



Evaluation of Critical Care Nurses' Compliance with the External Ventricular Drain Care Bundle for Critically ill Patients at Kenyatta National Hospital

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Abstract

Introduction: *The External Ventricular Drain (EVD) care bundle involves insertion, maintenance, troubleshooting, and monitoring for issues related to EVD, which is primarily the responsibility of nurses. Despite significant efforts to address external ventricular drain-related infections (ERIs) in CCUs and other critical care units, current studies suggest a high prevalence rate of external ventricular-related infections, particularly in LMICs and low-resource settings.*

Material and Method: *A mixed-method study was conducted at KNH Critical Care Units with a sample of 81 nurses. Data analysis of Quantitative continuous data was summarized using medians and interquartile ranges, and Categorical data was summarized using frequencies and proportions. Qualitative data was analyzed using manual thematic analysis.*

Results: *Most respondents were between 30 and 40 years old, 43.2%, females were 75.3%, higher diplomas were 54.3%, and 4.9% specialized in EVD care. 48.1% had good knowledge of the EVD care bundle, 46.9% had fair knowledge, and 5% had poor knowledge. Binary logistic regression and chi-square tests showed no factors associated with knowledge of the EVD care bundle ($P > 0.05$ chi-square). A basic diploma and no specialization in EVD care were associated with higher odds of a poor or fair knowledge of the EVD care bundle.*

Conclusion: *Most nurses exhibited fair practice of EVD care bundle but Lacked continuous medical education on EVD care, poor supervision and feedback on EVD care practice, and guidelines on EVD care not being easily accessible and understandable emerged as substantial perceived barriers to EVD care bundle utilization.*

Introduction

For neurologically intense patients with increased intracranial pressure, inserting an external ventricular drain (EVD) is the first life-saving procedure. Despite therapeutic functions,

continuous Intracranial Pressure (ICP) monitoring plays a significant role in the subsequent treatment decision (Khalaveh et al., 2021). Even if it's an important tool, EVD use has been associated with many complications, including hemorrhage,

misplacement, dislodgement, blockage, and, most significantly, infection (Hagel et al., 2014).

In the African context, scarce information has been published on the same. However, a study done in Ethiopia found the prevalence rate of EVD-associated infections to be 25.8% out of a sample of 93 patients. This study showed that 11.8% of the patients died because of EVD-related infections. In comparison, 43% of the patients died in total, and the mortality rate from EVD-associated complications was 45.8% after being diagnosed (Wondafrash & Tirsit, 2021).

The nurse's role in managing and preventing complications in a patient with EVD is critical. With proper training, EVD EVD-related infection will be minimized (Fang et al., 2021), coupled with high-quality nursing care (Whyte et al., 2020). Managing patients with an external ventricular drain remains a crucial nursing role, and patient outcome relies on nurse performance. Several studies have documented various reasons for EVD-related complications, but few have documented predictors of nurse performance regarding care of external ventricular drain (Aslam et al., 2022a)

This study has not been conducted in Kenya, and no other study or trial on this topic has been published in Kenya. This research will, therefore, provide a platform to explore the phenomenon using quantitative and qualitative research approaches.

Objectives of the Study

To evaluate Critical Care Nurses' Compliance with the External Ventricular Drain Care Bundle for Critically Ill Patients at Kenyatta National Hospital

Material and Methods

The study was approved by KNH-UON ERC approval number P493|05|2023, the institutional review board, and informed consent was obtained from all study participants.

Study type: This was a mixed-method study.

The study population of 81 critical care nurses having the quantitative aspect entailing data collection on nurses to answer the objectives on knowledge of nurses on the use of EVD care bundles, practice level on EVD care bundle and the barriers to utilization of EVD care bundle and qualitative aspect entailing data collected through in-depth interviews to answer the objective on resources available for utilization of EVD care bundle.

Participant selection: Included nurses who, at the time of the study, were actively working in the Intensive Care Unit (ICU) and targeting nurses engaged in direct patient care within the ICU. We excluded nursing students who were undergoing clinical placements in the ICU during the study period, nurses on leave during the study period, nurses who had less than six months of experience in the ICU, and nurses who had never interacted with an External Ventricular Drain (EVD) were not included in our study.

Study variables: Independent variables included demographic factors (age, sex), years of nursing experience, educational level, specialization, nurses' knowledge of ERI prevalence, adherence to EVD policies and SOPs, types of EVD used, and access to CMEs/updates on EVD. Dependent variables were knowledge regarding the EVD care bundle, utilization of the EVD care bundle, barriers that hindered the utilization of the EVD care bundle, and the availability of resources necessary for the utilization of the EVD care bundle.

Results

A. Socio-demographic characteristics of the study participants

This study included 81 nurses working in the critical care unit at Kenyatta National Hospital. Of the 81 nurses, the majority, 43.2% (n = 35), were aged between 30 and 40 years, followed by those above 40 years at 34.6% (n = 28). The rest were aged below 30 years.

75.3% (n = 61) of the participating nurses were females, and the rest were males with academic

qualifications of 54.3% (n = 44) of the nurses being holders of a higher diploma, 27.2% (n = 22) graduates and 12.3% (n = 10) were holders of a basic diploma. The rest were postgraduates.

Up to 49.4% (n = 40) had worked for more than ten years, 28.4% (n = 23) less than five years, and the rest had worked for 5 to 10 years. Four nurses out of the eighty-one had specialized in caring for patients with external ventricular drains.

Table 1: Sociodemographic characteristics of study participants

Characteristic	Description	Frequency/Median	(%)/IQR
Age in years		35.0	30.0, 44.0
	Less than 30 years	18	22.2
	30 to 40 years	35	43.2
	More than 40 years	28	34.6
Gender	Female	61	75.3
	Male	20	24.7
Educational Qualification	Diploma	10	12.3
	Higher Diploma	44	54.3
	Bachelors	22	27.2
	Postgraduate	5	6.2
Experience in years	Less than five years	23	28.4
	5 to 10 years	18	22.2
	More than ten years	40	49.4
Specialization in EVD care	Yes	4	4.9
	No	77	95.1

B. The level of knowledge of EVD care among critical care nurses

All the nurses (100%) responded positively that hand hygiene was necessary when handling EVD-related tasks. Of the 81 nurses, 87.7% (n = 71) said wearing sterile gloves when changing EVD dressings was required. When asked whether using aseptic techniques when performing EVD procedures was important, 96.3% (n = 78) of the nurses responded in the affirmative. All the nurses

agreed that it was a necessity to do documentation after carrying out EVD care. Other correct responses were aseptic techniques when obtaining cerebrospinal fluid sample 92.6% (n = 75), the appropriate positioning of the patient’s head 97.5% (n = 79), and keeping EVD drainage bag below the position of the patient’s head 77.8% (n = 63). Further, the following variables were explored on the impact of EVD care knowledge among critical care nurses

Table 2: Knowledge of EVD care among critical care nurses (N = 81)

No	Statement	Frequency	Percent
1.	Proper hand hygiene when handling EVD-related tasks	81	100
2.	Wear sterile gloves during EVD dressing changes	71	87.7
3.	Aseptic technique when performing EVD procedures	78	96.3
4.	Documentation of EVD care procedures	81	100
5.	Cerebrospinal Fluid samples be obtained aseptically	75	92.6
6.	Appropriate positioning of the patient's head	79	97.5
7.	The EVD drainage bag should be kept below the level of the patient's head	63	77.8
8.	Potential complications associated with improper EVD care		
	Infections	77	95.1
	Fluid and electrolyte imbalance	32	39.5
	Blocked drain	74	91.4
	Excess drainage	74	91.4
	CSF leakage	70	86.4

9	When should you clamp The EVD?		
	Before the patient sits up	52	64.2
	While transporting the patient	65	80.2
	When changing the patient's position	61	75.3
10	It is not a nursing responsibility to care for a patient with EVD		
	Replacing a ventricular drain	70	86.4
	Ensure proper alignment of the transducer	28	34.6
	Monitoring ICP readings	26	32.1
	Monitoring drainage	24	29.6

i). Overall knowledge of external ventricular drainage care

The overall knowledge of external ventricular care was derived from the percentage score for individual nurses, which was classified using Bloom's modified cut-off points.

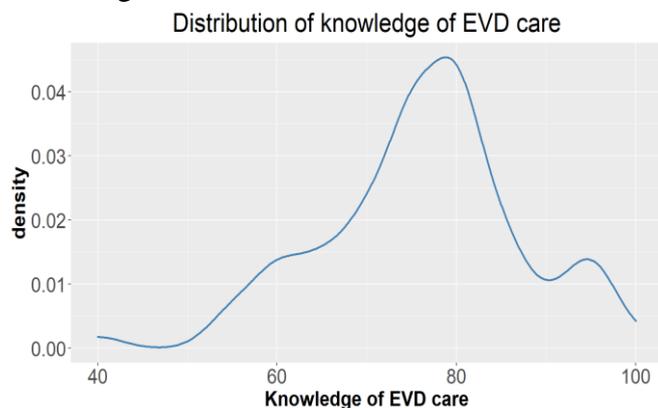
Table 3: Knowledge classified using Bloom's modified cut-off points.

Grade	Score
Poor	<60%
Fair	60-79%
Good	≥80%

ii). Distribution of knowledge of EVD care

The distribution of knowledge of EVD care among critical care nurses was left-skewed, with a median of 75% and an interquartile range of 70% to 80%. The lowest score was 40%, and the highest was 100%, with a mean knowledge score of 76.2%.

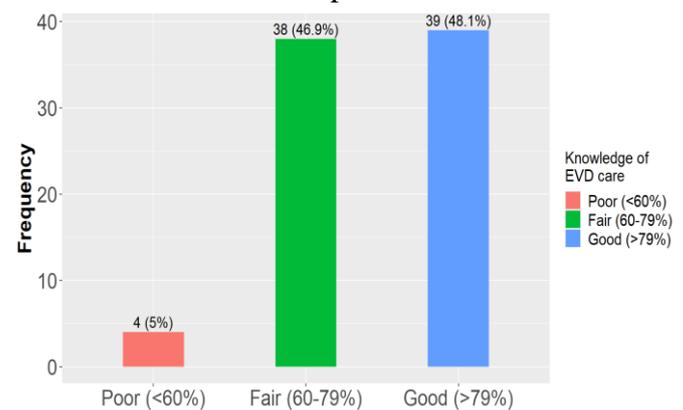
Figure 1: Density plot showing the distribution of knowledge of EVD care



iii). Overall knowledge score based on Bloom-modified cut-off points

The majority, 48.1% (n = 39) of nurses got a good score, followed by those with a fair score at 46.9% (n =38). The rest got a poor score.

Figure 2: Overall knowledge score based on Bloom-modified cut-off points



iv.) Factors associated with knowledge of EVD care bundle among nurses

The odds of having poor to fair knowledge among nurses aged between 30 and 40 years was 4% less than those of nurses aged under 30 years, OR 0.94 (95% CI 0.30, 2.94). Nurses who were aged above 40 years were 33% more likely to have poor to fair knowledge compared to nurses aged below 30 years, OR 1.33 (95% CI 0.41, 4.38)

Table 4: Factors associated with knowledge of external EVD care bundle among nurses

Factor	Description	Knowledge of EVD care		Crude OR (95% CI)	P value
		Poor to fair	Good		
Age in years	Less than 30 years	9	9	<i>Reference</i>	
	30 to 40 years	17	18	0.94 (0.30, 2.94)	0.93
	More than 40 years	16	12	1.33 (0.41, 4.38)	0.64
Gender	Female	34	27	1.89 (0.68, 5.28)	
	Males	8	12	<i>Reference</i>	
Level of education	Diploma	6	4	<i>Reference</i>	
	Higher Diploma	24	20	0.8 (0.20, 3.23)	0.75
	Bachelors and above	12	15	0.53 (0.12, 2.33)	0.40
Specialization in EVD care	No	40	37	1.08 (0.144, 8.07)	
	Yes	2	2	<i>Reference</i>	
Experience in years	≤5 years	10	13	<i>Reference</i>	
	6 to 10 years	11	7	2.04 (0.58, 7.17)	0.26
	>10 years	21	19	1.44 (0.51, 4.03)	0.49

C. Critical Care Nurses’ practice level on the EVD care bundle

These are responses to standard practices when handling patients with EVDs or carrying out

EVD-related procedures, which aim to find out whether nurses practice the right way when carrying out procedures.

Table5: Practice management when handling EVD

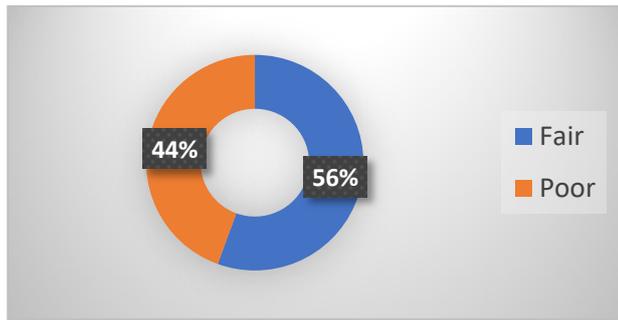
Practice areas	Frequency	Percent (%)
EVD Management		
1. Hand hygiene and PPE		
Hand hygiene before interacting with the EVD system	65	80.2
The nurse wears appropriate PPEs	81	100
2. Patient position procedure		
Headboard angle between 15 and 30	81	100
Keeps the head in a neutral position aligned to the cervical spine	81	100
3. Change of patient dressing procedure		
Assesses the EVD catheter dressing for cleanliness, integrity, and proper adhesions	81	100
Changes the dressing aseptically if it is soiled, loose, or as per hospital policy	36	44.4
4. Tubing care procedure		
Aseptic technique while handling tubing, handling kept to a minimum	57	70.4
Drainage bag emptied when reaches ¾ of its volume capacity	17	21.0
Check for signs of catheter obstruction	55	67.9
5. Documentation procedure		
The nurse accurately documents EVD care observations and interventions in the patient’s medical records	66	81.5
The nurse documents CSF output and other relevant measurements	81	100
Nurse documents CSF appearance (clear, cloudy)	71	87.7
Drain leveled (e.g., tragus/mid-sagittal line)	0	

80.2% (n = 65) of the nurses practiced hand hygiene before interacting with the EVD system, and PPEs (100%) were used appropriately for patients or carrying out EVD procedures. Others are 100% for headboard angle between 15 and 30, change of the dressing aseptically if it was soiled and loose or as per hospital policy was practiced by 44.4% (n = 36) of the respondents.

i). Overall score on practice management when handling EVDs

The majority, 56% (n = 45), demonstrated fair practice in managing external ventricular drains. The rest showed the poor practice of EVD management

Figure: Overall practice management of external ventricular drains



D Perceived barriers to the effective utilization of EVD care bundle by CCNs at KNH

The perceived barriers or challenges that were associated with the effective utilization of EVD care bundle by the critical care nurses were distributed as below;

Table: Perceived barriers to the effective utilization of EVD care bundle (N = 81)

Perceived Barriers	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Implementing an EVD care bundle is time-consuming	24 (29.6%)	44 (54.3%)	3 (3.7%)	7 (8.6%)	3 (3.7%)
Adequate resources are available for EVD care	10 (12.3%)	26 (32.1%)	10 (12.3%)	25 (30.9%)	10 (12.3%)
There is clear communication regarding EVD care bundle protocols	11 (13.6%)	30 (37%)	10 (12.3%)	21 (25.9%)	9 (11.1%)
There is a lack of awareness about the importance of EVD care bundle	8 (9.9%)	24 (29.6%)	2 (2.5%)	37 (45.7%)	10 (12.3%)
Staffing levels are sufficient to provide thorough EVD care	16 (19.8%)	27 (33.3%)	8 (9.9%)	22 (27.2%)	8 (9.9%)
There is a lack of proper training on EVD care bundle implementation	9 (11.1%)	13 (16%)	9 (11.1%)	37 (45.7%)	13 (16%)
Adhering to the EVD care bundle is integrated well into our daily routine	10 (12.3%)	24 (29.6%)	14 (17.3%)	28 (34.6%)	5 (6.2%)
There is a high level of teamwork and collaboration when implementing the EVD care bundle	5 (6.2%)	27 (33.3%)	7 (8.6%)	32 (39.5%)	10 (12.3%)
There is a need for more support from management to prioritize EVD care bundle adherence.	3 (3.7%)	10 (12.3%)	4 (4.9%)	30 (37%)	34 (45.7%)
EVD care bundle guidelines are easily accessible and understandable	11 (13.6%)	32 (39.5%)	12 (14.8%)	15 (18.5%)	10 (12.3%)
Workload demands make it difficult to follow the EVD care bundle consistently	4 (4.9%)	25 (30.9%)	7 (8.6%)	33 (40.7%)	12 (14.8%)
There is adequate supervision and feedback on EVD care bundle practices.	10 (12.3%)	36 (44.4%)	14 (17.3%)	16 (19.8%)	5 (6.2%)
The EVD care bundle's effectiveness in improving patients' outcomes is evident	3 (3.7%)	16 (19.8%)	7 (8.6%)	34 (42%)	21 (25.9%)
There is a lack of standardized documentation for EVD care bundle procedures.	4 (4.9%)	17 (21%)	10 (12.3%)	41 (50.6%)	9 (11.1%)
Nurses are motivated to adhere to the EVD care bundle due to its benefits.	10 (12.3%)	24 (29.6%)	15 (18.5%)	24 (29.6%)	8 (9.9%)
There is a need for ongoing education and training about the EVD care bundle.	3 (3.7%)	10 (12.3%)	2 (2.5%)	20 (24.7%)	46 (56.8%)
conflicts between different care protocols hinder EVD care bundle	9 (11.1%)	22 (27.2%)	15 (18.5%)	24 (29.6%)	13 (16%)
The physical layout of the CCU supports EVD care bundle implementation	12 (14.8%)	20 (24.7%)	11 (13.6%)	31 (38.3%)	7 (8.6%)

Discussion

A). Knowledge of external ventricular drain bundle of care

EVD bundle of care guidelines are critical in refining nurses' practices regarding managing patients with EVD (Aslam et al., 2022). The overall knowledge score in our study was 48.1% (good>79%), 46.9% (fair-60 to 79%), and 5% (poor<60%). The findings regarding the low level of knowledge among Critical care nurses in the study were consistent with the prior research done in Egypt. Cairo found that less than one-third of nurse interns had competent expertise in using EVDs in patient management (Ahmed et al., 2021), and similar were matched with those of Rychik et al. (2019).

Electrolyte imbalance was not mentioned as one of the complications of EVD insertion despite it being one of the critical complications, as found by another study by Ackerman et al.(2022).

B). Practice level on the EVD care bundle among critically ill patients

Correct and responsible nursing care may improve outcomes for patients needing CSF drainage (Muralidharan, 2015). In the current study, 56% of the respondents scored fair (60-79%) on practice and 44% scored poorly (<60%). Aslam and colleagues have reported a practice competency level of 6.7% before the implementation of EVD care guidelines (Aslam et al., 2022), where the differences in the two studies could result from the scoring used.

C). Perceived barriers to effective utilization of EVD care bundle

The current study revealed that continuous medical education on EVD care was strongly required. There was a lack of supervision and feedback on EVD care practice, guidelines on EVD care were not easily accessible and understandable, there was not enough support from the management on EVD care, and implementation of EVD care guidelines was

considered time-consuming. Contrary to the current study, where EVD care guidelines were considered time-consuming, it has been demonstrated that implementation of EVD care guidelines plays a crucial role in effectively managing patients with EVDs, including reducing infections (Reiter et al., 2023).

Conclusions

The findings of this study contribute to a deeper understanding of the EVD care bundle. It was evident that nurses had fair or reasonable knowledge of the EVD care bundle. The majority of the nurses exhibited fair practice in the EVD care bundle. However, several barriers hindered compliance with the EVD care bundle. Lack of continuous medical education on EVD care, lack of supervision and feedback on EVD care practice, and guidelines on EVD care not being easily accessible and understandable emerged as substantial perceived barriers to EVD care bundle utilization

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References

1. Ackerman, K., Mohammed, A., Chinthala, L., Davis, R. L., Kamaleswaran, R., & Shafi, N. I. (2022). Features derived from blood and intracranial pressure predict elevated intracranial pressure events in critically ill children. *Scientific Reports*, *12*(1), 21473. <https://doi.org/10.1038/s41598-022-25169-3>
2. Aslam, H., Afzal, M., Sarwar, H., & Khan, S. (2022). Effect of External Ventricular Drain Care Guidelines on Nursing Practice and Complications among Patients with Post-Traumatic Hydrocephalus. *Pakistan Journal of Medical and Health Sciences*,

- 16(2), 1128–1131.
<https://doi.org/10.53350/pjmhs221621128>
3. Hagel, S., Bruns, T., Pletz, M. W., Engel, C., Kalff, R., & Ewald, C. (2014). External Ventricular Drain Infections: Risk Factors and Outcome. *Interdisciplinary Perspectives on Infectious Diseases*, 2014, 708531.
<https://doi.org/10.1155/2014/708531>
 4. Reiter, L. A., Taylor, O. L., Jatta, M., Plaster, S. E., Cannon, J. D., McDaniel, B. L., Anglin, M., Lockhart, E. R., & Harvey, E. M. (2023). Reducing external ventricular drain associated ventriculitis: An improvement project in a level 1 trauma center. *American Journal of Infection Control*, 51(6), 644–651.
<https://doi.org/10.1016/j.ajic.2022.08.029>
 5. Reiter, L. A., Taylor, O. L., Jatta, M., Plaster, S. E., Cannon, J. D., McDaniel, B. L., Anglin, M., Lockhart, E. R., & Harvey, E. M. (2023). Reducing external ventricular drain associated ventriculitis: An improvement project in a level 1 trauma center. *American Journal of Infection Control*, 51(6), 644–651.
<https://doi.org/10.1016/j.ajic.2022.08.029>
 6. Wondafrash, M., & Tirsit, A. (2021). Prevalence of Ventriculostomy Related Infections and Associated Factors in Low Income Setup. *Ethiopian Journal of Health Sciences*, 31(6), 1257–1266.
<https://doi.org/10.4314/ejhs.v31i6.22>