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Passive Range of Motion Intervention to Improve Physical Mobility in a Hemorrhagic Stroke Patient After External Ventricular Drainage: A Case Study

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Abstract

Background: Hemorrhagic stroke is a life-threatening neurological disorder that often leads to significant motor impairment due to intracranial bleeding, elevated intracranial pressure, and disrupted neuromuscular function. Patients in intensive care settings are highly susceptible to complications related to prolonged immobility, including joint stiffness, muscle weakness, atrophy, contractures, impaired circulation, and pressure injuries. Passive Range of Motion (ROM) exercises are commonly applied as a nursing intervention for patients who are unable to perform voluntary movement, aiming to preserve joint mobility and prevent musculoskeletal deterioration.
Objective: This case study aimed to describe the implementation of nursing care in a hemorrhagic stroke patient with impaired physical mobility following External Ventricular Drainage (EVD), with a focus on the application and evaluation of passive ROM exercises in the General Intensive Care Unit (GICU).
Methods: A descriptive case study design was employed involving a female patient with hemorrhagic stroke who underwent EVD placement. Data were collected through comprehensive nursing assessment, direct observation, interviews, and medical record review. Passive ROM exercises were administered twice daily for 10–15 minutes using controlled movements of the upper and lower extremities. Neurological status, hemodynamic stability, and EVD function were continuously monitored.
Results: Over a five-day period, gradual improvement was observed. Muscle strength increased by one grade, joint mobility improved by approximately 10 degrees, and the Glasgow Coma Scale reached 12. No complications related to the intervention or EVD were identified.
Conclusion: Passive ROM may be safely incorporated into nursing care for hemorrhagic stroke patients with EVD and may help maintain joint function and reduce immobility-related complications, although outcomes are influenced by multiple clinical factors.

Keywords: Hemorrhagic stroke; passive range of motion; impaired physical mobility; external ventricular drainage; nursing care; critical care.

INTRODUCTION

Neurological disorders continue to represent a major global health challenge, contributing substantially to mortality, long-term disability, and functional dependence. Among these conditions, stroke remains one of the most critical due to its sudden onset and its potential to cause lasting neurological impairment, diminished quality of life, and increased

healthcare demands. Stroke occurs as a result of disrupted cerebral circulation, either due to vascular occlusion or intracranial bleeding, leading to neurological deficits that persist beyond 24 hours or result in death (1). Given its high prevalence and significant socioeconomic burden, stroke is widely recognized as a priority public health concern worldwide.

In Indonesia, stroke prevalence has reached 10.9 per 1,000 population, reflecting a considerable need for effective acute management, rehabilitation strategies, and sustained nursing care (2). Among the various types of stroke, hemorrhagic stroke is associated with higher mortality and more severe functional outcomes compared with ischemic stroke. Intracerebral hemorrhage can rapidly elevate intracranial pressure, compromise cerebral perfusion, and cause extensive neuronal damage, leading to profound neurological deficits (3).

Motor impairment is one of the most prominent consequences of hemorrhagic stroke. Patients frequently present with conditions such as hemiparesis, reduced muscle strength, altered muscle tone, and impaired voluntary movement, all of which significantly limit their ability to perform daily activities independently (4,5). In critical care environments, these impairments are often compounded by decreased levels of consciousness, mechanical ventilation, invasive monitoring devices, and prolonged bed rest. Consequently, patients are highly susceptible to immobility-related complications.

From a physiological standpoint, prolonged immobility contributes to reduced neuromuscular stimulation and muscle disuse. Over time, this can lead to muscle weakness, joint stiffness, impaired circulation, and decreased functional capacity. If not properly addressed, these conditions may progress into more serious complications such as muscle atrophy, joint contractures, venous stasis, pressure injuries, and delayed recovery (6,7). Therefore, maintaining physical mobility is a critical component of nursing care in stroke patients, particularly those in intensive care settings.

Range of Motion (ROM) exercises are widely implemented as part of nursing interventions to preserve joint mobility and musculoskeletal function. Passive Range of Motion (PROM), in particular, is indicated for patients who are unable to perform voluntary movement. In this approach, joint movement is facilitated by the nurse without requiring active participation from the patient. Passive ROM may help maintain joint flexibility, preserve soft tissue integrity, stimulate circulation, and reduce the risk of stiffness and contractures (8,9).

However, the application of mobility interventions in neurocritical care requires careful consideration, especially in patients undergoing External Ventricular Drainage (EVD). EVD is a critical neurosurgical procedure used to drain cerebrospinal fluid and regulate intracranial pressure. Despite its clinical benefits, EVD placement carries potential risks, including infection, catheter obstruction, accidental displacement, and instability in cerebrospinal fluid drainage (10,11). As a result, any nursing intervention involving patient movement must be performed with caution to avoid fluctuations in intracranial pressure or neurological deterioration.

In recent years, early mobilization has gained attention as an essential component of intensive care management. Evidence suggests that structured mobilization strategies can improve muscle strength, reduce ICU-acquired weakness, and enhance functional recovery in critically ill patients (12–14). Nevertheless, in neurocritical populations, mobilization must be tailored to the patient's neurological and hemodynamic stability, as inappropriate intervention may increase the risk of complications.

Although passive ROM is commonly recommended as a basic nursing intervention for immobilized patients, there is limited detailed clinical evidence describing its application in hemorrhagic stroke patients with EVD. Most existing studies focus on general stroke rehabilitation or non-critical care populations, with fewer reports addressing the complexities of neurocritical care settings. This gap highlights the need for case-based clinical descriptions that provide practical insights into safe and effective nursing interventions for mobility management in critically ill neurological patients.

From a clinical perspective, passive ROM represents a feasible and low-risk intervention that can be incorporated into routine nursing care when applied with appropriate monitoring. However, its implementation in patients with EVD requires careful assessment, strict adherence to safety protocols, and continuous evaluation of patient response. Understanding how this intervention can be safely integrated

into neurocritical care is essential for improving patient outcomes and preventing complications associated with prolonged immobility.

This case study aims to describe the implementation of nursing care in a hemorrhagic stroke patient with impaired physical mobility following External Ventricular Drainage (EVD) in the General Intensive Care Unit (GICU), with a specific focus on the application, monitoring, and evaluation of passive Range of Motion (ROM) exercises as a strategy to maintain joint mobility and support functional recovery.

METHODS

Study Design

This study used a descriptive case study design. This design was selected because it allows detailed exploration of nursing care implementation in a real clinical setting. The case study approach was used to describe the patient's condition, nursing problems, intervention procedures, safety considerations, and clinical outcomes during care in the GICU.

Participant

The participant was a female patient, referred to as Mrs. S, who was diagnosed with hemorrhagic stroke and underwent EVD placement. The patient was treated in the GICU and experienced impaired physical mobility.

The inclusion criteria were: confirmed diagnosis of hemorrhagic stroke, decreased physical mobility, reduced muscle strength, limited joint movement, and clinical indication for passive ROM exercises. Patients with unstable hemodynamic status, signs of worsening neurological condition, or contraindications to mobilization were excluded. The participant was selected using purposive sampling because her clinical condition matched the purpose of the study.

Nursing Assessment

The nursing assessment focused on neurological status, physical mobility, muscle strength, joint movement, vital signs, and EVD condition. Neurological assessment included level of consciousness and Glasgow Coma Scale score. Motor assessment included observation of limb movement, muscle response, and ability to perform voluntary movement. Joint mobility was assessed using range of motion measurement, while muscle strength was assessed using Manual Muscle Testing.

The patient initially showed reduced consciousness and weakness in the upper and lower extremities. Mobility was limited, and the patient was unable to perform active movement independently. These findings supported the nursing diagnosis of impaired physical mobility.

Nursing Intervention: Passive Range of Motion

Passive ROM exercises were implemented as part of routine nursing care. The intervention was performed twice daily for 10–15 minutes per session during the observation period. Movements were carried out slowly, gently, and according to patient tolerance.

The intervention included passive movement of major joints in the upper and lower extremities. Upper limb movements included shoulder flexion and extension, elbow flexion and extension, forearm pronation and supination, and wrist flexion and extension. Lower limb movements included hip flexion and extension, knee flexion and extension, and ankle dorsiflexion and plantarflexion. Each movement was repeated approximately 8–10 times, depending on the patient's response.

Before each session, the nurse assessed vital signs, level of consciousness, and EVD condition. During the intervention, the nurse monitored for signs of increased intracranial pressure, hemodynamic instability, abnormal drainage changes, pain response, facial grimacing, or other signs of discomfort. The intervention would be stopped if the patient showed neurological decline, unstable vital signs, increased drainage abnormality, or signs of distress.

Outcome Measurement

The main outcomes were muscle strength and joint range of motion. Muscle strength was evaluated using Manual Muscle Testing, with scores ranging from 0 to 5. Joint mobility was measured using a goniometer and recorded in degrees. Measurements were conducted before the first ROM intervention and after the nursing intervention period.

Improvement was identified through increased muscle strength scores and greater joint mobility compared with baseline findings. Additional clinical outcomes included level of consciousness,

neurological stability, hemodynamic condition, and EVD safety.

Data Collection

Data were collected through physical examination, direct observation, family interview, and review of medical records. The nursing process was used as the main framework for organizing data. Information from different sources was compared to ensure consistency between assessment findings, clinical records, and observed patient responses.

Data Analysis

Data were analyzed descriptively. The analysis focused on changes in physical mobility, muscle strength, joint movement, consciousness level, and safety indicators before and after passive ROM implementation. The results were interpreted in relation to nursing care, patient condition, and relevant literature.

Ethical Considerations

Informed consent was obtained from the patient's family because the patient had decreased consciousness. The patient's identity was protected using initials. The intervention was part of standard nursing care and did not involve additional invasive procedures. Patient safety was prioritized through continuous neurological and hemodynamic monitoring, especially because the patient had EVD. Ethical principles of beneficence, non-maleficence, autonomy, and confidentiality were maintained throughout the study.

RESULT

The patient was a female diagnosed with hemorrhagic stroke who underwent External Ventricular Drainage (EVD) placement and was admitted to the General Intensive Care Unit (GICU). At the initial nursing assessment, the patient demonstrated decreased consciousness, impaired physical mobility, reduced muscle strength in both upper and lower extremities, and inability to perform active movements independently. The patient's Glasgow Coma Scale (GCS) score on admission was 10, indicating moderate impairment of consciousness. Muscle strength assessment using Manual Muscle Testing showed generalized weakness with an average score of 2/5 in the affected extremities. Joint movement was limited, and passive movement produced mild stiffness, particularly in the shoulder, elbow, knee, and ankle joints.

Passive Range of Motion (ROM) exercises were implemented twice daily for approximately 10–15 minutes over a five-day observation period. The intervention was performed carefully with continuous monitoring of neurological status, hemodynamic stability, and EVD function. No interruption of the intervention was required because the patient remained clinically stable throughout the implementation period.

Gradual improvement in physical mobility was observed during the intervention period. Muscle strength increased from 2/5 to 3/5 in the upper and lower extremities by the fifth day of care. Improvement in joint flexibility was also noted, with an increase of approximately 10 degrees in the range of motion of major joints. The patient showed reduced joint stiffness and better tolerance to passive movement compared with the initial assessment.

Neurological status also improved progressively. The Glasgow Coma Scale increased from 10 to 12 at the end of the observation period, indicating improvement in consciousness and neurological responsiveness. Vital signs remained stable during ROM sessions, and no signs of increased intracranial pressure, hemodynamic instability, or neurological deterioration were identified. In addition, no complications related to EVD, such as catheter displacement, abnormal cerebrospinal fluid drainage, or infection, were observed during the intervention period.

The patient's clinical progress during the observation period is summarized in Table 1.

Table 1. Changes in Patient Condition Before and After Passive ROM Intervention

Clinical Indicator	Initial Assessment	Day 5 Evaluation
Glasgow Coma Scale (GCS)	10	12
Muscle Strength	2/5	3/5
Joint Range of Motion	Limited movement with stiffness	Improved by ±10°
Joint Stiffness	Mild stifness observed	Reduced stiffness
Voluntary Movement	Unable to move independently	Minimal spontaneous movement observed
Neurogical Responsiveness	Decreased responsiveness	Improved responsiveness
Hemodynamic Status	Stable	Stable
EVD Function	Functioning properly	No complications observed

DISCUSSION

This case study described the use of passive ROM exercises as part of nursing care for a hemorrhagic stroke patient with impaired physical mobility after EVD placement. During five days of observation, the patient demonstrated gradual improvement in muscle strength, joint mobility, and consciousness level. Muscle strength increased by one grade, while joint movement improved by approximately 10 degrees compared with the initial assessment. The patient's Glasgow Coma Scale also improved, reaching 12 at the end of the observation period. These findings support the role of passive ROM as a supportive nursing intervention for critically ill patients who cannot move independently. In patients with stroke, impaired motor function may occur because of damage to brain areas responsible for movement control. When this condition is combined with prolonged bed rest, the risk of musculoskeletal complications increases. Passive ROM may help reduce these risks by maintaining joint movement, minimizing stiffness, and supporting peripheral circulation (7-9).

The findings are also consistent with critical care rehabilitation principles. Early mobilization, including passive movement, has been associated with improved functional outcomes and reduced ICU-acquired weakness in critically ill patients (12-14). Although passive ROM is less intensive than active mobilization, it may serve as an initial mobility-preserving intervention when patients are still unable to participate actively. In this case, passive ROM was clinically appropriate because the patient had decreased consciousness and limited voluntary movement.

The presence of EVD required careful nursing judgment. EVD management is associated with potential complications, including infection, obstruction, catheter displacement, and drainage disturbance (10,11). Because movement and positioning may influence cerebrospinal fluid drainage and intracranial pressure, passive ROM was performed cautiously. The nurse monitored the patient's neurological status, vital signs, and EVD system before, during, and after the intervention. No adverse events occurred during the intervention period, suggesting that passive ROM can be safely implemented when strict safety precautions are followed.

However, the observed improvement should not be interpreted as the direct effect of passive ROM alone. In neurocritical care, patient recovery is influenced by multiple factors, including stabilization of intracranial pressure, medical therapy, surgical management, nursing care, nutritional support, and the natural course of neurological recovery. Therefore, passive ROM should be understood as one component of comprehensive nursing care rather than the sole cause of improvement.

From a nursing perspective, this case highlights the importance of early identification of impaired physical mobility. Nurses play an essential role in preventing complications of immobility by performing regular assessment, planning safe interventions, monitoring patient responses, and collaborating with the multidisciplinary team. Passive ROM is simple, low-cost, and feasible in intensive care settings, but it requires proper technique and safety awareness.

This case also emphasizes the need for individualized care. Not all neurocritical patients

are suitable for mobilization at the same level. Nurses must consider consciousness level, hemodynamic stability, intracranial pressure condition, EVD status, and patient tolerance before performing passive ROM. In patients with unstable vital signs or suspected increased intracranial pressure, the intervention should be delayed or stopped.

The study has several limitations. First, this was a single case study, so the findings cannot be generalized to all hemorrhagic stroke patients with EVD. Second, the observation period was only five days, which limits the ability to evaluate long-term functional recovery. Third, outcome measurement was limited to Manual Muscle Testing and goniometry. Future studies should include larger samples, longer follow-up, and more comprehensive functional assessment tools.

Despite these limitations, this case provides useful clinical insight into passive ROM implementation in neurocritical nursing care. The findings suggest that passive ROM may help maintain joint mobility and support early motor recovery when applied carefully and consistently. Further controlled studies are needed to evaluate its effectiveness in hemorrhagic stroke patients after EVD placement.

CONCLUSION

This case study showed that passive ROM exercises can be applied as part of comprehensive nursing care for a hemorrhagic stroke patient with impaired physical mobility after EVD placement in the GICU. The intervention was performed twice daily with careful monitoring of neurological status, hemodynamic condition, and EVD function.

During the five-day care period, the patient showed improvement in muscle strength, joint range of motion, and consciousness level. Muscle strength increased by one grade, joint mobility improved by approximately 10 degrees, and the Glasgow Coma Scale reached 12 by the end of observation. No adverse events related to passive ROM were found.

Passive ROM may serve as a supportive nursing intervention to maintain physical mobility and reduce complications of immobility in critically ill stroke patients. However, improvement should be interpreted cautiously because recovery may also be influenced by medical management, neurological stabilization, and other aspects of intensive care. Further research with larger samples and controlled designs is recommended.

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AUTHOR CONTRIBUTIONS

SK contributed to study conception, design, data collection, intervention implementation, data analysis, interpretation of findings, and manuscript preparation. TFF provided methodological support and assisted with data analysis. BR reviewed the manuscript critically and approved the final version. LOM contributed to manuscript revision and gave final approval for publication.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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