

Impact of Telenursing Program about Ventriculoperitoneal Shunt Care on Mothers' Knowledge and Complications Occurred among Children.

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Abstract

Introduction: Ventriculoperitoneal Shunt (VP) is one of the most commonly performed neurosurgical procedures and is necessary to treat hydrocephalus. Complications related to VP placement are common. Nurses play a vital role in providing knowledge and practices for mothers of children with VP shunt. Telenursing is delivering nursing care and conducting nursing practice by using technology and application of telenursing used for consultation, education, monitoring, and the evaluation of health care outcomes.

Aim of the study: evaluate the impact of telenursing program about VP shunt care on mothers' knowledge and complications occurred for their children. **Research Design:** quasi experimental design and pretest-posttest design was utilized fulfill the current study's goal. **Setting:** The study was conducted in the inpatient pediatric surgical department (neurosurgery unit) at Cairo University Specialized Pediatric Hospital (CUSPH). **Participants:** A purposive sample of 60 mothers of children who were experiencing placement of VP shunt will participate in the study, divided equally to study and control groups. **Data collection tools:** structured interview questionnaire, structured questionnaire for mothers' knowledge regarding care of children with VP shunt (pre and posttest), and postoperative VP shunt complications questionnaire. **Results:** there were highly statistically significant differences concerning mothers' knowledge preimplementation and post implementation of telenursing program. The complication of VP shunt in the study group is less than the control group with highly significance difference. **Conclusion:** Telenursing program positively improved mother's knowledge in study group after implementation than before. Moreover, children of mothers who received telenursing program had less complication than control group. **Recommendation:** Telenusing program should be established to improve mothers' knowledge about VP shunt care.

Keywords: Telenursing program, children with VP shunt, mothers Knowledge, complication of VP shunt

Introduction

Hydrocephalus is the most common childhood brain disorder as well as the most common in infancy secondary to congenital malformations with pediatric overall global prevalence of 88 per 100,000. Ventriculoperitoneal shunt (VPS) placement is one of the most commonly performed neurosurgical procedures and is necessary to treat most forms of hydrocephalus. Unfortunately, complications related to VPS placement are common estimated at approximately 11–25% within the first year after initial shunt placement (Paff, Alexandru-Abrams, Muhonen, & Loudon, 2018).

Hydrocephalus is the symptomatic accumulation of Cerebro-Spinal Fluid (CSF) inside the cerebral ventricles (Koleva & De Jesus, 2021). Hydrocephalus has complex pathogenesis and different causes and is the most common reason for brain surgery in young children (National Institute of Neurological Disorders and Stroke (NINDS), 2021). Haridas and Tomita, (2017) clarified that; hydrocephalus

is a disorder in which an excessive amount of cerebrospinal fluid accumulates within the cerebral ventricles and/or subarachnoid spaces, resulting in ventricular dilation Intra Cranial Pressure (ICP).

Infants and young children are more susceptible to symptoms of hydrocephalus secondary to increased intracranial pressure. Early manifestations include irritability or restlessness, lethargy, poor feeding, vomiting, and enlarged head. Late signs consist of enlarged bulging fontanel, sunset eyes, distended scalp veins, high-pitched cry, hypertonicity and seizures (Thompson, 2017, and Dewan, Rattani, Mekary, Glancz, Yunusa, et al, 2018).

In pediatric patients, untreated hydrocephalus can lead to many adverse effects including increase irritabilities, chronic headaches, learning difficulties, visual disturbances, severe mental retardation and in more advanced cases lead to death (Abdelmowla & Essa, 2019) and (Hanna, Essa, Makhlof, & Helmy, 2019) . Anyhow, shunting procedure is the treatment of choice with the golden goal of equalizing intracranial pressure,

minimizing/preventing brain damage as a result of increased intracranial pressure and reduces manifestations of neurological deterioration. The most common type of shunt is Ventriculo-Peritoneal (VP) shunt; catheter is inserted into brain ventricle, which is connected to valve and a long catheter which diverts cerebrospinal fluid to the peritoneal cavity where it is reabsorbed (Shuer, 2022).

Shunt insertion procedures pose a huge financial, social, psychological burden due to the associated high rate of complications with high mortality and morbidity (Maghrabi, & Baesa, 2017). In spite of significant developments in the technology and design of ventriculoperitoneal (VP) shunt systems, children suffer from wide range of postoperative complications varying between simple ones as feeding problems to serious shunt failure. Shunt failure is a common reason of shunt redoes surgeries and may originate from improper care as well as infection (Khan, Hamayun, Haqqani, Khanzada, Ullah, Khattak, et al, 2021).

Other complications are malfunctioning of VP shunts which lead to increased children morbidity. However, the most frequently reported post-operative complications are shunt infection, shunt placement failure, and shunt obstruction or malfunction, abdominal complications (peritonitis), valve complications, slit-ventricle syndrome and seizures. Children on VP shunt have reported to live with problems such as headache, cognitive impairment, and urinary incontinence. This affects their activities of daily living and quality of life and burden among their caregivers (Prakash, Dhandapani, Ghai, Singh, & Dhandapani, 2018).

The worldwide incidence of complications of shunt complications is variable from 20-45% and in rural areas, incidence reached up to 80% (Almazroea, 2019). Shunt infection-related complications are considered a global burden of hydrocephalus worldwide (Albehair, Alosail, Albulwi, AlAssiry, Alzahrani, et al, 2021). In Egypt, the incidence of VP shunt complication more than 50% of children with VP shunt developed postoperative shunt complications (Ebrahim, El Shokhaiby, & Alkholi, 2019). Other study concluded that, thirty (14.6%) patients had various forms of complications. Fifteen (50%) patients had complications related to the proximal catheter and the reservoir while 15 (50%) patients had complications related to distal catheter (Hamdan, 2018).

Nursing care provided for infant and children with VP shunt was and still challenging for effective shunt functioning and complication

reduction. Pediatric nurses play a key role in providing preoperative care and preparation, immediate post-operative care, care of child with complication and provide parent discharge teaching to provide care for their children at home (Joseph, Killian, Brady, & Meeker, 2017).

Nursing precaution of children with VP shunt includes close observation for any changes from normal behaviors and physical status, positioning on the unaffected side or on the back with head elevated at 15 °to 30 to reduce rapid drainage of CSF, check skin for redness around the shunt site on bony prominences, and check body temperature, hydration status and fluid consumption. In addition, using aseptic techniques when handling shunts to change dressings is necessary (Elaziz, Elaal, El-Sadik & Said, 2017).

Vacca (2018) concluded that, a proper nursing assessment leads to early identification of potential complications, which commonly in children with VP shunt and treated early, can result in positive neurodevelopmental outcomes in children. Carefully observe for any signs of bulging fontanel and measuring head circumference, observe shunt site for infection and monitoring vital and neurological signs before and after surgery. Then nurses must observe, report, and document all signs of increased ICP and if the child has returned for shunt revision, complete history taking from parents before surgery is needed.

Discharge planning has become an integral part of the care. Nurses play an essential role in the discharge planning process. Discharge planning must embrace needs of the individual child and their family to maintain a high-quality service. Proper discharge planning and adequate discharge readiness reduce the length of stay at the hospital, readmission rates, health costs, and post-discharge complications (Subasinghe & Pathirana, 2021). The parent-centered education was effective in improving the knowledge of parents regarding care of children with hydrocephalus and shunt. It helps them to extend the care of these children from hospital to home and hence improve their quality of life (Murali, Job & Udayakumaran, 2019).

Teaching parents to monitor and follow-up care, improves long-term consequences in children undergoing VP shunt. Parents are essential for positive outcomes to allow children with VP shunt have a productive life. Besides, prevention of complications and timely management can save costs associated with frequent hospitalization and shunt revisions and eliminate child as well as parent distress. Parents

need teaching about careful monitoring and early recognition of symptoms. (Amal & Boshra, 2019).

Technology development can change nursing practice. It can help nurses deliver nursing care for patients, families, and communities (Pepito & Locsin, 2019). Chaupi, (2017) proved that; Telenursing can be an alternative strategy in providing nursing care rather than face to face method. Telenursing is delivering nursing care and conducting nursing practice by using technology. There was some evidence related to application of telenursing in nursing practice and reported that it could be used for consultation, education, monitoring, and the evaluation of health care outcomes.

In the implementation of telenursing, nurses as health professionals should have adequate knowledge and competencies to deliver nursing care via telenursing. The competencies of nurses required in telenursing comprise social, personal, methodological, and professional competencies. Therefore, training for telenurses is needed, which in turn enhances the quality and satisfaction of telenursing services (Chaupis, 2017). Other study showed that the face-to-face training and telenursing were effective on the quality of care among family caregivers of children with cancer to a similar extent (Shohani, Mozafari, Khorshidi, & Lotfi, 2018).

Rakhmawati, (2020) found that, the innovation of telenursing technologies is diverse, such as mobile phones, smart phones, computers, Internet, videoconference, and telemonitoring equipment. The implementation of educational intervention through telenursing reduces the readmission rates. Gholami, Farahani, Karahroudy, Moghadam, & Boromandnia, (2022), showed that considering that the provision of this service is inexpensive and easy, it can be considered as a strategy to reduce readmission rates. Mohamed and Mahmoud (2021) recommended that, telenursing intervention program should be established to improve mothers' knowledge about post-operative care for one day surgery children.

Significance of the study

In Egypt, using the telenursing in pediatric nursing care began to be used and had positive effect such as illustrated by Mohamed and Mahmoud (2021) who examined the effect of telenursing intervention program on mothers' knowledge about postoperative care for one day surgery children and concluded that the telenursing intervention program positively

improved mother's knowledge in the study group after implementation than before.

Another study concluded that, using of telenursing was effective in decreasing burden, improving knowledge about covid-19 disease and improving coping strategies among family caregivers of patients with confirmed covid-19 (Elsayed, Taha, Ramadan, Ibrahim & Salah, 2021). Anyhow, there is a need to shed the light on the use of telenursing as a tool of delivering nursing teaching to the parents who care for their discharged children after ventricular peritoneal shunt insertion to overcome the far distance of the children residence from hospital as well as to reduce the need of children to come to the hospital, cost limitation and reduce complication.

It was observed by the researchers that most of children who underwent VP shunt were unable to come to the hospital after performing the operation because they live away from the hospital which may lead to occurrence of complication. On the other hand, it was observed that the majority of mothers have inadequate knowledge about post-operative care for children with VP shunt how to prevent VP shunt complications and the warning signs of complications.

In Egypt, there are scarce studies conducted and focused on teaching the parents of children with VP shunt. Hence, the current study is undertaken to evaluate the effect of telenursing discharge ventricular peritoneal shunt care program on mothers' knowledge and their children complications.

Hopefully the results will set a standard care that can be followed to improve the knowledge of these mothers and achieve better outcomes for their children and reducing the incidence of VP shunt complications among children. As well, it will provide guidance and recommendations that should be reflected in pediatric nursing education and provide evidence based data that can develop nursing practice and research in the field of pediatric surgery nursing.

Subject and Methods

Operational Definition:-

Telenursing:

Telenursing is providing information and delivering nursing care related to VP shunt care by using technology through mobile phones, smart phones, computers, and/or mobile apps.

Aim of the study

The aim of the current study was to evaluate the impact of telenursing program about VP shunt care on mothers' knowledge and complications occurred for their children.

Research Hypotheses

To fulfill the aim of the study, the following research hypotheses were formulated:

1. Mothers who will receive telenursing VP shunt care program will have higher knowledge score than those who receive routine hospital care.
2. Children, whose mothers will receive telenursing VP shunt care program, will have fewer complications than who will receive routine hospital care.

Research Design

Quasi experimental design and pretest-posttest design was utilized to achieve the aim of the current study. Quasi-experimental design is one type of experimental design that is very similar to the true experimental design except an absence of randomization (Campbell & Stanley, 2015).

Setting

The study was conducted in the inpatient pediatric surgical department (neurosurgery unit) at Cairo University Specialized Pediatric Hospital (CUSPH). It receives children from all over Egypt. The neurosurgical unit receives children who have different neurosurgical problems either congenital or acquired.

Participants

A purposive sample of 60 mothers of children with congenital or acquired hydrocephalus who were experiencing placement of shunt will participate in the study. The first 30 child with their mothers will be considered as a control group who will receive the hospital routine care. The second 30 child and their mothers will participate as a study group who will be exposed to telenursing care program. The sample size was calculated based on the following formula

(<http://www.ifad.org/gender/tools/hfs/anthropometry>).

$$n = \frac{T^2 \times p(1-p)}{m^2}$$

Description:

n= required sample size.

t= confidence level at 95% (standard value of 1.96).

p = estimated prevalence of children with hydrocephalus (congenital and acquired) and undergoing VP shunt in 2014 at CUSPH (0.38).

m = margin of error at 5% (standard value of 0.05).

$$n = \frac{(1.96)^2 \times 0.38(1-0.38)}{(0.05)^2} = 60$$

Inclusion criteria:

-Children aged from 1 month to 5 years

-Both gender.

-Children diagnosed with congenital or acquired hydrocephalus and undergoing placement of VP shunt for the first time.

- Mothers should have a mobile phone.

Exclusion Criteria:

- Children with any other congenital anomalies such as (gastrointestinal, genitourinary, and orthopedic anomalies as well as congenital heart defects).

Data collection tools

The required data was collected by the following tools, which developed by the researchers after extensive review of related literature.

Tool (1) Structured Interview questionnaire: - it includes 17 questions and composed of four parts:-

Part I: - It contained 8 questions about mothers (age, level of education, occupation, family income, consanguinity with the husband, and residence, if the mother was gained any knowledge about the child VP shunt care, and who give the mother this knowledge).

Part II: - It contained 5 questions about personal data related to the child (age, gender, child rank, and education, and the reason why the child doesn't go to nursery).

Part III: - It contained 2 questions about children past medical history which includes: family history of hydrocephalus & previous admission of child to hospital.

Part IV: - It contained 3 questions about child's current medical history (cause of disease, cause of current hospital admission, and duration of disease).

Tool (2) Structured questionnaire for mothers' knowledge regarding care of children with VP shunt (pre and posttest):

It is composed of 15 questions and divided into 2 parts:

Part I: it composed of 9 items such as definition, causes, signs and symptoms, management of hydrocephalus, complications of VP shunt, postoperative medications.....etc.

Part II: it consisted of 6 items about care of VP shunt such as pain care, VP shunt care, and the position of child, infection prevention, injury prevention, and child's nutrition. How to assess the conscious level, when to remove sutures, when the child is able to take a bath and how the child is able to live with VP shunt.

Scoring system:

Mothers' knowledge was scored as the following: complete and accurate answer will be scored (2) points, incomplete or inaccurate answers will be scored (1) point and the wrong or unknown answers will be scored (zero). The total score of the tool is 30. Based on mothers' answers, their total knowledge will be scored and categorized into: good knowledge $\geq 75\%$ (≥ 22.5), average knowledge $\geq 50\%$ to $<75\%$ (≥ 15 - <22.5) and poor knowledge $< 50\%$ (<15).

Tool (3) Postoperative VP shunt complications questionnaire: this tool was developed by the researchers after extensive reviewing of the literatures to assess postoperative VP shunt complications in children. It is divided into 6 parts:

Part 1: Evaluation of signs and symptoms of shunt infection (9 questions).

Part 2: It has 12 questions about signs and symptoms of shunt obstruction such as (continuous vomiting, increase head for infant child and abdominal circumference).

Part 3: It included 10 questions about signs and symptoms of increased intracranial pressure.

Part 4: Assessment of signs and symptoms of increased drainage of cerebrospinal fluid. It involved 5 questions such as (photophobia, nausea, vomiting, & headache).

Scoring system:

Post-operative complications were scored as the following: The answers of each question are divided into (yes or no). If the child has S&S for any complication will be considered occurred or yes and it will be scored as (1) point, while if the answer is did not occur or no, it will be scored as (0). The total score of the tool is (36). Based on answers of the mothers, the score of (0) will be categorized as controlled complications the total score of (1-3) is partially controlled while the score of more the 3 to 6 will be considered uncontrolled complications.

Pain Rating Scales: It will be used to assess the intensity of pain among children with VP shunt it includes: **A-**The Face, Legs, Activity, Cry, Consolability scale (FLACC) was developed by Voepel-Lewis, Shayevitz, & Malviya, 1997). FLACC scale is used to assess pain for children between the ages of 2 months and 7 years or children that are unable to communicate their pain. The scale is scored in a range of 0–10 with 0 representing no pain. The scale has five

criteria, which are each assigned a score of 0, 1 or 2. With the FLACC scale, the scores from 0 to 3 were classified as “none or mild”, from 4 to 6 as “moderate” and from 7 to 10 as “severe” pain or discomfort. FLACC scale is available online at: www.health.gov.au.

Glasgow Coma Scale (GCS) is scored between 3 and 15, with 3 being the worst and 15 the best. It composed of 3 parameters best eye response (E), best verbal response (V), and the best motor response (M). A score of 13 or higher correlates with mild brain injury (conscious), a score of 9 to 12 correlates moderate injury (semiconscious), and a score of 8 or less represents severe brain injury (unconscious). The pediatric Glasgow Coma Scale (PGCS) validate in children 2 years of age and younger.

Validity and Reliability

The tools were reviewed by three experts in pediatric surgery nursing, to test the content and face validity of the tools. Modifications of tools were done according to the experts' judgment. The tools were examined for content coverage, clarity, relevance, applicability, wording, length, format, and overall appearance. Reliability of tools will be performed to confirm its consistency using Cronbach's alpha. It equaled 0.72.

Procedure

The study tools were developed by the researchers after extensive review of the literature. After taking the approval of the research ethics committee of Faculty of Nursing, Cairo university, official permissions was obtained from the director of CUSPH and from the heads of pediatric neurological surgical unit and pediatric neurological surgery out-patient clinic. The researchers introduced themselves to the mothers of children who fulfill the inclusion criteria. In the first visit a written formal consent was attained after explanation of the aim, the nature of the study and mothers rights.

After the mothers accept to participate in the study, the researchers met each mother at special quiet room in the surgical department in waiting area to keep privacy of them in order to fill the study's tools. The researchers filled the structured interview questionnaire in both study and control groups then the mothers were given the pretest questionnaire regarding knowledge about VP shunt and its related care. The time to fill in the tools was ranged between thirty to forty five minutes for each mother. Data about the children will be obtained from the child history, physical

assessment and children medical records on individual bases.

In the 2nd day the researchers started to create whatsapp chatting group for only the study group. The researchers made sure that the mothers have awareness of using the mobile phone and whatsapp and they will inform the mothers who are unaware of their use. Then the researchers initiated the telenursing educational sessions for the mothers of study group about postoperative care of children with VP shunt that include (definition of disease, causes, types, function, and complication of shunt and shunt care including positioning, measurement of head circumference and abdominal girth, measurement of temperature, & cold compresses). While the child in hospital, the researchers gave 4 telenursing educational sessions preoperatively for mothers on 2 weeks, 2 sessions each weak on Sunday and Wednesday, each session took between thirty to forty five minutes. Telenursing educational sessions gave for only the study group through using power point presentation (ppt), videos, and photos. The researchers called the mothers directly if it is needed. While the control group received the routine care in the pediatric surgical unit and didn't give the telenursing sessions.

Immediate and one month after operation (shunt insertion), the researchers filled structured questionnaire (posttest) and VP shunt complication questionnaire to evaluate the impact of telenursing VP shunt care program on mothers' knowledge and children' postoperative complications for both study and control group.

Statistical analysis

The collected data coded, categorized, tabulated, and analyzed using the Statistical Package for Social Science (SPSS) program version 21. Descriptive data will be expressed as mean and standard deviation. Qualitative data was expressed as frequency and percentage. Comparison of means was performed using Paired sample t-test. Correlation among variables will be done using Pearson correlation coefficient. Level of significance was set at $P < 0.05$, 0.001 used as the cut off value for statistical significance.

Ethical Considerations

A primary approval was obtained from the research ethics committee in the Faculty of Nursing, Cairo University. A written informed consent was attained from children' mothers by the researchers after complete description of the purpose and nature of the study in order to

obtain their acceptance as well as to gain their cooperation. Children and their mothers were informed that participation in the study was voluntary; mothers had the right to withdraw from the study at any time without giving any reason and without any effect on the care of their children. Confidentiality was assured to children and their mothers.

Results

Table (1) reveals that 40% of mothers of children with VP shunt in the study and control group' age ranged from 25 to less than 30 years. The mean age of mothers in the study group was 29.4 ± 4.08 , while it was 28.73 ± 5.21 in the control group. More than two fifth of mothers (43.3) in the study group and 46.7 % in the control group had secondary school or technical school. The same table illustrated that the highest percentages of mothers in both groups (46.7% & 43.3% respectively) were working outside home. More than half of mothers in the study group and control group (53.3% & 56.7% in order) came from rural areas. 60% of parents in the study group and 50% in the control group had negative consanguinity.

Table (2) indicated that more than half (56.7% & 63.3% in order) of children with VP shunt in the study and control groups were males. More than two fifth (43.3%) of children in study group were aged 3 to 5 years and 46.7% of children in control group aged from 1 to 3 years. The mean age of children in the study group was 3.5 ± 2.48 years and it was 2.33 ± 1.80 years for children in control group. There was no statistically significant difference between the mean ages in both groups. The highest percentage (50% & 43.3% correspondingly) of children in both groups was ranked as first child in their families. The majority of children in study and control groups (73.7% & 80.9% respectively) didn't enter school because of health condition and their age.

It is evident from **table (3)** that the vast majority (83.3% & 96.7% in order) of family in both groups had no family history of hydrocephalus. Concerning the cause of hydrocephalus, it was found that more than two thirds (63.3% & 70% respectively) of children in both groups the cause of hydrocephalus was acquired. More than three quarters (76.7% & 80% correspondingly) of children in study and control group the cause of acquired hydrocephalus was brain tumor.

Table (4) clarified that the highest percentages of mothers in both groups didn't have information about surgical treatment (63.3% & 53.3% in order). Regarding the Source of information about surgical treatment; it

was found that the 20% of mothers in the study group source of information was physicians and 30% of mothers in the control group source of information were media. There were no statistically significant differences between mothers in both groups regarding information about VP shunt ($\chi^2 = 3.1$, $P > 0.05$ & $\chi^2 = 4.8$, $P > 0.05$ respectively).

Regarding the mothers' knowledge related to hydrocephalus & VP shunt in the study and control group **table (5)** revealed all of mothers in both groups didn't have complete knowledge about definition of hydrocephalus, causes of hydrocephalus, signs and symptoms, diagnosis, treatment of hydrocephalus and complication of VP shunt in pretest. After implementation of telenursing program the majority of mothers in the study group improve knowledge completely about define hydrocephalus about definition of hydrocephalus, causes of hydrocephalus, signs and symptoms, diagnosis, treatment of hydrocephalus and complication of VP shunt in posttest with percentage ranged from (60%-93.3%). On the other hand, mothers in control group still had incomplete knowledge or wrong or unknown about definition of hydrocephalus, causes of hydrocephalus, signs and symptoms, diagnosis, treatment of hydrocephalus and complication of VP shunt in posttest.

Table (6) concluded that there was no statistically significant difference between mothers in both groups as regards knowledge about hydrocephalus & VP Shunt in pretest ($t = 1.370$, $P > 0.05$). The total mean score of mothers' knowledge in the study group immediate posttest was 93.20 ± 17.9 compared with 28.53 ± 11.1 for mothers in control group. A highly statistically significant difference was detected between total mean score of mothers' in both groups in the immediate posttest ($t = 18.348$, $p < 0.001$). After one month, a highly statistically significant difference was noticed between the total score of mothers' knowledge in both groups in posttest ($t = 20.70$, $p < 0.001$). In control group, there was no statistically significant difference was noticed between the total score of mothers' knowledge in pre and posttest ($t = 1.560$, $p = 0.124$). Otherwise there was a highly statistically significant difference was noticed between the total score of mothers' knowledge in study group in pre and posttest ($t = 16.843$, $p < 0.001$).

Table (7) reflected that the score of mothers' knowledge in the study and control group about each area of care of VP shunt were incomplete with percentage ranged between (86.7%- 100%) in pretest. After implementation of telenursing program the mothers' knowledge

were complete with percentage ranged from (96.7%-100%) in immediate posttest and (60%-100%) after one month. However scores of mothers' knowledge in the control group about each area of care of VP shunt were incomplete with percentage (83.3%-93.3% and 90%-93.3%) in immediate and after one month (follow up) respectively.

Table (8) displayed that there were there were highly statistical differences between total mean scores of mothers' knowledge in immediate posttest and follow up after implementation of telenursing program between study and control group ($P = 0.000$). While there was no statistical difference between the study and control group in pretest ($t = 1.43$ and $P = 0.61$).

It was evident from **table (9)** that the complication in the study group is less than the control group. The most common complication was shunt infection which represented 23.3% in the study group and 40% in the control group with highly significance difference ($X^2 = 0.429$ and $P = 0.001$). All children in the study were managed by researchers and the neurosurgeons while all the control group was managed by routine care in the hospital.

Table (10) showed that there were statistically significant correlations between mothers' personal data (level of education and occupation) and mothers' knowledge outcomes ($r = 5.46$, $p < 0.05$ & $r = 8.55$, $p < 0.05$ respectively). On contrary, there were no statistically correlations between mother age and place of residence and mothers' knowledge outcomes ($p > 0.05$).

Table (11) specified that there were no statistically significant correlations between mothers knowledge and decrease VP shunt complication of their children in the pretest in the study group ($r = 0.175$, $P = 0.181$). However there were positive statistically correlations between mothers' knowledge and decrease VP shunt complication of their children in the posttest ($r = 2.75$, $P = 0.047$).

Table (1) Percentage Distribution of Mothers' Personal Data in study and control groups.

Mothers' Personal Data	Study (n=30)		Control (n=30)		X ²	P
	N	%	N	%		
Mothers' age/years:-						
20 to less than 25	5	16.7	11	36.7	8.02	0.513
25 to less than 30	12	40	12	40		
30 to less than 35	11	36.7	2	36.7		
35 to less than 40	2	6.7	5	6.7		
X ± SD	29.4±4.08		28.73±5.21			
Mother's level of education:-						
Read and write	2	3.3	3	10	9.58	0.385
Basic education	3	10	5	16.7		
Secondary/Technical school	13	43.3	14	46.7		
University education	12	40	8	26.7		
Mothers' occupation:-						
Working outside home	16	53.3	18	60	0.089	0.765
Housewife	14	46.7	12	40		
Place of residence:-						
Urban	14	46.7	13	43.3	2.330	0.127
Rural	16	53.3	17	56.7		
Consanguinity among Parents:-						
Yes	12	40	15	50	0.556	0.456
No	18	60	15	50		

* p ≤ 0.05

Table (2) Percentage Distribution of Children with VP Shunt Characteristics in the Study and Control Group (n=60).

Children' Characteristics	Study group (n=30)		Control group (n=30)		χ ²	p-value
	No.	%	No.	%		
Sex						
Male	17	56.7	19	63.3	0.03	0.85
Female	13	43.3	11	36.7		
Age / years						
<1	7	23.3	4	13.3	2.48	0.64
1-<3	10	33.3	14	46.7		
3-<5	13	43.3	12	40		
X ± SD	3.5 ± 2.48		2.33±1.80			
Child rank						
First	15	50	13	43.3	0.26	0.99
Second	7	23.3	8	26.7		
Third	8	26.7	9	30		
Nursery enrollment						
Did not go	20	66.7	24	80	0.00	1.00
Go to nursery	10	33.3	6	20		
Cause didn't go to nursery						
Health condition	10	50	10	41.6	35.31	0.004
His age younger	10	50	14	58.4		

Table (3) Percentage Distribution of Children with VP Shunt Past and Present History in the Study and Control Group (n-60).

Items	Study group (n=30)		Control group (n=30)		χ^2	p-value
	No.	%	No.	%		
Family history						
Yes	5	16.7	1	3.3	0.207	0.64
No	25	83.3	29	96.7		
Cause of hydrocephalus						
Congenital	11	36.7	9	30	1.15	0.28
Acquired	19	63.3	21	70		
Cause of acquired hydrocephalus						
Brain tumor	14	73.7	17	80.9	5.14	0.82
Meningitis	1	5.3	1	4.8		
Head trauma	1	5.3	1	4.8		
Hemorrhage	3	15.7	2	9.5		

Table (4) Percentage Distribution of mothers' information about surgical treatment and source of information about VP Shunt in the Study and Control Group (n-60).

Items	Study(n=30)		Control(n=30)		χ^2	p-value
	No.	%	No.	%		
Information about surgical treatment						
Yes	11	36.3	14	46.7	3.1	0.2
No	19	63.3	16	53.3		
Source of information about surgical treatment						
Physicians	6	20	4	13.3	4.8	0.18
Nurses	0	0	0	0		
Other mothers	1	3.3	1	3.3		
Media	4	13.3	9	30		
No one	19	63.3	16	53.3		

Table (5) Percentage Distribution of mothers' knowledge Related to Hydrocephalus & VP Shunt in the Study and Control Group (n-60).

Items	Study(n=30)				Control(n=30)			
	Pretest		Posttest		Pretest		Posttest	
	No.	%	No.	%	No.	%	No.	%
Definition of hydrocephalus & VP shunt								
Complete	0	0	18	60	0	0	6	20
Incomplete	12	40	10	33.3	14	46.7	18	60
Wrong/unknown	18	60	2	3.3	16	53.3	6	20
X ± SD	2.63±0.49		1.46±0.62		2.40±0.50		2.0±0.64	
Causes of Hydrocephalus								
Complete	0	0	21	70	0	0	3	10
Incomplete	14	46.7	9	30	11	36.7	21	70
Wrong/unknown	16	53.3	0	0	19	63.3	6	20
X ± SD	2.63 ±0.49		2.53 ±0.50		2.10 ±0.54		1.30 ±0.46	
Signs and symptoms of hydrocephalus								
Complete	0	0	26	86.7	0	0	0	0
Incomplete	15	50	4	13.3	16	53.3	16	53.3
Wrong/unknown	15	50	0	0	14	46.7	14	46.7
X ± SD	2.50±0.50		1.13±0.34		2.46±0.50		2.46±0.50	
Diagnosis of hydrocephalus								
Complete	0	0	27	90	0	0	0	0
Incomplete	12	40	3	10	18	60	21	70
Wrong or unknown	18	60	0	0	12	40	9	30
X ± SD	2.60±0.49		1.10±0.30		2.40±0.49		2.30±0.46	
Treatment of hydrocephalus								
Complete	0	0	27	90	0	0	0	0
Incomplete	18	60	3	10	21	70	25	83.3
Wrong/unknown	12	40	0	0	9	30	5	16.7
X ± SD	2.40±0.49		1.10±0.30		2.30±0.46		1.16±0.37	
Aim of VP shunt insertion								
Complete	0	0	28	93.3	0	0	0	0
Incomplete	11	36.7	2	6.7	15	50	18	60
Wrong or unknown	19	63.3	0	0	15	50	12	40
X ± SD	2.10 ±0.54		1.06±0.25		2.50±0.50		2.40±0.49	
Complication of VP shunt								
Complete	0	0	25	83.3	0	0	0	0
Incomplete	9	30	5	16.7	24	80	24	80
Wrong or unknown	21	70	0	0	6	20	6	20
X ± SD	2.30±0.46		1.16±0.37		2.20±0.40		2.20±0.40	

Table (6): Comparison of Total Mean Scores of mothers' knowledge about Hydrocephalus & VP Shunt in the Study and Control Group (n=60).

Mothers' knowledge about Hydrocephalus & VP Shunt	Mean ± S.D	t-test	P
Pretest			
Control group	28.53±11.1	1.370	0.176
Study group	28.53±11.1		
Immediate Posttest			
Control group	28.53±11.1	18.348	.000*
Study group	93.20±17.9		
After one month posttest			
Control group	27.33±7.24	20.70	.000*
Study group	63.85±5.91		
Control Group			
Pretest	29.63±12.0	1.560	0.124
Posttest	29.53±12.1		
Study Group			
Pretest	31.00±3.6	16.843	.000*
Posttest	93.20±17.9		

*P≤0.000

Table (7) Percentage Distribution Mothers' Knowledge about Care of VP Shunt between Control and Study Groups.

Care of VP shunt	Study group (n=30)						Control group (n=30)					
	Pretest		Immediate		After one month		Pre		Immediate		After one month	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pain care												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	30	100	0	0	0	0	30	100	25	83.3	27	90
Complete	0	0	30	100	30	100	0	0	5	16.7	3	10
Position & encourage movement												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	30	100	0	0	0	0	30	100	27	90	28	93.3
Complete	0	0	30	100	30	100	0	0	3	10	2	6.7
VP shunt care												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	30	100	0	0	0	0	30	100	28	93.3	28	93.3
complete	0	0	30	100	30	100	0	0	2	6.7	2	6.7
Wound care & prevent infection												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	30	100	1	3.3	0	0	30	100	28	93.3	27	90
complete	0	0	29	96.7	30	100	0	0	2	6.7	3	10
Prevent injury												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	26	86.7	1	3.3	18	60	26	86.7	25	83.3	27	90
complete	4	13.3	29	96.7	12	40	4	13.3	5	16.7	3	10
Nutrition												
Wrong or unknown	0	0	0	0	0	0	0	0	0	0	0	0
Incomplete	27	90	0	0	0	0	27	90	27	90	27	90
complete	3	10	30	100	30	100	3	10	3	10	3	10

Table (8) Comparison of Total Mean Scores of Mothers' Knowledge about Care of VP Shunt between Control and Study Groups.

Item	Mean & S.D	T.test	P.value
Pretest			
Control group	20.8±2.8	1.43	0.61
Study group	20.9±2.8		
Immediate Posttest			
Control group	17.1±4.1	76.8	0.000*
Study group	62.4±4.4		
Follow up(after 1 month)			
Control group	17.1±4.1	63.6	0.000*
Study group	59.7±5.1		

*P≤0.000

Table (9) Comparison of postoperative VP shunt complication in the study and control group

Items	Study group (n=30)		Control group (n=30)		X ²	P
	No.	%	No.	%		
Shunt infection	7	23.3	12	40	0.429	0.001*
Shunt obstruction	3	10	9	30	0.207	0.001*
Abdominal complication	1	3.33	6	20	2.239	0.302
Seizure	2	6.7	3	10	1.824	0.317
Wound infection	2	6.7	12	40	0.315	0.000*

*P≤0.000

Table (10) Correlation of mothers' knowledge scores about VP shunt care and their characteristics in the study group (N=30)

Mother' characteristics	Mothers' Knowledge	
	R	p-value
Age	0.2	0.95
Level of education	5.46	0.001*
Occupation	8.55	0.005*
Place of residence	3.22	0.07

* P <0.05

Table (11) Correlations between Mothers' Knowledge and decrease VP complication (n=30) in study group

P	Mothers' knowledge	
	R	P
Pretest	0.175	0.181
Posttest	2.75	0.047*

* p <0.05

Discussion

Telenursing is one of the information and communication system technologies for remote nursing services that are carried out virtually in providing nursing care

practices. telenursing communication technology can improve and facilitate nursing care services (Tarigan, 2022). So the aim of the current study to evaluate the impact of telenursing program about ventriculoperitoneal shunt care on mothers' knowledge and complications occurred for their children.

The result of the current study revealed that that 40% of mothers of children with VP shunt in the study and control group' age ranged from 25 to less than 30 years. More than two fifth of mothers (43.3) in the study group and 46.7 % in the control group had secondary school or technical school. These results agreed with Abd Elaziz, Abd Elaal, Abd El-Sadik, & Said, (2017) who found that 59% of the studied mothers aged from 25 to 35 years old, with a mean age 32.97 ± 6.6 years. Regarding educational level, 64.1% of them had secondary education.

It is evident from the current study that the highest percentages of mothers in both groups were working outside home. More than half of mothers in the study group and control group came from rural areas. 60% of parents in the study group and 50% in the control group had negative consanguinity. This result in agreement with Kafal & Mohamed (2020) who studied maternal knowledge and practices regarding home-care management of their hydrocephalic children with ventriculoperitoneal shunt and indicated that 70% of mothers' came from rural areas. Meanwhile, parents had negative consanguinity and 64% of mothers were working.

Based on the result of the current study, indicated that more than half in order) of children with VP shunt in the study and control groups were males. More than two fifth of children in study group were aged 3 to 5 years and 46.7% of children in control group aged from 1 to 3 years. These findings in accordance with a study carried out by Murali, et al, (2019) who showed that A total of 8 (40%) were in the preschooler category, and 25% were in the toddler category. 65% of the children were boys and 35% were girls, The current study results indicated that, the majority of children in study and control groups didn't enter nursery because of health condition and their age. On the same line with this finding of a study done by Prakash, et al (2018) who concluded that cognitive domain was affected in 12%–50% of the children who underwent VP shunt. Cognitive deficits increase the difficulties at school and impair the academic performance of the children. Also Mahmoud, Saad, Shafik & Mohammed (2023) had the same results as 63% of children with VP shunt didn't go to school continuously.

The present study results clarified that, the vast majority of family in both groups had no family history of hydrocephalus. Concerning the

cause of hydrocephalus, it was found that more than two thirds of children in both groups the cause of hydrocephalus was acquired. More than three quarters of children in study and control group the cause of acquired hydrocephalus was brain tumor. This result is supported in Mahmoud, et al (2023) that reported 83.3% of family had no family history of hydrocephalus and one-third (33.3%) of children had brain tumor.

As regard to mothers' information about surgical treatment and source of information about VP Shunt in the both group the finding showed that the highest percentages of mothers in both groups didn't have information about surgical treatment and there were no statistically significant differences between mothers in both groups regarding information about VP shunt. Regarding the Source of information about surgical treatment; it was found that the source of information was physicians and media. Similarly, Abd Elaziz, et al (2017) who stated that the studied mothers had reported that source of information regarding hydrocephalus was from health team and 18.4% of them reported that mass media. Also Islam, (2023) also supported the results as showed that the use of mass media among mothers can change knowledge bases, attitudes and behaviors that relate to their children's care.

Regarding to the effect of telenursing on mothers' knowledge Related to Hydrocephalus & VP Shunt between the two groups on pre-post intervention, the present study revealed that, there was a significant increasing knowledge of mothers in study group than in control group on post intervention. This result supported by the study conducted by Mohamed, et al., (2021) who revealed that there were positive highly statistical significant differences between the total mean scores of mothers' knowledge post and following the telenursing program of control and study groups.

As regards knowledge about hydrocephalus & VP Shunt in pretest the current study presented that no statistically significant difference between mothers in both groups as regards knowledge about hydrocephalus & VP Shunt in pretest. In control group, there was no statistically significant difference was noticed between the total score of mothers' knowledge in pre and posttest. A highly statistically significant difference was detected between total mean score of mothers' in both groups in the immediate and after one month posttest. This indicated the positive effect of the telenursing program and met the hypotheses of the study. This finding was

supported by Murali, et al (2019) and Abd Elaziz, et al (2017) the difference in the mean pretest–posttest knowledge score was statistically significant after the parent-centered education and nursing management protocol regarding knowledge about hydrocephalus and shunt.

The current study indicated that the score of mothers' knowledge in the study and control group about each area of care of VP shunt were incomplete with percentage in pretest. After implementation of telenursing program the mothers' knowledge were complete in immediate posttest and after one month. However scores of mothers' knowledge in the control group about each area of care of VP shunt were incomplete in immediate and posttest and after one month. This result in the same line with the outcome of Mahmoud, et al (2023) who found that less than two-thirds (63.3%) of studied mothers had poor level of knowledge at pre-educational intervention, which improved post educational intervention to the majority (86.7%) of them had good level of knowledge regarding ventriculoperitoneal shunt care.

According to total mean scores of mothers' knowledge about care of VP shunt between control and study groups, the present study revealed that there were there were positive highly statistical differences between total mean scores of mothers' knowledge in immediate posttest and follow up after implementation of telenursing program between study and control group. These results are supported by many studies in the same context. In a review by Afik, et al (2021) to identify the important role of telenursing in improving nursing services for patients. The results of a review of 10 articles found that the form of nursing services with telenursing could prove long-distance service, time efficiency and funding allocation.

The existing study emphasized that the complication in the study group is less than the control group. The most common complication was shunt infection which represented 23.3% in the study group and 40% in the control group with highly significance difference. These findings are supported by Mahmoud, et al (2023) who found that infection the highest percentage complication after VP shunt (56%) followed by shunt obstruction (44%) and recommended that continuous educational programs to increase awareness of the mothers' having children with VPS to ensure enough knowledge and practice and improving quality of life.

In light of the findings of the present study regarding the correlation between the mothers'

level of education, occupation and mothers' knowledge outcomes there were statistically significant correlations before and after receiving telenursing program. This result is in agreement with Ibrahim & Abd Elkhair, (2023) who found that there was a highly statistically significant positive correlation between mothers' knowledge and practices and their educational level. There was a statistically significant positive correlation between mothers' knowledge and practices before receiving empowerment guidelines and working status.

Regarding correlations between mothers' knowledge and decrease VP complication in study group the present study illustrated that there were positive statistically correlations between mothers' knowledge and decrease VP shunt complication of their children in the posttest in the study group. This result is in agreement with Khalafallah, Ahmed, Mohamed & Mohamed (2017) who studied the impact of protocol of care for mothers of children with VP shunt on occurrence of postoperative complications and concluded that the designed protocol of care was effective in improving mothers' knowledge and practice regarding the care of children with VP shunt, as well as reducing the occurrence of the postoperative complications among children in the study group.

Conclusion

The current study concluded that telenursing intervention is a significant method of health care delivery and positively improved mother's knowledge about VP shunt care in study group after implementation than before compared with control group. Moreover, children whose mothers will receive telenursing VP shunt care program, had fewer complication than who children who received routine hospital care.

Recommendations

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

- Applying telenursing intervention in nursing care as a routine care to facilitate contact of mothers with nurses whenever they need
- High-quality researches incorporating other undiscovered health outcomes and satisfaction are required to establish the benefit of telenursing in enhancing children with VP shunt care for a larger sample and a longer period of time.

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