American Journal of Nursing Research, 2025, Vol. 13, No. 2, 16-24
Available online at http://pubs.sciepub.com/ajnr/13/2/1
Published by Science and Education Publishing
DOI:10.12691/ajnr-13-2-1

Effect of Nursing Interventions on Early Postoperative Complications of Ventriculoperitoneal Shunt for Hydrocephalus in Pediatric Patients

Hend Abdelhady Salah El-Morsy[1,*], Fawzia El Sayed Abusaad[2], Hatem Ibrahim Badr[3], Magda Ahmed Abd El-Aziz[4]

[1]Department of Nurses' Training, Biyala Central Hospital, Kafr El-Shaikh City, Egypt
[2]Department of Pediatric Nursing, Faculty of Nursing, Mansoura City, Egypt
[3]Department of Neurosurgery, Faculty of medicine, Mansoura City, Egypt
[4]Department of Pediatric Nursing, Faculty of Nursing, Mansoura City, Egypt
*Corresponding author: hindshady2233@gmail.com

Received March 05, 2025; Revised April 07, 2025; Accepted April 14, 2025

Abstract **Background:** Pediatric hydrocephalus is the accumulation of too much cerebrospinal fluid inside the ventricles when the normal production and absorption of cerebrospinal fluid is disrupted. The most common treatment for hydrocephalus is a ventriculoperitoneal shunt, despite its postoperative complications. Nurses have an essential role to in decreasing the incidence of postoperative complications. So, nursing interventions include providing pre and postoperative care for children, as well as educating their caregivers for ongoing care at home. **Aim:** This study aimed to evaluate effect of nursing interventions on early postoperative complications of ventriculoperitoneal shunt for hydrocephalus in pediatric patients. **Methods:** A pre-experimental framework was utilized on a sample of 72 children and their caregivers who were admitted to the pediatric neurosurgery department and pediatric neurosurgical outpatients affiliated to Mansoura University Hospital (MUH), Mansoura city, Dakahlia governorate, Egypt. Data were gathered through the use of four tools: Demographic data of hydrocephalus pediatric patients and their caregivers, clinical assessment of pediatric hydrocephalus patients, reported practices about home care and clinical outcomes. **Results**: During the follow-up for thirty day postoperative, early postoperative complications of the pediatric patients who received the nursing interventions was 13.9% of the pediatric patients had shunt infection, 12.5% of the pediatric patients had convulsion, 6.9% of the pediatric patients had shunt malfunction and 1.4% of them died. **Conclusion:** There was an improvement in clinical presentations of pediatric patients with no or fewer postoperative complications. **Recommendations**: Repetition of the study is needed on a larger sample in multicenter settings to emphasize the role of nursing interventions in reducing the postoperative complication and improving outcomes.

Keywords: *Pediatric hydrocephalus, Ventriculoperitoneal shunt, Nursing interventions*

Cite This Article: Hend Abdelhady Salah El-Morsy, Fawzia El Sayed Abusaad, Hatem Ibrahim Badr, and Magda Ahmed Abd El-Aziz, "Effect of Nursing Interventions on Early Postoperative Complications of Ventriculoperitoneal Shunt for Hydrocephalus in Pediatric Patients." *American Journal of Nursing Research*, vol. 13, no. 2 (2025): 16-24. doi: 10.12691/ajnr-13-2-1.

1. Introduction

Hydrocephalus is the accumulation of unusually large amounts of cerebrospinal fluid (CSF) within the ventricular system, the clear fluid that envelops the brain and spinal cord. This could stem from a blockage in the regular circulation of the CSF, issues with absorption into the venous system, or increased production of CSF, leading to an unusual enlargement of the brain cavities known as ventricles. This dilation can result in harmful elevated pressure on the brain tissues [1].

Hydrocephalus ranks among the most prevalent neurosurgical conditions in children globally, with approximately 400,000 new pediatric diagnoses annually. A link exists between the nation's income level and the occurrence of hydrocephalus among children. Children in Africa are some of the most frequently and gravely impacted by the disease [2]. The worldwide occurrence of hydrocephalus is estimated at approximately 85 cases per 100,000 people, showing significant differences among various age groups. Specifically, the prevalence is 88 per 100,000 among the pediatric population, while it is significantly lower at 11 per 100,000 in adults [3].

The management of hydrocephalus can be either medical or surgical, influenced by its cause. Following subarachnoid hemorrhage or meningitis, the circulation or absorption of CSF might be temporarily hindered. In this situation, employing drugs that reduce CSF production

could be advantageous. Surgical treatment involves excising the obstructive lesion, inserting a shunt, or performing both procedures. A shunt is made of polyethylene tubing that typically runs from a lateral ventricle to the peritoneal cavity (ventriculoperitoneal shunt). Shunts pose risks of infection or abrupt blockage, manifesting as signs and symptoms of acute hydrocephalus [4].

For many decades, a Ventriculoperitoneal (VP) shunt has served as the standard therapy. Complications related to shunts, such as shunt dysfunction and shunt infection, are inevitable, and these issues significantly impact neurological functional outcomes, especially in neonates and infants [5]. Shunt displacement and newly developed seizure disorders are significant late complications [6]. Other rarer complications involve CSF leakage, seizures, and ileus, which can complicate a VPS procedure shortly after surgery. The chances of these risks are affected by age, and most children needing these procedures are infants [7]. Neurosurgery nurses are essential in securing favorable patient outcomes by delivering nursing interventions aimed at enhancing patients' results and minimizing postoperative complications or clinical issues. Caring for a child diagnosed with hydrocephalus presents significant challenges responsibility for both families and healthcare providers. Assisting the family in managing the challenges associated with their child's condition is a crucial duty of nursing professionals. Children diagnosed with hydrocephalus require ongoing specialized health care throughout their lives. Continuous neurosurgical monitoring will be necessary for these individuals over the long term [8].

Children who have hydrocephalus have ongoing special health care requirements and need to be assessed periodically. The main objective is to set achievable goals and a suitable educational plan that will enable the child to reach their highest developmental and educational potential. Home caregivers are the initial responders in identifying when there is an issue. Almost all caregivers found it difficult to differentiate between early childhood development or minor ailments and a failure of the shunt, and only a small number believed that recognizing malfunctions improved through the passage of time. So, notify them that complications related to shunts may arise at any moment, regardless of the duration the shunt has been installed. Additionally, every patient with a shunt needs careful observation for potential complications [9].

Finally, nursing professionals working in neurosurgery units are required to deliver perioperative education to the parents of pediatric patients who are scheduled to undergo shunt surgery. This education ought to include home care, post-care follow-up, and advice on when and how to obtain suitable medical guidance. Additionally, decreasing the interval between the appearance of shunt malfunction symptoms and caregivers pursuing medical assistance for the children, so that preventable complications can be avoided. Moreover, offering a care manual for managing children diagnosed with hydrocephalus and shunts, along with the child's shunt-related details, could be made accessible for parents for long-term utilization [10].

1.1. Significant of the Study

It is valuable to highlight the serious role of nurses in nursing interventions for early postoperative complications of pediatric patients with hydrocephalus and have ventriculoperitoneal shunt which includes preoperative care and preparation, immediate post-operative care, careful monitoring, early recognition of symptoms of complications, and implementing accurate nursing care. Therefore, this study will increase the body of knowledge and practical skills of nursing staff and provide parents with educated discharge plan which will influence on children and caregiver quality of life and children's clinical outcomes.

1.2. Research Hypothesis

Children who receive the nursing interventions are expected to have less early postoperative complications than those who do not.

1.3. Research Aim

This study aimed to evaluate effect of nursing interventions on early postoperative complications of ventriculoperitoneal shunt for hydrocephalus in pediatric patients.

1.4. Research Objectives

- Assess effect of nursing interventions on incidence of clinical presentations of postoperative complications.
- Evaluate the effectiveness of nursing education on the caregiver' practices.
- Emphasis the crucial role of nursing interventions in reducing the postoperative complication and improving outcomes.

2. Materials and Methods

2.1. Study Design

A pre-experimental research design was employed to achieve this study.

2.2. Setting

The study was conducted in the pediatric neurosurgery department and pediatric neurosurgical outpatients affiliated to Mansoura University Hospital (MUH), Mansoura city, Dakahlia governorate, Egypt.

2.3. Subjects

The study included a sample of 72 children and their caregivers who were admitted to the previous mentioned settings during the study period, children newly diagnosed with hydrocephalus were set to receive treatment through a ventriculoperitoneal shunt in the neurosurgery department, followed up for 1 month in outpatient care along with their caregivers who agreed to take part in the research. The criteria for eligibility included children 1 month to less than 18 years old of both gender, undergoing to first VP shunting, preoperative care and

post-operative follow up at the pediatric neurosurgical outpatient clinic. Also, the eligibility criteria included caregiver who were accepted to contact through the telephone after discharge for one month, committed to implement researcher instruction at home, cooperative and at near distance from Mansoura city and committed to report their practices.

2.4. Tools of Data Collection

Data were collected by using four tools:

Tool I: A structured questionnaire: The researcher created the questionnaire following an extensive examination of the relevant literature and research [11], [12]. It consisted of two sections as outlined below; Part one concerned with demographic data of hydrocephalus pediatric patients which composed of (10) questions covered the following items (age, sex, and ranking) and their caregivers (age, gender, marital status, education, occupation, mobile number, and relationship with the child). Part two concerned with medical history of pediatric hydrocephalus patients which composed of (5) questions covered the following items (causes of hydrocephalus, past history of trauma, postoperative length of stay (in days), comorbidities, and previous neurosurgery).

Tool II: Clinical assessment sheet: The researcher developed it after a comprehensive examination of relevant literature and studies [13,14]. Clinical presentations of the pediatric patients preoperative (initial evaluation), postoperative (prior to discharge), and during follow-up for a period of one month which composed of (21) questions covered the following items about the presence of (fever, vomiting, decreased feeding, irritability, decreased child's movement, increased head circumference, increased abdominal circumference, decreased child's movement, loss of bladder control, abnormality of anterior fontanel, abdominal pain or tenderness, erythema, warmth and tenderness over the shunt tubing, and abdominal rigidity, etc.…).

Tool III: Reported practices about home care management: The researcher developed it following a comprehensive examination of the relevant literature and studies [15]. Concerned with assessing reported practices by studied caregivers about home care management of VP shunt which composed of (11) questions covered the following items positioning, managing pain, ensuring proper function of the shunt device, protection of the shunt area, prevention of infection, bathing, feeding, elimination, allowed activity, drug therapy and follow up visits.

Tool IV: Clinical outcomes sheet: The researcher developed it after conducting a thorough examination of the pertinent literature and studies [7,16] for thirty-day postoperative complications evaluation during the follow-up: two primary outcomes included; part one concerned with 30-day mortality (as stated on the death certificate in the hospital records or during a postoperative phone call if the patient passed away at home). Part two concerned with clinical presentations, frequencies, and classifications of complications of ventriculoperitoneal shunts thirty-day complications included, which composed of (6) questions covered the following items (shunt malfunction, shunt infections, Cerebrospinal fluid leakage, ileus, convulsion, gut perforation and abdominal complications).

Preparatory phase

This phase include a review of related literature covering various aspects of early postoperative complications of ventriculoperitoneal shunt and nursing interventions using available books, articles, journals and internet search to be acquainted with previous and current relevant literature and to develop tools of the study for data collection, review preoperative nursing care and preparation, immediate post-operative care, recognition of symptoms of complications, discharge and follow up and develop the content of the Teaching Booklet as a handout for caregivers.

Tools Validity & Reliability

Tools of the study were tested through jury members by 5 experts in the field of nursing to ensure the content validity of tools and necessary modifications are done. Reliability of the study tools was measured to evaluate whether all items on the study tools measure the same variable over time and how well the study items fit together conceptually. The internal consistency of the study tools was tested by using Cronbach's alpha coefficient test in SPSS program, version 24 to examine the produced tools for dependability. Tool 1 was reliable as r = 0.87, tool II was reliable as r = 0.97, tool III was reliable as r = 0.78 and tool IV was reliable as r = 0.70.

Ethical considerations

Ethical approval was granted by the Research Ethics Committee of the Faculty of Nursing, Mansoura University on June 1, 2022 to conduct the study. Children and their caregivers were made aware that taking part in the study is optional and they can opt out at any moment without any obligation. The anonymity and confidentiality of data were guaranteed and utilized solely for research purposes.

Exploratory phase

Pilot study

Pilot study was conducted on 10 % of the total sample size of hydrocephalus pediatric patients and their caregivers (10 pediatric patients, 10 their caregivers), it was carried out to test the clarity, feasibility, and applicability of the study tools, the sample of the pilot study was included in the total study sample, because there were no significance modifications required in the study tool.

Operational phase/fieldwork

- The data was collected over a period of eighteen months that started from the beginning of November 2022 to the end of May 2024. The researcher began by introducing herself to the participants and providing a quick overview of the study's purpose and nature. Hydrocephalus pediatric patients and their caregivers meeting inclusion criteria were visited immediately by the researcher after admission during preparatory phase at neurosurgery outpatient clinic. The researcher explained the aim of the study to caregivers and ask if they want to participate in the study or not. The caregivers who refused participation in the study were excluded.
- The framework of the study was carried out in five phases as the following:

1). Assessment phase

- Pediatric neurosurgical outpatients' appointment on Wednesday of every week from 9 a.m. to 1 p.m., where the hydrocephalus pediatric patients were prepared for ventriculoperitoneal shunt, each hydrocephalus pediatric patient and caregiver were assessed individually for demographic data and medical history of pediatric hydrocephalus patients by the researcher by using tool (I) part (1, 2).
- Hydrocephalus pediatric patients who were ready for admission were admitted on Wednesday in the pediatric neurosurgery department and a ventriculoperitoneal shunt procedure was performed after three days following admission day on Sunday.

2). Planning phase

- The Teaching booklet was designed by the researcher, revised, and modified in the Arabic language by the study supervisors based on an extensive review of related literature.
- A booklet was written in a simple Arabic language and supplemented by photos to help in the understanding of its content.

The general objective of the Teaching booklet was:

- At the end of educational sessions, the caregivers expected to acquire knowledge and practical skills about pre- and postoperative care for ventriculoperitoneal shunt in children with hydrocephalus and improve their children's clinical outcomes.

The specific objectives of the Teaching booklet sessions were:

- Define hydrocephalus.
- Describe ventriculoperitoneal shunt procedure.
- Discuss information regarding preparations prior to ventriculoperitoneal shunt procedure.
- Explain immediate postoperative care.
- Enumerate complications and clinical manifestations of complications.
- Describe home care and parental discharge education for a child with a Ventriculoperitoneal Shunt.
- List the indications to call the doctor.

3). Development of the Teaching booklet sessions:

- In this phase, the researcher scheduled six sessions, 3 sessions before ventriculoperitoneal shunt operation and 3 sessions after ventriculoperitoneal shunt operation, in addition to the opening and closing sessions.
- **Opening session**: at the beginning of this session, the researcher introduced herself and explained the content and the objective of these educational sessions. It took between 10-15 minutes.
- **First Session**: at the beginning of this session, the researcher stated the objectives of this session. It included; brief definition about of fontanel, cerebrospinal fluid, ventricles and the meaning of hydrocephalus, its causes, types. It took between 30-45 minutes.
- **Second Session**: started by taking feedback about the previous sessions and included clinical presentation of hydrocephalus in infants, children and adolescents, and how to prevent hydrocephalus. It took between 30-45 minutes.
- **Third Session**: it included information regarding the meaning of ventriculoperitoneal shunt, its shape, and function. In addition, preparations prior to the ventriculoperitoneal shunt procedure which included assessment of head circumference, fontanelles, cranial sutures and level of consciousness, also irritability, altered feeding habits and high pitched cry. Firmly support the head and neck, skin care for the head, monitor vital signs regularly, provide quiet and calm environment, prevent the child from nosocomial infection, change the infant position frequently. It took between 30-45 minutes.
- **Fourth Session**: it included information about postoperative care which included positioning of the child carefully on the un operated side to prevent pressure on the shunt valve, the child remained flat to prevent the too-rapid reduction of intracranial fluid, observation for signs of increased intracranial pressure that indicate obstruction of the shunt, alert for the usual manifestations of cerebrospinal fluid infection, including elevated temperature, poor feeding, vomiting, decreased responsiveness, and seizure activity, observe signs of local inflammation at the operative sites and along the shunt tract, administer antibiotics by the IV route as ordered, inspect the incision site for leakage, and test any suspected drainage for glucose, an indication of cerebrospinal fluid, in addition to discuss the complications, and clinical manifestations of complications. It took between 30-45 minutes.
- **Fifth Session**: it included information about home care and parental discharge education for a child with a Ventriculoperitoneal Shunt. It took between 30-45 minutes.
- **Sixth Session**: it included information about caregivers' practices about home care postoperative, which included hand washing, wound care, head and abdominal circumference, and temperature measurement, in addition to indications of contacting the hospital/doctor. Explain to the caregivers how to recognize signs that indicate shunt malfunction or infection. Also, active children may have injuries, such as a fall, that can damage the shunt, and the tubing may pull out of the distal insertion site or become disconnected during normal growth. Advise the caregivers to consult with their child's neurosurgeon or neurosurgery nurse about activities after discharge, as providers vary in their recommendations. It is also important to encourage the caregivers to enroll infants and toddlers with hydrocephalus into an early childhood development program to monitor their development and quickly address any signs that they are not keeping up with their typically developing peers. It took between 30-45 minutes.
- Closing Session: a review of what was explained during the previous sessions. It took 10-15 minutes.

4). Implementation phase

- During the preoperative period in the pediatric neurosurgery department, the researcher provided the study group the preoperative nursing care and assessed their clinical data (baseline assessment) by

using the tool (II).

- the researcher explained to caregivers the content of the teaching booklet which consisted of 6 sessions, 3 sessions before ventriculoperitoneal shunt operation and 3 sessions after ventriculoperitoneal shunt operation, each session takes from 30-45 minutes, one session per day. Each session started at 10 am for morning and at 2.30 pm for afternoon shifts.
- The study group was divided into small groups, each one consisted of two to three pediatric patients and their caregivers.
- The researcher used a variety of teaching methods during the session, including lectures, group discussions, demonstrations, and re-demonstrations. colorful handout was used.
- Handout was provided for caregivers regarding care of shunt at home, complications and clinical manifestations of complications and when to call the doctor.
- Brief, clear and simple words used during the session by the researcher, as well as at the end of each session, a summary was given.

5. Evaluation phase

- After the discharge, pediatric patients were followed for a period of one month, and contacted either through the telephone or ask to visit the outpatients on the specified day one week after discharge, and were evaluated for their clinical presentations postoperatively (follow up) by using the tool (II) and assessing caregiver' reported practices regarding home care management of VP shunt by using the tool (III).
- Postoperative complications related to shunt were evaluated and noted by using the tool (IV).

Statistical analysis

The collected data were organized, compiled into tables, and analyzed statistically utilizing SPSS software (Statistical Package for the Social Sciences, version 26, SPSS Inc., Chicago, Illinois, United States). Count and percentage were used for describing and summarizing data. Arithmetic mean (X) and standard deviation (SD) were used as measures of central tendency and dispersion respectively for normally distributed quantitative data. The Wilcoxon signed-rank test was used to test differences and analyze changes in ordinal data and non-parametric distributed metric data from repeated measures that compares two paired groups (pre- and post-intervention).

3. Results

Table 1 illustrates that among 72 children, the age of hydrocephalus pediatric patients 58.3% were infant with a mean age of 41.08 ± 56.85 months, 52.8% of hydrocephalus pediatric patients were female, in relation to their ranking 30.6% of them were third child among his siblings.

Table 2 reveals the caregivers' characteristics, the majority of caregivers, specifically over fifty percent, were aged between 18 and 30 years, with an average age of 30.76 ± 8.07 years, all caregivers were female 100%, the vast majority of them (97.2%) were married. As regards to education, data reveled that, 55.6% had secondary education, Majority of them (93.1%) were non-employee. Moreover, the mother was a primary caregiver among 94.4% of them.

Table 3 illustrates that among 49 young children, the majority of the pediatric patients (89.8%) had a lack of feeding preoperatively compared to 5.4% 1-month post with statistically significant difference as P-value = 0.000. also, the majority of young children in the pediatric patients had bulging fontanel and increase in head circumference preoperatively (97.9% & 95.9%) which decreased to 2.7% of them 1-month post with a statistically significant difference at p= 0.000.

Table 4 shows that none of the pediatric patients had gastrointestinal tract symptoms immediate postoperative and during follow up for a period of one month that there is no statistically significant a P-value of 1.000.

Table 5 presents the caregiver reported practices, most of caregivers (98.6%) reported that they were maintaining positioning, and ensuring proper function of the shunt device at two weeks post, this percentage decreased to 55.8% & 73.0% after one month, with P-values of 0.001, & 0.003, respectively. Additionally, the vast majority of caregivers (97.2%) reported that they protected the shunt area at two weeks post, which decreased to 71.2% one-month post showing a statistically significant difference at p=0.002. As regard managing pain, all of caregivers reported that they managing pain at two weeks post, which reached to 98.0% of them one-month post with no statistically significant difference a P-value of 0.317.

Table 6 illustrates that the clinical outcomes for thirty-day postoperative, more than one tenth of the pediatric patients (13.9%) of the pediatric patients had shunt infections, 12.5% of the pediatric patients had convulsions, 6.9% of the pediatric patients had shunt malfunction and 1.4% of them died during the thirty-day postoperative.

Table 1. Percentage distribution of hydrocephalus pediatric patients according to their demographic data (N=72)

Characteristics	Number	%
Age (months)		
Infant	42	58.3
Toddler	8	11.1
Preschool	4	5.6
School age	13	18.1
Adolescent age	5	6.9
X ± SD	41.08 ± 56.85	
Gender		
Male	34	47.2
Female	38	52.8
Ranking		
First	21	29.2
Second	21	29.2
Third	22	30.6
Fourth and more	8	11.1

Table 2. Percentage distribution of caregivers according to age, gender, marital status, education, occupation, and relationship with the child (N=72)

Characteristics	Number	%
Age (years)		
18-30	42	58.3
31-45	27	37.5
>45	3	4.2
X ± SD	30.76 ± 8.07	
Gender		
Female	72	100.0
Marital status		
Married	70	97.2
Divorced	0	0
Widowed	2	2.8
Education		
Illiterate	9	12.5
Read and write	11	15.3
Secondary education	40	55.6
University education and more	12	16.7
Occupation		
Employee	5	6.9
Non-employee	67	93.1
Relationship with the child		
Mother	68	94.4
Grandmother	2	2.8
Other (Relatives)	2	2.8

Table 3. Percentage distribution of clinical presentations of the pediatric patients preoperative (baseline assessment), postoperative (before discharge), and during follow up for one month in young children (N=49)

Clinical presentations	preoperative (baseline assessment) (N=49)		Postoperative								Test of significant
			Immediate at inpatient ward (N=49)		2 Weeks at home (N=49)		3 Weeks at outpatient (N=48)		one month at outpatient / home (N=37)		
	N	%	N	%	N	%	N	%	N	%	
Decreased feeding											P1 (0.025*) P2 (0.000**) P3 (0.000**) P4 (0.000**)
Present	44	89.8	49	100	4	8.1	4	8.3	2	5.4	
Absent	5	10.2	0	0	45	91.8	44	91.7	35	94.6	
Bulging fontanel											P1 (0.000**) P2 (0.000**) P3 (0.000**) P4 (0.000**)
Present	48	97.9	12	24.4	1	2.0	0	0	1	2.7	
Absent	1	2.0	37	75.5	48	97.9	48	100	36	97.3	
Increase in head circumference											P1 (0.000**) P2 (0.000**) P3 (0.000**) P4 (0.000**)
Present	47	95.9	1	2.0	1	2.0	0	0	1	2.7	
Absent	2	4.0	48	97.9	48	97.9	48	100	36	97.3	

The Wilcoxon signed-rank test of significant
*statistically significant at $p \leq 0.05$/ ** highly statistically significant at $p \leq 0.01$
(P1) comparing pre and immediate post
(P2) comparing pre and 2 weeks post
(P3) comparing pre and 3 weeks post
(P4) comparing pre and 1-month post

Table 4. Percentage distribution of gastrointestinal tract symptoms of the pediatric patients postoperative (before discharge), and during follow up for one month (N=72)

Gastrointestinal tract symptoms	Postoperative								Test of significant
	Immediate at inpatient ward (N=72)		2 Weeks at home (N=72)		3 Weeks at outpatient (N=68)		one month at outpatient/ home (N=52)		
	N	%	N	%	N	%	N	%	
Abdominal pain or tenderness									P1 (1.000) P2 (1.000) P3 (1.000)
Present	0	0	0	0	0	0	0	0	
Absent	72	100	72	100	68	100	52	100	
Abdominal rigidity									P1 (1.000) P2 (1.000) P3 (1.000)
Present	0	0	0	0	0	0	0	0	
Absent	72	100	72	100	68	100	52	100	

Increased in Abdominal circumference (in cm.)									P1 (1.000) P2 (1.000) P3 (1.000)
Present	0	0	0	0	0	0	0	0	
Absent	72	100	72	100	68	100	52	100	

The Wilcoxon signed-rank test of significant
*statistically significant at $p \leq 0.05$/ ** highly statistically significant at $p \leq 0.01$
(P1) comparing immediate post and 2 weeks post
(P2) comparing immediate post and 3 weeks post
(P3) comparing immediate post and 1-month post

Table 5. Percentage distribution of caregivers' reported practices about maintain positioning, ensuring proper function of the shunt device, protection of the shunt area, and managing pain follow up for one month (N=72)

Caregivers' reported practices	Postoperative						Test of significant
	2weeks (N=72)		3weeks (N=68)		1month (N=52)		
	N	%	N	%	N	%	
Maintain positioning							P1 (0.001**) P2 (0.000**)
Done	71	98.6	56	82.4	29	55.8	
Not done	1	1.4	12	17.6	23	44.2	
Ensuring proper function of the shunt device							P1 (0.003**) P2 (0.000**)
Done	71	98.6	58	85.3	38	73.0	
Not done	1	1.4	10	14.7	14	26.9	
Protection of the shunt area							P1 (0.002**) P2 (0.000**)
Done	70	97.2	56	82.4	37	71.2	
Not done	2	2.8	12	17.6	15	28.8	
Managing pain							P1 (0.317) P2 (0.317)
Done	72	100	67	98.5	51	98.0	
Not done	0	0	1	1.5	1	1.9	

The Wilcoxon signed-rank test of significant
*statistically significant at $p \leq 0.05$/ ** highly statistically significant at $p \leq 0.01$
(P1) comparing 2 weeks post and 1-month post
(P2) comparing 3 weeks post and 1-month post

Table 6. Percentage distribution of clinical outcomes for thirty-day postoperative (N=72)

Clinical outcomes	Present		Absent	
	N	%	N	%
Certificated death	1	1.4	71	98.6
Shunt malfunction	5	6.9	67	93.1
Shunt infections	10	13.9	62	86.1
Cerebrospinal fluid leakage	0	0	72	100
Ileus	0	0	72	100
Convulsions	9	12.5	63	87.5
Gut perforation and abdominal complications	0	0	72	100

4. Discussion

In relation to the age of hydrocephalus pediatric patients, the current research demonstrated that, more than half of them were in the infant age with a mean age of 41.08 ± 56.85 months. This finding aligned with the research [17] who performed a study on Clinical study and management of hydrocephalus in children at the surgery department of Dr. V. M. Government Medical College and Hospital situated in Solapur and reported that, more than half of them presented within first 6 month of age. Also, this finding is in consistency with [18], who conducted a study about " A study of VP shunt in management of hydrocephalus in the Department of Surgery, Gandhi Medical College Bhopal, Madhya Pradesh, India" and reported that, the maximum number of pediatric patients were infants.

From the perspective of the researcher, this result could be attributed to the fact of linked to a genetic defect or a complication of another disorder. Congenital hydrocephalus is caused by a complex interaction of genetic and environmental factors during fetal development. Also, the most common cause of acquired hydrocephalus in infants is intraventricular hemorrhage, most often as a consequence of prematurity.

The findings of the present study indicated that over fifty percent of caregivers were aged between 18 and 30 years, with an average age of 30.76 ± 8.07 years. This finding was consistent with [19] who carried out a research entitled as Management of childhood hydrocephalus in our centre. Parents' knowledge, experiences and expectations at the Neurosurgery, Usmanu Danfodiyo University Teaching Hospital Sokoto. Nigeria. and reported that, most of the participants were younger than 30 years of age.

This study stated that, there was significant improvement in feeding and decrease bulging fontanel one -month post-operative, this is contrary to [20] who conducted a study about "Assessment of complications of ventriculoperitoneal shunt" and reported that, poor feeding

and, bulging fontanallae were the most common presenting complaints observed in the first 3 months after VP shunt insertion.

Moreover, there was an improvement in head circumference, which decreased at one -month post-operative with a statistically significant difference at p= 0.000, aligning with the findings of [21] who studied "Childhood hydrocephalus in Sokoto: experience with 401 series" and reported that there was a statistically significant reduction in occipitofrontal circumferences postoperatively with $P < 0.001$. The researcher supposes that, this significant improvement in feeding, decrease bulging fontanel and head circumference were associated with the expected positive outcome of ventriculoperitoneal shunt surgery and follow up for hydrocephalus pediatric patients and their caregivers.

The current study demonstrated that none of the pediatric patients exhibited G.I.T symptoms immediately after surgery and throughout a one-month follow-up, showing no statistically significant difference. This discovery aligns with the result of [22] who conducted a study about " Evaluating educational material from the perspective of informal caregivers of children with hydrocephalus " and reported that the educational resources aligned with families' everyday experiences and surgical encounters and can be utilized by healthcare providers to emphasize key aspects of caring for children with hydrocephalus, enhancing the health education process. Moreover, the educational resources can help with the early identification of signs and symptoms related to VP shunt dysfunction and can also serve as a reference to address questions at home.

Moreover, this finding is in accordance with [23] who carried out a research involving "Abdominal complications of ventriculoperitoneal shunt in pediatric patients: experiences of a pediatric surgery clinic" and reported that abdominal complications generally appeared within eight months.

This study stated that, almost of caregivers reported that, they practiced maintaining positioning, and ensuring proper function of the shunt device, protection of the shunt area and managing pain during follow up for a period of one-month post-operative. In the same line [24] stated that, adequate postoperative analgesia is important, the head of the pediatric patient should be kept elevated by 30°–45° and dressings should not be removed for 48 hours after the procedure.

Concerning the clinical outcomes for thirty-day postoperative, the current research demonstrated that the pediatric patients had shunt infections during thirty-day postoperative which was the commonest outcomes. This result was agreed with [25] who conducted a study about "Frequency of Complications after Paediatric Ventriculoperitoneal Shunt Surgery for Management of Hydrocephalus: An Observational Cohort Study at Pakistan Institute of Medical Sciences, Islamabad, Pakistan and explored that, the children developed shunt related infections which was the commonest post-operative complications. In this regard a study done by [26] about Hydrocephalus Management Challenges in a Low-income Country, who found that, shunt infection was the most common complication in a tertiary hospital in Nigeria.

Additionally, the results of the present research indicated that, 12.5% of the pediatric patients had convulsions during thirty-day postoperative. This discovery aligned with [27] who carried out research on "Complications of Paediatric Ventriculoperitoneal (VP) Shunt: Experience in A Tertiary Care Hospital at Bangladesh Shishu Hospital & Institute and found that, 16.67% of Pediatric patients had seizure complications of VPS in pediatric hydrocephalus.

Finally, the findings of the present research indicated that the effective role of nursing interventions on early postoperative complications of ventriculoperitoneal shunt for hydrocephalus pediatric patients. This is similar to the finding of [28] and reported that, the educational intervention significantly enhanced the quality of life for mothers and their children with ventriculoperitoneal shunts and suggests creating a simplified and thorough booklet for these children to prevent post-operative complications and enhance quality of life. Also, [11] stated that, there were statistically significant positive correlations found between the overall knowledge score and the overall practice score concerning ventricular peritoneal shunts.

Limitations of the study

- Decreasing the number of admissions than before because of financial issues and unavailability of ventriculoperitoneal shunt catheters in the pediatric surgical department, it was planned to collect data for one year with 101 children and their caregivers, but the data were collected for eighteen months with 72 children and their caregivers.
- Dropout of study sample numbers at the last two weeks of one month follow up because of the progress of pediatric patients and the caregivers refused to contact by the telephone. Also, the sutures were removed within one to two weeks of surgery in the outpatient, and the researcher couldn’t meet the pediatric patients again unless problem was appearing.

5. Conclusion

According to the results of the present study, it can be inferred that there was an enhancement in clinical presentations of pediatric patients with no or fewer postoperative complications. This improvement reflects the positive effect of the teaching booklet and nursing interventions.

6. Recommendations

Based on the results of this study, it is recommended to provide nurses and caregivers with knowledge about early postoperative complications of pediatric patients with hydrocephalus and have ventriculoperitoneal shunt which includes preoperative care and, post-operative care. Also, applying telenursing intervention in nursing care as a routine care to facilitate contact of caregivers with nurses and following up post discharge. Additional research is required to replicate the study on a more extensive sample across multiple centers in order to emphasize the role of nursing interventions in reducing the postoperative

complication and improving outcomes.

References

[1] Ikwuegbuenyi, C. A., Zolo, Y., Nyalundja, A. D., Ngoma, P., Abu-Bonsrah, N., Kanmounye, U. S., & Groves, M. L. (2023). Implementing evidence-based interventions for managing pediatric hydrocephalus: A systematic review protocol. Journal of Surgical Protocols and Research Methodologies, 2023(1).

[2] Dewan, M. C., Rattani, A., Mekary, R., Glancz, L. J., Yunusa, I., Baticulon, R. E., Fieggen, G., Wellons, J. C., Park, K. B., & Warf, B. C. (2019). Global hydrocephalus epidemiology and incidence: Systematic review and meta-analysis. Journal of Neurosurgery, 130(4), 1065-1079.

[3] Koleva, M., & De Jesus, O. (2022). Hydrocephalus. StatPearls Publishing, Treasure Island (FL). http:// europepmc.org/ books/NBK560875.

[4] Marcdante, K., Kliegman, R. M., & Schuh, A. M. (Eds.). (2022). Nelson Essentials of Pediatrics, E-Book. Elsevier Health Sciences.

[5] PARK, Y. (2022). Treatment strategies and challenges to avoid cerebrospinal fluid shunting for pediatric hydrocephalus. Neurologia medico-chirurgica, 62(9), 416-430.

[6] Bawa, M., Dash, V., Mahalik, S., & Rao, K. (2019). Outcome analysis of patients of congenital hydrocephalus with Ventriculoperitoneal shunt at a tertiary care hospital in North India. *Pediatric Neurosurgery*, *54*(4), 233-236.

[7] Das, S., Rahman, A., Nath, H. D., Halder, R., & Ghosh, D. (2021). Thirty days complications of pediatric hydrocephalus following ventriculoperitoneal shunt surgery. International Journal of Neurology Research, 3(1), 01-05.

[8] Hockenberry, M. J., & Wilson, D. (2018). Wong's nursing care of infants and Children-E-book. Elsevier Health Sciences.

[9] Dorner, R. A., Lemmon, M. E., Vazifedan, T., Johnson, E., & Boss, R. D. (2023). Symptoms of cerebrospinal shunt malfunction in young children: A national caregiver survey. Child Neurology Open, 10, 2329048X2311535.

[10] Job, K., Murali, A., & Udayakumaran, S. (2019). Effectiveness of structured teaching program on knowledge regarding home care management of children with hydrocephalus and shunt among their parents. Journal of Pediatric Neurosciences, 14(3), 114.

[11] Said, K., Abd Elaziz, M., Abd Elaal, E., & Abd El-Sadik, B. (2017). Nursing management protocol for mothers of children having ventricular peritoneal shunt. Egyptian Nursing Journal, 14(3), 226.

[12] Abdelmowla, R. A. A., & Essa, A. A. (2019). Ventriculoperitoneal Shunt: Impact of Nursing Management on Outcomes of Patients with Adult Hydrocephalus. ARC Journal of Nursing and Healthcare, 5(1).

[13] Ebrahim, A. E., El Shokhaiby, U. M., & Alkholy, A. A. (2019). Management of postoperative Ventriculoperitoneal shunt complications in pediatric patients. The Egyptian Journal of Hospital Medicine, 76(6), 4346-4352.

[14] Khalafallah, D. H., Ahmed, E. M., Mohamed, F. R., Ali, K. B., & Mohamed, S. A. (2017). The impact of protocol of care for mothers of children with ventriculoperitoneal shunt on occurrence of postoperative complications. IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS), 5, 73-86.

[15] Kafl, R. H., & Mohamed, M. F. (2020). Maternal Knowledge and Practices regarding Home-Care Management of their Hydrocephalic Children with Ventriculoperitoneal Shunt. IOSR Journal of Nursing and Health Science (IOSR-JNHS), 9(1), 30-37.

[16] Vacca, V. M. (2018). Ventriculoperitoneal shunts. Nursing, 48(12), 20-26.

[17] Deshmukh, S. N., & Yadav, A. T. (2020). Clinical study and management of hydrocephalus in children. International Surgery Journal, 7(4), 1258.

[18] Pal, S. S., & Dubey, S. (2017). A study of VP shunt in management of hydrocephalus. International Surgery Journal, 4(5), 1697.

[19] Ogunleye Olabisi, O., Ismail Nasiru, J., & Lasseini Ali, S. B. B. (2018). Management of childhood hydrocephalus in our centre. Parents' knowledge, experiences and expectations. Global journal for research analysis, 7(4).

[20] Kumar, A. (2023). Assessment of complications of ventriculoperitoneal shunt. International Journal of Life Sciences Biotechnology and Pharma Research, 12 (2).

[21] Obanife, H., Nasiru, J., Lasseini, A., Ega, O., & Shehu, B. (2021). Childhood hydrocephalus in Sokoto: Experience with 401 series. Journal of Pediatric Neurosciences, 16(2), 119.

[22] Tavares, P. D., Ukawa, T. B., Hamamoto Filho, P. T., & De Avila, M. A. (2020). Evaluating educational material from the perspective of informal caregivers of children with hydrocephalus: A qualitative study. World Neurosurgery, 139, 427-433.

[23] Burhan, B., Serdar, K. B., Abdurrahman, A., Edip, A. M., & Ebuzer, D. (2018). Abdominal complications of Ventriculoperitoneal shunt in pediatric patients: Experiences of a pediatric surgery clinic. World Neurosurgery, 118, e129-e136.

[24] Pillai, S. V. (2021). Techniques and nuances in Ventriculoperitoneal shunt surgery. Neurology India, 69 (Suppl 2), S471-S475.

[25] Khizar, A., Mehtab, H., Zahid, S., Yadav, P. K., Ali, B. T., & Amjad, M. (2023). Frequency of complications after paediatric Ventriculoperitoneal shunt surgery for management of hydrocephalus: An observational cohort study. Nepal Journal of Neuroscience, 20(3), 3-9.

[26] Anele, C. O., Omon, H. E., Balogun, S. A., Ajekwu, T. O., & Komolafe, E. O. (2021). Hydrocephalus management challenges in a low-income country. Journal of West African College of Surgeons, 11(3), 29-34.

[27] Paul, S. K., Islam, R., Ghosh, P. K., Biswas, P. K., Hossain, D., & Rashid, M. A. (2022). Complications of paediatric Ventriculoperitoneal (VP) shunt: Experience in a tertiary care hospital. Dhaka Shishu (Children) Hospital Journal, 37(2), 129-134.

Mahmoud Mohamed Abd-EL Baky, S., Saad Al Sharkawi, S., Shafik Mahmoud, F., & Mohammed Abdelaziz, S. (2023). Effect of educational intervention on quality of life for mothers' having children with Ventriculoperitoneal shunt. Journal of Nursing Science Benha University, 4(1), 1030-1047.

© The Author(s) 2025. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).