

Beyond the drain: exploring nursing expertise in external ventricular drainage management

P. G. N. Danushka¹, M. R. Jayasinghe², Y. Jeyaratnam³, A. M. D. K. Aththanayaka¹

¹National Hospital of Sri Lanka, Colombo, Sri Lanka

²University Hospitals Plymouth NHS Trust, Derriford Hospital, Plymouth, United Kingdom

³Faculty of Medicine, University of Colombo, Sri Lanka

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Abstract

Introduction

External ventricular drainage (EVD) is critical in managing neurocritical patients. Proper nursing care is essential for infection prevention, troubleshooting, and routine maintenance of EVD. This study aims to assess the knowledge among the nursing officers working at a tertiary care neurocritical care center in Sri Lanka regarding the principles and practices of EVD management.

Methodology

This study employed a descriptive cross-sectional design to assess nursing officers' knowledge and practices regarding EVD management. Data were collected using a pre-tested, self-administered questionnaire designed to evaluate key domains, including EVD function, maintenance, infection prevention, and troubleshooting.

Results

There were 172 nursing officers, their mean age of 30.34 ± 4.98 , and the majority (94.2%) were females. Out of the sample, 29% had more than 5 years of clinical experience, and 92.4% had not received formal training on nursing care on EVD. The mean knowledge was 84.45%, and more than 88% had over 75% score. Knowledge was significantly associated with having a formal training in EVD care ($p=0.025$).

Conclusion

Most nursing officers in neurocritical care have good knowledge about EVD management. More than 88% scored above 75%. Having formal training would enhance the level of knowledge. This shows that formal training is important to keep improving care for patients with EVD.

Correspondence: P. G. N. Danushka

E-mail: danupiti@gmail.com

 <https://orcid.org/0000-0001-6068-6081>

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Introduction

External ventricular drain (EVD) insertion is a commonly performed procedure in neurosurgery units. This procedure is often done as a life-saving procedure in emergency conditions like acute hydrocephalus [1]. An EVD is a catheter that is percutaneously introduced into the frontal horn of the lateral ventricle using a twist drill or burr hole and connected to an external transducer, which can be used for both diagnostic measuring of intracranial pressure (ICP) and therapeutic purposes, such as cerebrospinal fluid (CSF) drainage [2].

This form of treatment can elevate the likelihood of infections like meningitis and catheter-related ventriculitis, leading to higher rates of illness and death. The occurrence of these infections ranges from approximately 2% to 27%, depending on factors such as the duration the catheter remains in place, the patient's underlying condition, the method used for catheter insertion, the type of drainage device, and how the device is managed [3]. The American Association of Neuroscience Nurses' guidelines have been proven effective in preventing EVD-related infections. Many centers have developed bundles and protocols proven to lower the risk of infection, similar to what we have seen in procedures such as central lines. At Riverside Methodist Hospital in Central Ohio, there was no reported EVD infection for almost two years after the EVD bundle application.[2]

Reducing the risk of infection in these patients helps lower healthcare costs by minimizing the length of hospital stays and resource consumption. It also contributes to improved clinical outcomes. Additionally, improper handling of medical devices, often linked to inadequate training among healthcare staff, is a common cause of adverse events [4].

Once an EVD is inserted, its monitoring, maintenance, and troubleshooting primarily fall under the responsibility of the nursing staff. Providing precise and responsible nursing care can significantly contribute to improved outcomes in patients who need cerebrospinal fluid drainage.[5]

Nursing officers play a crucial role in the monitoring and

maintenance of EVDs. Their responsibilities encompass several key areas, including infection prevention through strict hand hygiene, sterile dressing changes, and minimizing catheter manipulation. They are also tasked with monitoring CSF drainage, ensuring that the drainage system is positioned correctly in relation to the patient's anatomical reference point. Additionally, nursing officers are responsible for troubleshooting potential complications, such as identifying early signs of blockage, over-drainage, or CSF leakage. Proper patient care is essential, including positioning the patient to maintain optimal drainage and monitoring for any neurological deterioration[6].

The study aims to evaluate the awareness and knowledge of nursing officers at a tertiary care neurocritical care center in Sri Lanka about managing EVDs. It focuses on assessing their understanding of EVD indications, insertion, and monitoring, as well as current practices in infection prevention, troubleshooting, and cerebrospinal fluid drainage. The study also seeks to identify challenges faced by nurses in EVD management and plans to develop a targeted educational program to improve their knowledge and clinical practices.

Methodology

This study was conducted as an audit aimed at evaluating the awareness and practices related to EVD management among nursing officers working at a tertiary care neurocritical care center in Sri Lanka. The audit was carried out within the Neurocritical Care Units, including Intensive Care Units and Neurosurgical Wards. All nursing officers with direct patient care responsibilities who were actively involved in EVD management during the study period were included. Since the audit encompassed the entire nursing staff involved at a tertiary care neurocritical care center in Sri Lanka. Clinical experience is categorized as less than 5 years or 5 years or more, differentiating early career and experienced nursing officers for analysis.

Data were collected using a pretested self-administered structured questionnaire designed to assess knowledge and practices related to different aspects of EVD management, including indications for EVD insertion, troubleshooting, and potential complications such as infections and blockages. The questionnaire was developed and reviewed in collaboration with experts in the neurocritical care field to ensure its relevance and content validity. The questionnaire was completed individually by nursing officers during working hours without interviewer assistance.

summarize findings related to adherence to established EVD management protocols, identification of knowledge gaps, and evaluation of current nursing practices. As this study involved auditing existing clinical practices, formal ethical clearance was not required; however, ethical principles were strictly upheld throughout the process. Informed consent was obtained from all participating nursing officers to ensure voluntary participation with full awareness of the audit's objectives. Confidentiality was maintained by anonymizing all participant data, securely storing the information with restricted access, and reporting the results in aggregate form to prevent disclosure of sensitive or identifying information.

Results

A total of 172 nursing officers participated in the study. The mean age of the participants was 30.34 ± 4.98 years, and the majority were female, with the ratio of 8:2 among the participants. Socio-demographic characteristic is represented in Table 1.

Table 1: Frequency distribution of Socio-demographic characteristics among the study population

Description	Number
Age	30.34 ± 4.98
Gender	
Female	162 (94.2%)
Male	10 (5.8%)
Marital status	
Married	87 (50.6%)
Unmarried	85 (49.4%)
Experience	
More than 5 years experience	29 (16.8%)
Less than 5 years experience	143 (83.2%)
Training	
Formal training in EVD care	13 (7.6%)
No formal training in EVD care	159 (92.4%)

Regarding professional experience, 16.8% of nursing officers had more than five years of clinical experience, while 83.2% had less than five years of experience. A substantial proportion (92.4%) had not received any formal training specifically related to nursing care for patients with EVD.

Assessment of knowledge revealed a mean score of 84.45%, indicating a generally high level of understanding among the participants. Notably, more than 88% of the nursing officers achieved a knowledge score exceeding 75%. Distribution of correct responses to knowledge regarding EVD care is represented in Table 2.

Descriptive statistics were utilized to analyze the data and

Table 2: Distribution of correct responses to knowledge regarding EVD care

Description	Correct responses Number (Percentage)
Primary function of an EVD	171 (99.4%)
Normal color of CSF	171 (99.4%)
Normal intracranial pressure (ICP) range	156 (90.7%)
Normal daily production volume of CSF	127 (73.8)
Importance of maintaining a closed EVD system	155 (90.1%)
Number of ventricles in the human brain	166 (96.5%)
Condition caused by obstruction of CSF flow	140 (81.4%)
Symptoms indicating raised intracranial pressure	167 (97.1%)
Explanation of the Monro-Kellie hypothesis	146 (84.9%)
Components and significance of Cushing's triad	152 (88.4%)
Optimal tip placement location of an EVD catheter	108 (62.8%)
Best patient position for effective EVD drainage	146 (84.9%)
Effect of EVD chamber height on CSF drainage	147 (85.5%)
Importance of hourly CSF observation	135 (78.5%)
Clinical significance of changes in CSF color or consistency	163 (94.8%)
Appropriate actions if CSF appears cloudy or bloody	158 (91.9%)
How an obstructed EVD can lead to hydrocephalus	147 (85.5%)
Importance of strict aseptic technique during EVD maintenance	160 (93%)
Precautions during patient transfer with an EVD to avoid complications	58 (33.7%)
When to report excessive CSF drainage to the medical team	133 (77.3%)

Statistical analysis demonstrated that formal training in EVD care was significantly associated with higher knowledge scores ($P=0.025$). In contrast, no significant associations were observed between knowledge scores and other variables such as age, gender, or general clinical experience.

These findings suggest that while the overall knowledge regarding EVD care was high among the nursing officers, EVD care training played a critical role in enhancing their knowledge. The lack of formal EVD-specific training among most participants highlights a potential area for targeted educational interventions to further improve nursing care quality in this context.

Discussion

Nursing officers play a crucial role in the monitoring and maintenance of EVDs. The general aim of this study is to assess the awareness and knowledge of nursing officers at a tertiary care neurocritical care center in Sri Lanka regarding EVD management and identify gaps in best practices. In addition, various socio-demographic characteristics were outlined, and the study aimed to explore the relationship between knowledge and practices. This chapter, therefore, presents a discussion of the current findings in relation to the study objectives, while drawing comparisons with previous research and existing literature.

The results showed that most of the participants were female. This could be attributed to the historical perception of nursing as a predominantly female profession, with women traditionally making up the majority of those pursuing nursing education [7]. The majority of participants were young adults, primarily within the 30 – 40 age range. Individuals in this age group are typically active, capable, and in their most productive years [7]. Furthermore, majority of them had less than 5 years of work experience, which is consistent with the previous literature(8). Also, majority of them didn't receive any formal training in EVD care[5].

The present study highlights a generally high level of knowledge among nursing officers regarding EVD care, with a mean score of 84.45% and over 88% of participants scoring above 75%. This finding is encouraging, as effective nursing care is critical to the safe management of patients with EVDs, which are widely used to monitor and control intracranial pressure by draining CSF in neurosurgical and neurocritical care settings [9]. However, our study also reveals a significant gap in formal training, with 92.4% of nurses lacking specialized education in EVD care, underscoring an urgent need for structured training programs.

The significant association between EVD care and higher knowledge scores ($P=0.025$) underscores the importance of targeted educational interventions. This aligns with existing guidelines and literature emphasizing that specialized training improves nurses' competence in managing EVD systems, including proper catheter maintenance, aseptic techniques during CSF sampling, and vigilant monitoring for complications such as infection, obstruction, or hemorrhage. [2,5]. Nurses play a pivotal role in continuous assessment of the drainage system, neurological status, and early identification of warning signs such as changes in consciousness, headache, nausea, or signs of infection, which are critical to preventing adverse outcomes [10]. There was no statistical significance seen between socio-demographic factors and knowledge score. This finding was confirmed by an existing literature [11].

This study's findings emphasize the critical need to develop and implement comprehensive, evidence-based training programs focused on EVD care for nursing staff. Such programs should include theoretical knowledge, practical skills, and competency assessments to ensure nurses are well-prepared to manage these complex devices safely. Moreover, ongoing education and quality assurance measures are essential to maintain high standards of care and reduce complications associated with EVD use.

Conclusion

The study found that nursing officers generally have good knowledge of external ventricular drain care and prevention of increased intracranial pressure. However, most lacked formal training, which was linked to better knowledge levels. This underscores the need for structured neurosurgical training and standardized guidelines to improve nursing practice and patient safety. Implementing targeted education programs is essential to enhance care quality in neurosurgical settings.

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Supplementary

https://drive.google.com/file/d/1h4IObZ_YQGJBbK7ZmHVrwOp-roK4ZVR9r/view?usp=sharing