

# Effect of External Ventricular Drain Care Guidelines on Nursing Practice and Complications among Patients with Post-Traumatic Hydrocephalus

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## ABSTRACT

**Background:** External Ventricular Drain (EVD) care is considered as an advanced specialized nursing skill for neurological patients. EVD care guidelines plays a vital role in improving nurses' practices regarding care of patients with EVD. The complications associated with EVD are strongly linked with nursing care as well as their level of practices. Unfortunately, in clinical settings most of nurses have incompetent EVD care practices. So, there is a dire need to adopt EVD care guidelines to improve their practices regarding EVD care.

**Objective:** To assess the effect of external ventricular drain care guidelines on nursing practice and complications among patients with post traumatic hydrocephalus.

**Methodology:** A quasi experimental study included 120 registered nurses and 80 patients selected with a purposive sampling technique. A 10 weeks educational intervention consists of PowerPoint lectures on EVD care guidelines of American Association of Neuroscience Nurses (AANN), audio visual demonstration (AVD) and hands on workshop practice sessions were given by the expert of relevant field to registered nurses on caring of patients with (EVD). Data on nurses' practices and complications among patients were collected two times before and after the intervention via validated tools.

**Results:** The study revealed a significant ( $p < 0.001$ ) change in nurses' practices and patients' complications after External ventricular drain (EVD) care guidelines implementation. The practices had been competent as 79 (65.8%) from 8(6.7%). The complication of meningitis in pre-guidelines implementation was 30 (75%) and post-guidelines implementation it was 13(32.5%). The kinking of tube was reduced from 4 (10.0%) to 3(7.5%). After guidelines implementation the rest of complications of EVD were also reduced among patients.

**Conclusion:** External ventricular drain (EVD) care guidelines of American Association of Neuroscience Nurses (AANN) significantly improve registered nurses practices which ultimately reduced the complications of EVD among patients.

**Key words:** Post Traumatic hydrocephalus, External ventricular Drain care guidelines, Registered Nurses, Practice, Complications, Patients

## INTRODUCTION

Post traumatic hydrocephalus (PTH) is a serious complication that follows a traumatic brain injury (TBI) (Jasey & Dabaghian, 2021). The incidence of post traumatic hydrocephalus in patients who suffered with TBI has been found to be 51 percent (Kowalski, Weintraub, Rubin, Gerber, & Olsen, 2018). PTH is linked with increased morbidity, disability and mortality in patients. External ventricular drain is one of the most common procedure for treatment of PTH (Chen et al., 2017).

External ventricular drain (EVD) is frequently used for removal of cerebrospinal fluid (CSF) in patients with post traumatic hydrocephalus and other neurological conditions (Hepburn-Smith et al., 2016). EVD placement is a lifesaving procedure in post-traumatic hydrocephalus (Fried et al., 2016).

Nursing is a growing profession that seeks for evidence-based practices to improve patient's outcomes. The management of EVD drain is mainly becomes a nursing responsibility (Oliveira Costa, Medeiros, Martins, Menezes, & Araújo, 2015). The practices regarding EVD was assessed by Ahmed N. A et al among 100 nurses in Cairo and found that 76% nurses have incompetent practices and 24% have competent practices (NA, SS, SE, & AE, 2021). Further, a study conducted by Tsai-Yun Hsieh (2018) among 110 nurses in Tainan. The study reported that external ventricular drain care practices of nurses were significantly improved from 12% to 100% after the implementation of educational intervention.

However complications of EVD arises due to invasive nature of the device. There are various complications of EVD such as infectious complications (Meningitis, Ventriculitis with an incidence of 45% (Hepburn-Smith et al., 2016). Mechanical complications of EVD is kinking of tube, failure of any part of system for example wet filter, EVD catheter migration, blockage of EVD, EVD dislodgement and catheter breakage. Physiological complications are hypo and hyper drainage of CSF and CSF leak from entry site (Muralidharan, 2015). EVD related prevention of infections is

important and nurses play a vital role in infection control (Fang et al., 2021).

The complications related to EVD was assessed by Sobral & Campos among 46 adult patients and found that 28% of them (n=13) presented complications, the most frequent being related to infectious causes (69%, n=9) and malfunctioning of the drainage valve (31%, n=4) (Sobral & Campos, 2012). Studies have shown that educational interventions with nurses have resulted in a 40%-50% reduction in invasive device related complications (Souza, 2020). External ventricular drain care guidelines in the form of a theoretical content and practical activity by hands on workshop is an effective strategy for nurses to improve their practices.

According to Talibi et al., (2020) implementation of evidence-based care bundle for reduction of EVD related infections. A total of 275 EVD (120 pre and 155 post EVD care bundle) inserted over a period of 1532 days were included. Pre care bundle the infection rate was 27%. After introduction of evidence based EVD care bundle infection rate declined to 10% ( $p < 0.001$ ) with the incidence from 21 to 9 cases per 1000 EVD days ( $p = 0.003$ ). After implementation of evidence based EVD care bundle can significantly decrease EVD infection rates (Talibi et al., 2020).

To the best of the researcher's knowledge, this study is the first of its kind in Pakistan, and no other research studies or trails on this topic among nurses have been published in Pakistani context. Therefore it will provide the platform to explore the phenomenon using quantitative research approach. The complications associated with EVD are strongly linked with nursing care as well as their level of practices. In clinical settings most of the nurses have incompetent EVD care practices. Therefore, competent nursing care practices are required to reduce the complications rates in patients with post traumatic hydrocephalus. The current study aimed to assess the effect of external ventricular drain care guidelines on nursing practice and complications among patients with post traumatic hydrocephalus.

## MATERIAL AND METHODS

The study objective was to assess the effect of external ventricular drain care guidelines on nursing practice and complications among patients with post traumatic hydrocephalus in a government hospital Lahore, Pakistan. The study was a quasi experimental (one group pre and posttest) conducted between September 2021 to February 2022. The target population of this study was included 120 registered nurses who were working in neurosurgery intensive care unit and high dependency unit of a government hospital Lahore, Pakistan. All registered nurses signed a written informed consent. The sample was drawn through purposive sampling technique. The registered nurses who gave informed consent were between the ages of 25-50 years and had no prior training and education on external ventricular drain care were included in the study and 80 patients aged 18 years or above, free from comorbidities were involved in study for complications assessment. A 10 weeks educational intervention consists of PowerPoint lectures on EVD care guidelines of American Association of Neuroscience Nurses (AANN), audio visual demonstration (AVD) and hands on workshop practice session were given by expert of this field. The registered nurses were divided into groups for practice sessions and each group comprised of 08 registered nurses. Data on nurses' practices and complications among patients were collected twice before and after the educational intervention through validated instruments.

The demographic form consists of age, Total years of job experience, and years of working in Neurological department, highest degree of qualification and department name. Data on practices was collected through 34 items of observational checklist which was designed from American Association of Neuroscience Nurses (AANN) Guidelines for EVD maintenance and removal (Jung, 2016). The right steps were scored one when done correctly and those done incorrectly or not done were scored zero. Practices was categorized as competent practices if score >75% and incompetent practice if score < 75% (Mohamed Maarouf & Faltas Marzouk Faltas, 2020). Complications was measured in the form of frequency with counts and percentages through observational sheet. The presence of complication was marked as yes (1) and No (0) for no complication in patients (Mansoor, 2020).

**Pilot study:** The pilot study was conducted on 10% of the study participants who were later excluded from the study sample and substituted with other nurses to test the applicability, clarity and efficacy of the tool and to estimate the time needed for data collection. The external ventricular drain care administered

questionnaire was modified according to the results of the pilot study. The reliability has been calculated through Cronbach's alpha which is 0.834. Content Validity index (CVI) of External ventricular drain care practices tool was also calculated which was 0.935.

Data was entered and analyzed by using Statistical package for social sciences (SPSS) version 23. For data analysis purpose, frequencies, percentages, mean and standard deviation were used as descriptive statistics while Wilcoxon signed rank test was used to compare the difference in pre and post-practice scores after educational intervention. The Fisher's exact test was used for all categorical data and expressed as frequency with counts and percentages. P value  $\leq 0.05$  will be considered as statistically significant.

## RESULTS

The mean age of participants was  $33.65 \pm 6.1$  years. Only 35(29.2%) participants had > than 5 Years of experience while 57 (47.5%) had 1-5 years of experience. Only 5 (4.2%) participants had MSN degree while 45 (37.5%) participants had diploma holder degree. Seventy three (60.8%) were from neurosurgery ICU department while 47 (39.2) participants was from high dependency department (Table 1).

Results indicated that before intervention 112 (93.3%) participants had incompetent practices whereas 8(6.7%) had competent practices. After educational sessions competent practices score was 79(65.8%) and incompetent practice score was 41(34.2%) (Table 2). On the other hand, results revealed that changes in mean of pre and post intervention. Pre intervention mean was 15.6250 and after intervention it was changed to 26.1750 (Table 3). Wilcoxon signed-rank test was used to compare the change in practices score of pre and post intervention. Results indicated that post intervention median change in practices scores was significant among participants (Table 4).

Results showed that before educational intervention frequency of meningitis was 30 (75%) and after educational intervention it was 13(32.5%). The kinking of tube was reduced from 4 (10.0%) to 3(7.5%). The rest of the complications also reduced from pre intervention to post intervention. The Fisher's exact test was used to compare the change in complications of pre and post intervention. Results indicated that after intervention mean reduction of complications was significantly occurred among patients (Table 5).

Table 1: Demographic characteristics of the participants

Variable	No.	Frequency (f)	Percentage (%)
Age (years)	25-35	82	68.3
	36-45	29	24.2
	>45	9	7.5
Mean $\pm$ S.D	33.65 $\pm$ 6.1		
Total years of job experience	< Than 1 years	28	23.3
	1-5 Years	57	47.5
	> Than 5 Years	35	29.2
	Total	120	100.0
Years of working in Neurosurgery department	< Than 1 years	41	34.2
	1-5 Years	46	38.3
	> Than 5 Years	33	27.5
	MSN	5	4.2
Highest degree	Generic BSN	31	25.8
	Post RN BSN	39	32.5
	Diploma holder	45	37.5
Recent working department name	Neurosurgery ICU	73	60.8
	High dependency unit	47	39.2

Table 2: Pre and Post intervention of external ventricular drain care practices score among Nurses (n=120).

Variables	Category	Pre- intervention	Post- intervention
Practices	Incompetent practices	112(93.3%)	41(34.2%)
	Competent practices	8(6.7%)	79(65.8%)

Table 3: Comparison of practice scores pre and post intervention (n=120)

Variable	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25 <sup>th</sup>	50 <sup>th</sup> (Median)	75 <sup>th</sup>
Pre_practices score	120	15.6250	4.40600	7.00	29.00	13.0000	15.0000	15.0000
Post_practices score	120	26.1750	2.31423	18.00	32.00	25.0000	26.0000	27.0000

Table 4: Wilcoxon signed rank test for Comparison of practice scores pre and post intervention (n=120)

Variable	Pre-intervention	Post- intervention	Median difference	z-value	Sig.
Practices score	15.00	26.00	11.00	-9.372	.000

Table 5: Pre and Post guidelines implementation on complications among patients with post-traumatic hydrocephalus (n=80).

Complications	Pre-guidelines complications in patients		Post-guidelines complications in patients		p_value
	yes		yes		
	f	%	f	%	
Meningitis	30	75.0	13	32.5	0.00
Kinking of tubing	4	10.0	3	7.5	0.50
Wet filter	1	2.5	0	0.0	0.50
Migration of EVD catheter	1	2.5	0	0.0	0.50
EVD blockage	8	20.0	6	15.0	0.38
EVD dislodgement	2	5.0	1	2.5	0.50
Catheter breakage	1	2.5	0	0.0	0.50
Hypo and hyper	7	17.5	6	15.0	0.50
CSF leak	4	10.0	2	5.0	0.33

**DISCUSSION**

The current study aims to assess the effect of external ventricular drain care guidelines on nursing practice and complications among patients with post traumatic hydrocephalus. The study results showed that nearly all registered nurses had incompetent practices before education on external ventricular drain (EVD) care. The results can be justified as registered nurses had no previous education in this essential skill. The results are also supported by Ahmed N. A et al showed that 76% registered nurses had incompetent practices and 24% have competent practices in Cairo. In Pakistan, the availability of published literature is limited regarding EVD care and its complications. A cross-sectional study was conducted by Masood Uz Zaman Babar *et al* at Liaquat University of Medical & Health Sciences Hyerabad. The study reported that EVD infection rate was 78(85.7%) among patients. A clearly defined guideline on different aspects of integration and maintenance can be a useful approach for reducing the frequency of EVD related infections (Babar, 2021).

The study shown that significant (p <0.001) improvement in practices of registered nurses was found after education based on American Association of Neuroscience Nurses (AANN) Guidelines for EVD care. The results are consistent with the findings of a research done by Dina Mohamed Maarouf reported a significant improvement in registered nurses' practices from the median in pretest results was 5% while in posttest was 75% with (p =0.001) in Egypt. The results were in accordance with the study conducted in Tainan by Tsai-Yun Hsieh. The study reported similar results to our study that the pre intervention practices of nurses were incompetent while after educational intervention practices of nurses were significantly improved with consistent rate from 12% to 100% (p<0.000).

The results of the present study was supported by Talibi et al which was based on implementation of evidence based care bundle for reduction of EVD related infectious complications. The results of the study were align with our results as pre care bundle the infection rate was 27% while after EVD care bundle introduction the infection rate declined to 10% (p<0.001). Moreover a study conducted by YangLiM and Med supported our study results that educational intervention at the neurosurgery intensive care unit staff reduced EVD related complications among patients. The results of study showed that 38 of 693 (5.48%) patients presented with complications in pre intervention while in post intervention complications incidence decreased by 52.19% (P < .0001) to 58 of 2211 (2.62%) patients.

To our knowledge, this is the first study conducted in a public hospital Lahore, Pakistan, to determine the effectiveness of the American Association of Neuroscience Nurses (AANN) Guidelines in the education of EVD care and evaluating the outcomes concerning registered nurse practices and complications among patients. This study is useful for faculty and programme directors in charge of pre-service nursing curriculum reform in colleges of nursing. However, there are certain limitations, such as the study is single-center and the lack of a control group, which may restrict its actual usefulness.

**CONCLUSION**

This study supports the American Association of Neuroscience Nurses (AANN) Guidelines in improving nurse's practices regarding EVD care and reduction of EVD associated complications among patients as well. The significant gain in practices scores occurs meanwhile a significant reduction in patient's complications occurs after guidelines implementation.

**Recommendations:** The current study adds significant contribution to the existing literature by demonstrating how to employ the American Association of Neuroscience Nurses (AANN) EVD care guidelines in the nursing care of patients with EVD.AANN guidelines of EVD care must be included in the curriculum of nurses in Pakistan. The periodic refreshing in-service training courses should be provided to nurses in order to keep their practices updated regarding external ventricular drain care. Furthermore critical care units should be supplied by AANA guidelines regarding nursing care for EVD care. The study should be conducted in multicenter settings to assess effectiveness of AANA guidelines of EVD care.

**Conflict of Interest:** Nil

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