

External Ventricular Brain Drain: Effect of Nursing Guidelines on Internship Nursing Students' Performance

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Abstract

Background: External Ventricular Drain (EVD) care is considered an advanced specialized nursing skill for the neurological patient. Internship nursing students are more exposed to the (EVD) during clinical experience so they need to improve their performance related to (EVD) to ensure patients' safety and eliminate errors through safe performance. **Aim:** this study was conducted to evaluate the effect of external ventricular brain drain guidelines on internship nursing students' performance. **Study design:** a quasi-experimental study; **Subject & setting:** A convenient subject of forty internship nursing students at neurological intensive care units affiliated to Ain Shams University Hospitals. **Tools:** (1) External Ventricular Brain Drain self-administered questionnaire, (2) Nurses' practice and attitude observational checklist pre & post guideline implementation. **Results:** there were significant improvement in the level of performance of internship nursing students post guideline implementation ($P > 0.05$). **Conclusion:** nursing guidelines had statistically significant positive effect on internship nursing students' performance regarding external ventricular brain drain evidenced by most of the studied sample had satisfactory knowledge, practice and attitude. **Recommendation:** The periodic refreshing in-service training courses should be provided to internship nursing students in order to keep them of updating knowledge and practice regarding external ventricular brain drain.

Introduction

External ventricular brain drain (EVD) is one of the most common lifesaving procedures in neurologic intensive care unit. Various forms of acute brain injury benefit from the continuous intracranial pressure (ICP) monitoring and cerebrospinal fluid (CSF) diversion provided by an EVD (Rajanandini, 2015). After insertion, the EVD monitoring, maintenance and troubleshooting essentially become a nursing responsibility (Visish & Brent, 2014). Accurate and accountable nursing care may have the ability to portend better

outcomes in patients requiring CSF drainage (Katrina, 2017).

The EVD systems drain cerebrospinal fluid (CSF) from the lateral ventricles of the brain to a collection system outside of the body. This procedure requires an external ventricular catheter to be inserted through a ventriculostomy (opening) into the frontal portion of the lateral ventricle, preferably on the non-dominant side of the brain (Vaibhav, Ronilda, & Kirby, 2013). This procedure is performed by a neurosurgeon in the operative room or in the ICU setting using strict aseptic technique. (Slazinski,

Anderson, Cattell, Eigsti, Heimsoth, & Holleman, 2011)

Once an intraventricular catheter is inserted, it is attached to a collection reservoir to allow for drainage of CSF. Adjusting the height of the collection chamber regulates the flow by increasing or decreasing the amount of pressure required for the CSF to drain (**Andrade, Paiva, and Amorim, 2011**). The CSF drainage is dependent on the balance between ICP and the height of the reservoir. Ventricular drainage can be used to assist with controlling increased ICP by providing a temporary exit for the CSF flow (**Camacho, Boszczowski, & Freire, 2013**).

The indications of EVD placement are to divert CSF during acute periods of hydrocephalus related to illness of injury such as in subarachnoid hemorrhage or meningitis, shunt infections; the CSF is temporarily diverted until treatment with antibiotics is complete or until the infection is cleared, and monitoring intracranial pressure; the EVD can be connected to a transducer that converts fluid pressure into an electronic signal which displayed on a monitor providing a pressure reading in mmHg and it can also be used to determine ICP through a visual method. (**Winkler, Woernle, Seule, Held, Bernays, and Keller, 2013**)

Upon receiving a patient with an EVD, the nurse should place an EVD sign above the patient's bed, at the foot of the patient's bed and outside of the patient's room. Inform family members about the importance of maintaining the patient's position in bed and monitoring the system (Lee, Park, and Back, 2012). Also, must follow routine care requirements with complete aseptic technique to maintain competency which including: EVD set up and leveling, wound care, clamping,

monitoring, taking CSF sampling, changing drain, transporting patient and documentation (**Hunn, Mujic, Sher, Dubey, Peters, and Hunn, 2014**).

EVD associated meningitis or ventriculitis is a common complication with an incidence of 0–22%. (**Dey, Jaffe, Stadnik, and Awad, 2012**). Risk factors that have been associated with EVD infections include systemic infection, depressed skull fracture, lack of tunneling of EVD catheter, site leak, catheter irrigation, frequency of CSF sampling and possibly duration of EVD placement. (**Olson, Zomorodi, Britz, Zomorodi, Amato, Graffagnino, 2013**). A common nursing practice aimed at reducing this complications and maintain optimal patients' health. (**Slazinski, Anderson, Cattell, Eigsti, Heimsoth, & Holleman, 2011**)

Aim of the study:

The aim of this study was to evaluate the effect of external ventricular brain drain nursing guidelines on internship nursing students' performance through the following:

1. Assess knowledge, practice and attitude of internship nursing students regarding external ventricular brain drain.
2. Implement external ventricular brain drain nursing guidelines
3. Evaluate the effect of implementing external ventricular brain drain nursing guidelines on knowledge, practice and attitude of internship nursing students

Research hypotheses:

In order to achieve the aim of this study, it was hypothesized that, the implementation of the nursing guideline

will lead to significant positive improvement in knowledge, practice and attitude of internship nursing students regarding external ventricular brain drain.

Subject and Methods

Study design: A quasi experimental study.

Subject & setting: A convenient sample of forty (40) internship nursing at neurological intensive care units affiliated to Ain Shams University Hospitals.

Tools applied (pre & post): tools were developed by the researchers to collect the data for this study.

Tool 1: Extra ventricular brain drain self-administered questionnaire tool consists of two parts:

- 1st part concerned with demographic characteristics of internship nursing students such as: age, gender, qualification, etc.

- 2nd part concerned with internship nursing students' knowledge. It was derived from reviewing literatures (Katrina, 2017; Rajanandini, 2015; Visish & Brent 2014; and Vaibhav, Ronilda, and Kirby, 2013) about:

- External ventricular brain drain system management included: EVD definition, indication, contraindication, complication and management (25 questions)

Scoring system: -

Regarding internship nursing students' knowledge:

- Total score for this part was 25 degrees; (1) mark was given for correct answer and (zero) for wrong answer.

- The points were summed and converted into a percentage scoring, the total scoring system was classified as, unsatisfactory level (<90%), satisfactory level ($\geq 90\%$ = 22.5 degree)

Tool 2: Internship nursing students' practice and attitude observational checklists regarding external ventricular brain drain. It was a standardized tool adopted from (The Royal Children's Hospital Melbourne, 2018; Hassan 2012; Mattox, 2012; National Safety and Quality Health Service Standards, 2012 and Ritter, 2011) to assess practice and attitude of internship nursing students regarding external ventricular brain drain. It included three parts:

- 1st part nurses' observational checklist regarding external ventricular brain drain care as:

- Mandatory checks (9 steps).

- Hourly documentation (7 steps).

- Leveling the EVD system (3 steps).

- Dressing change (26 steps)

- Removal of EVD (3 steps).

- ICP paper set up (4 steps).

- ICP zeroing measure (10 steps).

- Monitoring ICP (4 steps).

- ICP documentation (4 steps).

- 2nd part observational checklist "rating scale" regarding nurses' attitude

toward responsibility & accountability during external ventricular brain drain care included:

- Attitude of physical safety (8 items).
- Attitude of emotional safety (5 items).
- Attitude of asepsis (4 items).
- Attitude of teaching (3 items).
- Attitude of documentation (4 items).

The scoring system:

A: Regarding EVD observational checklist

- Total score of practice test was 70 degrees, (1) mark was given for done and (zero) for not done/done incorrectly.

- The points were summed and converted into a percentage scoring, the total scoring system was classified as, unsatisfactory level (<90%), satisfactory level ($\geq 90\%$ = 63 degree).

B: Regarding nurses' attitude observational checklist:

- Total score of this part was 72 degree, the scale was consisting of (24 items) used to assess nurses' attitude during external ventricular brain drain care.

- The response was on 3-point scale ranged from 1 mark was given for (rarely done), 2 mark was given for (often done) and 3 mark was given for (usually done).

- The points were summed and converted into a percentage scoring, the total scoring system was classified as,

unsatisfactory level (<90%), satisfactory level ($\geq 90\%$ =65 degree).

Validity and reliability: testing validity of the external ventricular brain drain self-administered questionnaire tool was reviewed by a panel of seven experts from critical care nursing staff at faculty of nursing Ain Shames University to ascertain their face and content validity and relevancy. Testing reliability of proposed tool was done statistically by alpha-cronbach test was (0.782) which perceptively that indicate high reliability of the used tool.

Pilot study: the pilot study was carried out on 10% of the studied sample who were later excluded from the study sample and substituted with other students to test the applicability, clarity and efficacy of the tools and to estimate the time needed for data collection. The external ventricular brain drain self-administered questionnaire tool were modified according to the results of the pilot study.

Protection of Human Rights: for ethical reasons, a primary permit was granted from the hospital director to apply this study. Also, at the initial interview, each legible internship nursing student was informed about the aim of the study and its importance. The researchers emphasized that participation in the study is entirely voluntary, and anonymity and confidentiality were assured through coding the data. Oral approval consent was taken from each student who agreed to participate in the study; also, they were assured that they have the right to withdraw from the study at any time. As well as the obtained information will be used only for the purpose of the study.

Field work: The current study was carried out through preparation, implementation and evaluation.

1. Preparation phase:

- At the beginning, the researchers assessed needs of the internship nursing student (pre-test) and based on needs assessment finding, the external ventricular brain drain self-administered questionnaire tool was developed by the researchers based on reviewing the recent and related literature and revised by a specialized professors of critical care nursing. The Internship nursing students' practice and attitude observational checklists regarding external ventricular brain drain was an adopted tool.

2. Implementation & evaluation phase:

- Data collection for this study was carried out in the period from first January to the end of March 2020. The methods of teaching used were lectures followed by focus group discussions in addition to audiovisual materials and practice.

- The researchers were available in the morning and afternoon shift four days per week by rotation.

- The researchers started to collect data and implement the guideline in the following way:

- 1.All internship nursing student received the EVD self-administered questionnaire tool to estimate pre test assessment for knowledge within 30 minutes.

- 2.All internship nursing student practice & attitude were assessed by the researchers through observational check list within 90 min.

- 3.Internship nursing students were given booklet about external ventricular brain drain. Training sessions were conducted by the researchers which are

divided into four sessions (four days per week; each session took two hours and involved nine to ten internship nursing student.

4. A booklet in English language, based on recent medical and nursing knowledge derived from (**Katrina, 2017, Rajanandini, 2015; Visish, 2014; and Woernle et.al, 2011**) it gives insight about EVD related terminology ,definition, indications, contraindications, management included:

- Mandatory checks
- Hourly documentation
- Leveling the EVD system
- Dressing change
- Removal of EVD
- ICP paper set up
- ICP zeroing measure
- Monitoring ICP
- ICP documentation

- 5.The EVD self-administered questionnaire tool were filled by students post guideline implementation to evaluate their Knowledge within 30 minutes.

- 6.The observational checklists were filled by researchers post guideline implementation to evaluate internship nurses' practice & attitude regarding external ventricular brain drain care within 90 minutes.

Guidelines sessions:

- 1.The 1st session was directed toward theoretical knowledge content about extra ventricular brain drain included: EVD related terminology, definition, indications, contraindications, how it work, and complications. It was given in about two hours.

- 2.The 2ndsession was directed toward student' practice regarding mandatory checks, hourly documentation and leveling the EVD system. It was given in about two hours.

3.The 3rd session was directed toward student' practice regarding dressing change, removal of EVD & ICP paper set up. It was given in about two hours.

4.The 4th session was directed toward student' practice regarding ICP zeroing measure, monitoring ICP & ICP documentation. It was given in about two hours.

Statistical analysis: All data were collected, coded, tabulated and subjected to statistical analysis. Statistical analysis is performed by statistical package SPSS 21, also Microsoft office Excel is used for data handling and graphical presentation. Quantitative variable are described by the means, standard deviation (SD), while qualitative categorical variables are described by percentage and proportions. Descriptive statistics are used to analyze the response to individual items and the respondents' characteristics. Chi-square and P-value test used to test correlation.

Results

Data in table (1) shows the distribution of the studied group according to their demographic characteristics. As regard to age, this table shows that most of internship nursing students (80%) were in the age group (20<22) years old. As regard to years of experience, most of internship nursing students (82.5%) had no experience and all of them didn't received any training courses regarding external ventricular brain drain.

Figure (1) shows that; there was significant improvement in internship nursing students' total knowledge post guidelines implementing regarding extra ventricular brain drain at $P \leq 0.05$.

Table (2) shows frequency distribution of satisfactory level of

internship nursing students' knowledge regarding extra ventricular brain drain post the nursing guidelines implementation.

Figure (2) shows that; there was significant improvement in internship nursing students' total practice and attitude post guidelines implementation regarding extra ventricular brain drain at $P \leq 0.05$.

Table (3) shows frequency distribution of satisfactory level of internship nursing students' practice and regarding extra ventricular brain drain post the nursing guidelines implementation.

Table (4) shows that there is no correlation between the selected demographic variables with total knowledge and total practice scores among the studied sample.

Discussion

Insertion of an external ventricular drain (EVD) is arguably one of the most common and most important lifesaving procedures encountered in the neurologic intensive care unit. Patients who require an EVD should be closely monitored by nurses trained and competent in assessment and management of both the drain and the neuroscience patient population (Rajanandini, 2015).

Maintenance, and monitoring for EVD complications has essentially become a nursing responsibility. Accurate and adjustable nursing care may have the ability to portend better outcomes in patients with external ventricular brain drain.(Almir, Wellingson, Iuri, and Gustavo, 2014)

Present study results revealed that there was a statistically significant difference in the internship nursing students' total knowledge regarding

external ventricular brain drain pre and post guidelines implementation. This result in accordance with **(Bauer, McGwin, and Melton, 2011)** who found in his study which entitled "The relationship between INR and development of hemorrhage with placement of ventriculostomy" improvement of nurses EVD knowledge post guidelines implementation.

Regarding internship nursing students' knowledge of EVD system and nursing management, the current study revealed that the most of internship nursing students had satisfactory level of knowledge post guidelines implementation. This may be due to lack of internship nursing students' experience and training courses regarding external ventricular brain drains pre guideline implementation. This result supported with **(Rajanandini, 2015)** who found in his study which entitled "External ventricular drains: Management and complications" that there was improvement in nurses' knowledge post program implementations.

Regarding internship nursing students' total practice, this study revealed that, there was a statistically significant difference regarding external ventricular brain drain pre and post guidelines implementation. This finding may be due to inadequacy of training on caring for patient with EVD as it's not in their curriculum and they are recent graduated and had no experience in addition to lack of procedure book, policy and rules regarding external ventricular brain drain system care in ICU. Meanwhile, the majority of internship nursing students had unsatisfactory attitude to maintain patient

safety during external ventricular brain drain practice. This is in agreement with **(Chi, Chang, Chiu, and Huang, 2010)** who found in his study which entitled "Infections associated with indwelling ventriculostomy catheters in a teaching hospital" that, the most common errors were that the leveling of EVD, and the poor care technique. Also this result is similar to result by **(Vaibhav, Ronilda, and Kirby, 2013)** who reported lack of safety and infection control measures in the study entitled "Factors associated with external ventricular drain placement accuracy".

Analysis of specific activities related to the procedure of EVD care and ICP monitoring the study revealed that, most of nurses' students under study, were not leveling the EVD, checking label 3 times, removal EVD correctly, setting up ICP paper, and documented ICP. This is supported with **(Katrina, 2017)** who found in the study entitled " External Ventricular Drains and Intracranial Pressure Monitoring: Self Learning Guide" that all nurses under study had poor practice for EVD system.

Finally, the results of the study also revealed that there was a positive correlation between internship nursing students' (knowledge, practice and attitude) post guidelines implementation. These results are in agreement with **(Woernle, Burkhardt, Bellut, Krayenbuehl, and Bertalanffy, 2011)** who found that, there was significant correlation between nurses' knowledge, practice and attitude in their study entitled "Do iatrogenic factors bias the placement of external ventricular catheters".

Table no. 1: Frequency and percentage distribution of demographic characteristics of the internship nursing student under study (n= 40)

Items	(N=40)	%
Age group (years):		
20- < 22	32	80
22 <24	8	20
Mean± SD	21.61±1.03	
Years of experience:		
Yes	7	17.5
No	33	82.5
Received training courses:		
Yes	0	0
No	40	100

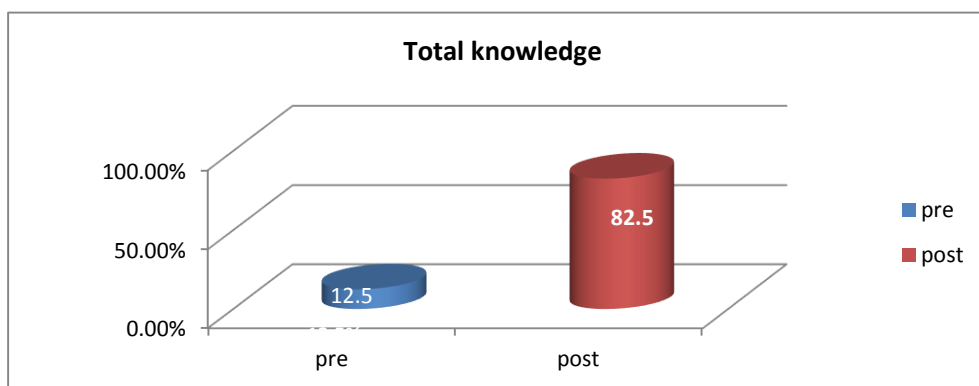
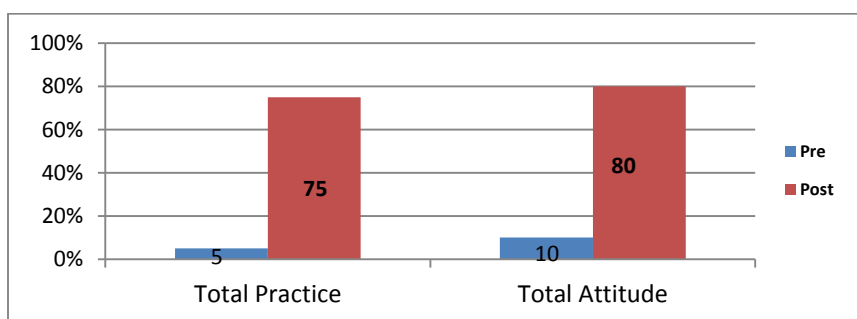
**Figure No.1: Frequency distribution of satisfactory level of internship nursing students' total knowledge regarding external ventricular brain drain pre and post nursing guidelines implementation (n=40).****Figure No.2: Frequency distribution of satisfactory level of internship nursing students' total practice & attitude regarding external ventricular brain drain pre and post nursing guidelines implementation (no=40).**

Table no.2: Frequency distribution of satisfactory level of internship nursing students' practice & attitude regarding extra ventricular brain drain pre and post guidelines implementation (no=40).

Items	Pre		Post		X ²	P
	No	%	No	%		
EVD care:						
• Mandatory checks.	10	25	32	80	8.73	0.013*
• Hourly documentation.	7	17.5	31	77.5	11.94	0.001**
• Leveling the EVD system.	9	22.5	33	82.5	8.811	0.034*
• Dressing change.	15	37.5	40	100	18.56	0.001**
• Medication insertion	10	25	29	72.5	9.80	0.001**
• CSF sampling	5	12.5	29	72.5	8.65	0.001**
• Changing the EVD system set	8	20	32	80	7.31	0.001**
• Removal of EVD	4	10	27	67.5	4.61	0.001**
• ICP paper set up.	6	15	30	75	7.26	0.027*
• ICP zeroing measure.	5	12.5	26	65	5.59	0.018*
• Reading ICP.	8	20	35	87.5	6.735	0.034*
• ICP documentation.	7	17.5	33	82.5	8.571	0.003*
Nurses' attitude:						
• Attitude of physical safety	13	32.5	40	100.0	7.89	0.019*
• Attitude of emotional safety	23	57.5	30	75	6.087	0.014*
• Attitude of asepsis	17	42.5	36	90	9.861	0.007*
• Attitude of teaching	0	0.0	8	20	5.00	0.025*
• Attitude of documentation	6	15	35	87.5	11.6	0.001**

Table no.4: Correlation among variables of knowledge, practice and attitude regarding extra ventricular brain drain post guidelines implementation (n=40).

Items	Knowledge		Practice	
	r value	P value	r value	P value
Knowledge	-			
Practice	0.71	0.001		
Attitude	0.52	0.05	0.07	0.04

Conclusion

Nursing guidelines had statistically significant positive effect on internship nursing students' performance regarding external ventricular brain drain evidenced by most of the studied sample had

satisfactory knowledge, practice and attitude.

Recommendation

The periodic refreshing in-service training courses should be provided to

internship nursing students in order to keep them of updating knowledge and practice regarding external ventricular brain drain. Moreover critical care units should be supplied by a protocol about nursing care for extra ventricular brain drain.

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