlation between total nurses' knowledge and socio–demographic characteristics among the studied groups (n=70)

socio–demographic characteristics	Total knowledge scores (n=70)											
	Control group (n=35)						Study group (n=35)					
	Preprogram		Immediately after		After one month		Preprogram		Immediately after		After one month	
	r	P	r	P	r	P	r	P	r	P	r	P
Age (in years)	-0.546	0.001**	-0.524	0.001**	-0.536	0.001**	0.368	0.029*	0.185	0.288	0.012	0.946
Level of education	0.002	0.991	0.025	0.888	0.010	0.955	0.194	0.265	0.337	0.048*	0.100	0.569
Residence	0.009	0.959	0.061	0.727	0.019	0.914	0.011	0.949	0.078	0.658	0.194	0.265
Years of experience inside pediatric surgical unit	-0.338	0.047*	-0.330	0.053	0.330	0.053	-0.347	0.041*	-0.149	0.392	-0.107	0.539
Marital status	0.044	0.801	0.077	0.659	0.052	0.769	0.113	0.517	0.081	0.642	0.085	0.629

**Statistically significant difference at (P<0.05)*

Table (8): Correlation between total nurses' performance and socio–demographic characteristics among the studied groups (n=70)

socio–demographic characteristics	Total performance scores (n=70)											
	Control group (n=35)						Study group (n=35)					
	Preprogram		Immediately after		After one month		Preprogram		Immediately after		After one month	
	r	P	r	P	r	P	r	P	r	P	r	P
Age (in years)	0.042	0.811	0.100	0.567	0.105	0.550	0.083	0.635	0.168	0.333	0,062	0.725
Level of education	0.027	0.879	0.073	0.677	0.006	0.971	0.203	0.241	0.001	0.994	0.074	0.672
Residence	0.100	0.569	0.112	0.523	0.113	0.517	0.009	0.960	**0.378**	**0.025***	0.328	0.055
Years of experience inside pediatric surgical unit	0.141	0.420	0.052	0.768	0.084	0.632	0.025	0.887	120	0.494	0.116	0.506
Marital status	0.293	0.088	0.246	0.154	**0.366**	**0.030***	0.298	0.082	0.124	0.477	0.136	0.435

**Statistically significant difference at (P<0.05)*

Table (1): Explains percentage distribution of the studied nurses according to their socio–demographic characteristics. It was found that 45.7%, 42.9% of nurses in the control and study group their age less than 30 years old and 37.1% of them were technical institute education while 40% of nurses in the study group were nursing diploma. This table also illustrated that half (54.3%) of the nurses in the study and control group came from rural areas. Regarding years of experience, 37.1% of nurses in the control group were from 5 to less than 10 years of experience while 42.9% of them in the study group were less than 5 years of experience and 27%, 28% of the nurses respectively in the control and study group were married. It was found that more than one thirds (35%) of control and study group nurses did not attend training courses on caring for newborns with spina bifida.

Table (2): Displays levels of total knowledge scores of studied nurses regarding spina bifida, it was presented that only14.3% of nurses in control group had high level of knowledge regarding spina bifida preprogram while the majority of the nurses (97.1%, 91%) respectively in the study group had high level of knowledge immediately after and one month after implementation of the program with statistically significant difference between nurses knowledge preprogram, immediately after and one month after the program with p= 0.0001**Also the table illustrated that nurses mean of total knowledge about spina bifida in the study group had improved immediately after and one month after with mean ± SD 20.914 ± 1.221, 19.68 ± 1.510 respectively.

Table (3): Presents percentage distribution of nurses' performance related to preoperative care for neonates with spina bifida, it was illustrated that half of the nurses in the control group (54.3%) had satisfactory performance preprogram regarding infant weight while the majority of nurses in the study group (91.4%) had satisfactory performance immediately after and one month after the program. Concerning axillary temperature measuring, it was found that 45.7% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) had satisfactory performance in the study group immediately after and one month after the program.

Also, apical pulse, it was noted that 62.9% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) had satisfactory performance in the study group immediately after and one month after the program. In relation to respiratory rate, it was observed that 54.3% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) had satisfactory performance in the study group immediately after and one month after the program

Concerning laboratory investigation or collection of blood specimen it was found that 57.2% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) had satisfactory performance in the study group immediately after and one month after the program. Regarding administration of intravenous fluid, the table illustrated that 82.9% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) had satisfactory performance in the study group one month after the program.

The table also presented that only 37.1% of the nurses in control group had satisfactory performance preprogram regarding positioning and handling of the neonates while all of nurses (100%) had satisfactory performance in the study group immediately after and 94.3% of them had satisfactory performance one month after. The table also illustrated that only 34.3% of the control group nurses had satisfactory performance preprogram regarding lesion

stabilization and monitoring while all of nurses (100%) had satisfactory performance in the study group immediately after and 97.1% of them had satisfactory performance one month after.

Concerning infection control to prevent cerebrospinal fluid contamination, it was noted that more than two thirds (65.7%) of the nurses in control group had satisfactory performance preprogram while 97.1% of nurses in the study group had satisfactory performance immediately after and 88.6% of them had satisfactory performance one month after. In relation to latex sensitivity, it was found that only 8.5% of the nurses in control group had satisfactory performance preprogram while 68.6% of nurses in the study group had satisfactory performance immediately after and 65.7% of them had satisfactory performance one month after

Regarding thermoregulation, it was found that only 31.4% of the nurses in control group had satisfactory performance preprogram while 62.9% of nurses in the study group had satisfactory performance immediately after and 57.2% of them had satisfactory performance one month after the table also presented that there is a statistically significant difference with P=0.0001 in all steps of preoperative nursing care before, immediately after and one month after program implementation.

(Table 4): Shows percentage distribution of nurses' performance of the studied nurses related to postoperative care for neonates with spina bifida, it was fond that only 37.1% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and 94.3% of them had satisfactory performance one month after. Regarding wound care and handling, it was found that only 31.4% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and one month after

Concerning observing the problem that may occur post operative **(Chiari mal formation)** it was noted that that 42.9% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and one month after.

In relation to observing the problem that may occur post-operative **(hydrocephalus)** it was observed that no one of nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and 91.5% of them had satisfactory performance one month after. Concerning observing the problem that may occur post operative (**urinary tract complication**) it was noted that that 22.9% of the nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and one month after.

The table also illustrated that only 15.7 % of the nurses in control group had satisfactory performance preprogram regarding observing the problem that may occur post operative **(bowel complication)** while the majority of nurses (97.1%) in the study group had satisfactory performance immediately after and one month after. It was also found that 28.5 % of the nurses in control group had satisfactory performance preprogram regarding nutrition while the majority of nurses (97.1%) in the study group had satisfactory performance immediately after and one month after also the table illustrated that there is statistically significant difference with P=0.0001 in all steps of postoperative nursing care before, immediately after and one month after the program implementation.

Table (5): Presents levels of total performance scores of the studied nurses regarding pre and post operative care for neonates with spina bifida, it was noted that 42.8% of nurses in control group had satisfactory performance preprogram while all of nurses (100%) in the study group had satisfactory performance immediately after and 97.1% of them had satisfactory performance one month after with statistically significant difference P=0.0001.

The table also illustrated that mean of total performance scores of the studied nurses regarding pre and post operative care for neonates with spina bifida in the control group preprogram was 96.43 ± 3.60, while the mean improved in the study group to 148.22 ± 2.21, 142.57 ± 2.99 respectively immediately after and one month after with statistically significant difference P=0.0001

Table (6): Portrays the correlation between total nurses' knowledge and total performance of nursing care for newborns with spina bifida before, immediately after and one month after the program implementation in study group. It was found that 54.3% of nurses with unsatisfactory performance had poor knowledge before the program and 28.6%,11.4% of nurses with satisfactory performance had moderate and high knowledge respectively preprogram while the majority of nurses (97.1%,91.4%) with satisfactory performance had high level of knowledge respectively immediately after and one month after.

The table also presents that there were astatically significant positive correlation between nurses' knowledge and performance regarding nursing care for neonates with spina bifida immediately after and one month after the program implementation with r=0.547, r=0.908 respectively and highly statistically significant difference in nurses' knowledge and

performance immediately after with p=0.007**, also statistically significant difference in nurses' knowledge and performance one month after the program implementation with p=0.020*

Table (7): Presents correlation between total nurses' knowledge and socio–demographic characteristics among the studied groups, it was noted that there was appositive correlation between nurses' knowledge and their age preprogram in the control group and study group with a highly statically significant difference in control group before, immediately after and one month after P= 0.001** and statically significant difference in study group before the program with P= 0.029*.It was also found that there is appositive correlation between nurses' knowledge and their level of education immediately after the program in the study group with statically significant difference P=0.048*. It was observed that there is appositive correlation between nurses' knowledge and their experience years in the control group and study group preprogram with statically significant difference P=0.047*,0.041* respectively.

Table (8): Correlation between total nurses' performance and socio–demographic characteristics among the studied groups, it was illustrated that there were appositive correlation between total nurses' performance and their residence in the study group immediately after the program r=0.378 with statically significant difference P=0.025*.Also it was noted that there is appositive correlation between total nurses' performance and their marital status in the control group after one month of the program r=0.366 with statically significant difference P=0.030*.

Discussion

Spina bifida is a congenital birth defect that affects the spine and is typically present at birth and is one of the most common and important issues in the field of pediatric nursing and lead to death of neonate. It is a specific kind of neural tube defect. If the neural tube does not completely shut, spina bifida may develop anywhere along the spine. The spinal cord's protective backbone does not properly develop and close when the neural tube does not completely seal. The spinal cord and nerves are frequently harmed as a result. The risk of infection from exposed nerves or extra trauma must be reduced as soon as possible through surgery. Meningocele, myelomeningocele, and spina bifida occulta are different types of the condition. A treatment strategy must be determined after the type of spina bifida is determined. However, the majority of newborns with spina bifida occulta do not need therapy. First dimension that explored in the present study by pediatric nurses was the assessment of nurses' performance (knowledge and practice) To evaluate the basic knowledge and practice that pediatric nurses utilize during their care for neonates with spina bifida and to identify area of knowledge defects that need to be managed accordingly **(Hunt J 2018**; **Schletker et al., 2019)**

Nursing interventions include placing the infant in prone position and covering the sac with a moist sterile dressing to minimize the risk of infection. Since increased intracranial pressure may result in hydrocephalus, measuring the infant's head circumference is important for early intervention. Special considerations include management of neurogenic bladder and bowel control. A series of operations may be performed to prevent spinal cord exposure and correct deformities **(Malheiro et al., 2017; Provençal & Costa.2022**)

The study illustrated a statistically significant difference between the study group and the control group before, immediately after and one month after program implementation in the nurses' total knowledge scores regarding nursing care for neonates with spina bifida. These results were consistent with (**Oladele et al., 2020)** findings that there was a statistically significant change between the pre- and post-training samples in terms of the majority of the examined sample's meningitis knowledge. This was in line with the findings of (**Ahmed., & Srour 2023; & Hussien et al., 2021)**, who found that the majority of study nurses had good knowledge after completing the training program and three months later, their overall knowledge was poor prior to that program. **This might** occur as a result of the institution's curricula not offering the proper courses, and progress might be brought about by the program's efficacy.

The study also supported (**Hashem & Abusaad 2016)**, who found a statistically significant difference between the knowledge and practice of nurses regarding the treatment of children with ostomy immediately after the implementation of the training program. Moreover, this number was marginally lower a month after the intervention guidelines were put in place. While knowledge retention is typically affected by time, this finding is may be explained by this fact.

In relation to total practice, the mean scores related to nursing intervention pre and post operatively for neonates with spina bifida, The results showed that total score of all nurses' practice improved significantly immediately after and one month after program implementation than before and there was a statistically significant difference between the study group and the control group before, immediately after and one month after program implementation. **This could** be described by the lack of evaluation by nursing staff against established standards of patient care and the lack of regular assessment of nursing practice by hospital adminstration to identify

strengths and weaknesses in order to address, improve and update nurses' knowledge and practice in addition to raising the standard of nursing interventions given to neonates.

Similar to our study, (**Taha 2021)** noted that there were statistically significant changes in nurses' performance immediately after and one month after adoption of the nursing intervention protocol in comparison with the pre-nursing intervention protocol. The nurse intervention plan was put into place, but after one month a minor deterioration was noticed. These findings were in line with (**Jissir & Hassan 2019)** observation that nurses' abilities statistically improved after the program were implemented in comparison to pre-test. Similar to this, (**Abdelmowla et al., 2017)** claimed that after applying the nursing instructions brochure, the majority of nurses had ad sufficient level of practice. **The reason** is because the educational program for nursing staff is crucial in helping them acquire and improve the skills necessary to serve patients with high levels of care. Moreover, (**Hussein & Rada 2016)** found that before the establishment of intervention guidelines addressing pre and post operative nursing intervention for infants with intestinal obstruction, the majority of nurses had unsatisfactory practice scores.

Conclusion

Based on the results of the present study, it can be concluded that the pediatric nurses in the neonatal intensive care unit of Tanta University Main Hospital lacked the necessary basic knowledge and practice related to the care of newborns with spina bifida. The implementation of the program resulted in significant improvements in nurses' knowledge and practice, so that the program successfully corrected the nurses' lack of knowledge and performance.

Recommendations

Based on the findings of the present study, the following recommendations are suggested:

1. Frequent and regular in-service training programs should be held to update the knowledge and practice of nurses in the pre- and post-operative care of neonates with spina bifida.
2. Supplying handbooks with detailed instructions on how to perform Pre- and postoperative nursing interventions in neonates with spina bifida in the neonatal intensive care units (NICU).
3. Periodic evaluation of nursing practice in accordance with specified hospital policy criteria identify strengths and weaknesses that need to be addressed.

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