



Assessment of Vascular Access Efficiency in Patients with Neurological Disorders and Its Relationship with Treatment Outcomes and Caregiver Satisfaction

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Abstract

Background: Vascular access (VA) is one of the invasive procedures performed in patients receiving secondary care.

Objectives: This study aimed to assess the association between VA quality, treatment outcomes, and caregiver satisfaction among patients admitted to hospitals in Ilam City.

Methods: In this cross-sectional study, 120 patients diagnosed with neurological disorders and admitted to the intensive care units of teaching hospitals in Ilam city during 2020 - 2021 were included. The data collection instrument comprised four sections: a demographic characteristics form, a VA evaluation checklist, a patient companion satisfaction questionnaire, and a treatment outcomes checklist. Data were analyzed using SPSS software version 16, with descriptive and inferential statistical tests.

Results: The study included patients with a mean age of 65.4 ± 12.9 years; most were male (57.5%) and rural residents (58.3%). The first-attempt success rate for VA was 96.7%, and complications, including swelling/redness (34.2%), phlebitis (24.2%), and hematoma (20%), were observed. Patient companions reported a high mean satisfaction score (33.55 ± 7.38). VA adequacy was strongly and positively correlated with caregiver satisfaction ($r = 0.92$, $P < 0.001$). However, the association with treatment outcomes was not statistically significant ($P = 0.06$).

Conclusions: The quality of VA procedures among the studied patients was satisfactory; most procedures were successfully performed on the first attempt, and both nurses and physicians achieved proper fixation, with all indicators exceeding 90%. In addition, VA adequacy was significantly positively associated with patient companion satisfaction. However, VA adequacy was not significantly associated with treatment outcomes.

Keywords: Vascular Access, Neurological Disorders, Vascular Access Adequacy, Caregiver Satisfaction

1. Background

Vascular access (VA) is among the most common invasive procedures performed in patients receiving secondary care. In some cases, this procedure is not performed optimally because of various factors, including limited surgeon experience, inadequate

healthcare system resources, and the patient's clinical condition. Inadequate VA establishment may cause discomfort, complications, and even mortality (1-3). Effective VA is an important determinant of patient survival and well-being and is recognized as a key factor in preserving the lives of patients undergoing hemodialysis. Any dysfunction in established VA can

compromise patient health and create serious clinical challenges. Indeed, VA outcomes are regarded by patients, caregivers, and healthcare professionals as a critical priority and are essential for improving patient and healthcare outcomes (4-6).

Achieving a suitable fistula may be challenging or even impossible for some individuals (4). One of the most valuable indicators of graft or fistula patency is the direct assessment of arteriovenous blood flow using methods such as ultrasonography, blood pressure measurement, plethysmography, and thermodilution techniques (7, 8). Monitoring VA in patients with end-stage renal disease undergoing treatment is highly important. If VA thrombosis occurs, it may lead to irreversible and emergent complications. Thrombosis is a concerning complication and requires urgent management when it occurs (7, 9, 10).

VA care is another critical issue in patients with VA. There are no strictly defined boundaries for VA care, and multiple members of the healthcare team, including nurses and physicians, are involved in its management. Post-insertion care, troubleshooting, and complication management are essential and require coordinated teamwork (11, 12). Patients admitted to intensive care units may experience additional VA-related problems because of their complex clinical conditions (13).

Neurological disorders have a high prevalence and frequently lead to hospital admission. This group includes patients with stroke. Stroke is a cerebrovascular event characterized by a sudden reduction in cerebral blood flow due to disruption of the blood vessels supplying the brain. Under these conditions, a lack of oxygen leads to brain tissue damage (14, 15). Stroke is a major public health problem and the most common disabling neurological disorder in adults. It can impair sensory, motor, perceptual, visual, and cognitive systems (13).

2. Objectives

Given the high number of hospitalized patients diagnosed with neurological disorders, this study aimed to determine the effectiveness of VA in such patients and to assess its relationship with treatment outcomes and caregiver satisfaction among patients admitted to hospitals in Ilam city.

3. Methods

3.1. Study Design and Setting

In this cross-sectional study, 120 patients diagnosed with neurological disorders who were admitted to the

intensive care units of teaching hospitals in Ilam city during 2020 - 2021 were included.

3.2. Inclusion and Exclusion Criteria

The inclusion criteria were hospitalization in hospitals in Ilam city, age 18 years or older, admission due to neurological disorders, absence of pre-existing VA, informed consent from the patient's legal guardian to participate in the study, and the ability to cooperate and participate in the research. The exclusion criteria included pre-existing VA and unwillingness of the patient or the patient's legal guardian to continue participation in the study.

3.3. Data Collection and Instruments

The data collection instrument consisted of four sections: a demographic characteristics form, a VA evaluation checklist, a patient companion satisfaction questionnaire, and a treatment outcomes checklist.

3.3.1. Demographic Characteristics Form

The first section included demographic information, including age, gender, level of education, type of VA (peripheral or central), place of residence (urban or rural), and supplementary insurance status (yes/no).

3.3.2. Checklist for Evaluation of Vascular Access Quality

The second section consisted of a checklist assessing VA quality, including successful VA placement by a surgeon or anesthesiologist on the first attempt (yes/no), proper fixation of VA by the physician (yes/no), proper fixation of VA by nursing staff (yes/no), absence of catheter dislodgement until completion of the required treatment in the ward, according to the guidelines of the Iranian Ministry of Health (yes/no), and absence of VA occlusion (yes/no). In this section, a "yes" response indicated a desirable condition and received a score of 1, whereas a "no" response indicated an undesirable condition and received a score of 0. The total score ranged from 0, indicating an undesirable condition, to 5, indicating a desirable condition.

3.3.3. Treatment Outcomes Checklist

The third section included a checklist of treatment outcomes, including hematoma (yes/no), phlebitis (yes/no), and swelling or redness at the catheter insertion site (yes/no). In this section, a "yes" response indicated an undesirable condition and received a score of 1, whereas a "no" response indicated a desirable condition and received a score of 0. The total score

ranged from 0, indicating a desirable condition, to 3, indicating an undesirable condition.

3.3.4. Caregiver Satisfaction Questionnaire

The fourth section consisted of a questionnaire assessing caregiver satisfaction with the care provided. This instrument contained 10 questions evaluating the level of satisfaction. The scoring range was from 0, indicating low satisfaction, to 50, indicating high satisfaction.

For completion of the study instruments, demographic information was obtained from patients' medical records. The VA evaluation checklist and treatment outcomes checklist were completed through clinical examination and observation of the patients' condition. The caregiver satisfaction questionnaire was completed through interviews with the patient's legal guardian. Because all instruments used in the study were researcher-made, their validity and reliability were assessed by the research team, and data collection began after confirmation of their validity and reliability.

3.4. Validity and Reliability of the Tools

The face and content validity of the demographic form, VA checklist, treatment outcomes checklist, and satisfaction questionnaire were evaluated and confirmed by a panel of experts, including a vascular surgeon, a neurologist, a PhD in nursing, and a PhD in epidemiology. The reliability of the instruments was evaluated and confirmed.

3.5. Research Procedure

The study procedure was conducted as follows: patients admitted to hospitals in Ilam who required VA were included in the study. The indication for VA was determined by the treating physician and documented in the patient's medical record. No invasive intervention was performed as part of this research; only patients who underwent VA placement as part of routine treatment were included in the study.

3.6. Statistical Analysis

For data analysis, SPSS software version 16 was used to perform descriptive and inferential statistical analyses.

3.7. Ethical Considerations

This study adhered to the ethical guidelines approved by the Ethics Research Committee of Ilam University of Medical Sciences.

4. Results

As shown in Table 1, 57.5% of the patients were male. In addition, 52.5% had primary education, 58.3% lived in rural areas, 60% had a history of diabetes, and 57.5% had a history of cardiovascular disease. The mean (SD) age of the patients was 65.4 (12.9) years.

Table 1. Demographic Characteristics of Patients (N = 120)^a

Variables	Values
Gender	
Male	69 (57.5)
Female	51 (42.5)
Education level	
Illiterate	23 (19.2)
Primary	63 (52.5)
Secondary	27 (22.5)
University	7 (5.8)
Place of residence	
Urban	50 (41.7)
Rural	70 (58.3)
History of diabetes	
Yes	72 (60)
No	48 (40)
History of cardiovascular disease	
Yes	69 (57.5)
No	51 (42.5)
Age (y)	65.4 ± 12.9

^a Values are expressed as No. (%) or mean ± SD.

As shown in Table 2, 96.7% of VA procedures were successfully performed on the first attempt, and 97.5% were properly secured by the physician.

As shown in Table 3, 20% of the patients developed a hematoma, 24.2% experienced phlebitis, and 34.2% had swelling or redness at the catheter insertion site.

Table 4 presents the minimum, maximum, and mean scores obtained by the patients. The mean (SD) patient companion satisfaction score was 33.55 (7.38), the treatment outcomes score was 5.21 (0.79), and the VA quality score was 4.48 (0.75).

Correlation analysis of the variables presented in Table 5 showed a statistically significant positive relationship between the adequacy of VA and caregiver satisfaction ($r = 0.92$, $P < 0.001$). In addition, a positive but non-significant relationship was observed between the adequacy of VA and treatment outcomes ($r = 0.21$, $P = 0.06$). A negative, non-significant relationship was also found between treatment outcomes and caregiver satisfaction ($r = -0.17$, $P = 0.52$).

Table 2. Evaluation of the Quality of Vascular Access (N = 120)^a

Vascular Access Quality Indicator	Yes	No
Successful vascular access on the first attempt	116 (96.7)	4 (3.3)
Proper fixation by physician	117 (97.5)	3 (2.5)
Proper fixation by nurse	116 (96.7)	4 (3.3)
No catheter dislodgement until end of treatment	92 (76.7)	28 (23.3)
No vascular access occlusion	97 (80.8)	23 (19.2)

^a Values are expressed as No. (%).**Table 3.** Treatment Outcomes Related to Vascular Access (N = 120)^a

Treatment Outcome	Yes	No
Hematoma	24 (20.0)	96 (80.0)
Phlebitis	29 (24.2)	91 (75.8)
Swelling or redness at catheter site	41 (34.2)	79 (65.8)

^a Values are expressed as No. (%).**Table 4.** Mean Scores of Vascular Access Quality, Treatment Outcomes, and Patient Companion Satisfaction (N = 120)

Variables	Minimum	Maximum	Mean ± SD
Vascular Access Quality (0 - 5)	0	5	4.48 ± 0.75
Treatment Outcomes (0 - 6)	3	6	5.21 ± 0.79
Patient Companion Satisfaction (0 - 50)	26	50	33.55 ± 7.38

5. Discussion

VA placement requires adequate physician knowledge, clinical skills, and confidence, and appropriate management of the patient's clinical condition must be ensured. However, this process can be challenging because of the heavy workload of healthcare staff and the shortage of specialized surgeons, which may delay VA placement. Multiple attempts to establish VA may lead to several complications, including psychological distress, anxiety, pain, venous injury, and infection. In addition, complications such as phlebitis, catheter infiltration or leakage, occlusion, and bloodstream infection have been reported as consequences of VA placement (16-19). Given the importance of VA, the present study was conducted to determine VA efficiency in patients with neurological disorders and its relationship with treatment outcomes and caregiver satisfaction among patients admitted to hospitals in Ilam city.

Among the complications observed in the present study were hematoma (20%), phlebitis (24.2%), and

swelling or redness at the insertion site (34.2%). In a study by Ortiz et al. investigating complications after peripheral vascular intervention, 74.4% of patients experienced minor complications, whereas only 10.5% had severe complications requiring surgery (20). Some medications, such as aspirin, angiotensin-converting enzyme inhibitors, and calcium channel blockers, may be effective in maintaining VA, and appropriate measures should be taken regarding their prescription. Conversely, warfarin use may have negative effects on VA status in patients (21).

In the review study by Almasri et al., the results of 200 studies with a total sample size of 875,269 patients were examined. The primary patency rate after 2 years was reported as 55% in patients with fistulas, 40% in those with grafts, and 50% in those with catheters. Furthermore, mortality was highest among patients with catheters (26%), followed by those with grafts (17%), whereas the lowest mortality rate was observed in patients with fistulas (15%). Overall, autogenous access was reported as the best type of access for dialysis patients (22). In another study conducted by Ullman et al., 74 cohort studies involving different types of central

Table 5. Correlation Between Adequacy of Vascular Access, Treatment Outcomes, and Patient Companion Satisfaction

Variables	Adequacy of Vascular Access	Treatment Outcomes	Caregiver Satisfaction
Adequacy of Vascular Access	1		
Treatment Outcomes	r = 0.21, P = 0.06	1	
Caregiver Satisfaction	r = 0.92, P < 0.001	r = -0.17, P = 0.52	1

venous access devices in pediatric patients were included. The results showed that approximately 25% of catheters failed before completion of therapy. The highest failure rate was reported for umbilical catheters at approximately 28.6 per 1000 catheter days, while the lowest failure rate was observed for totally implanted devices at approximately 0.15 per 1000 catheter days (23).

5.1. Study Limitations

The limitations of this study include its single-center design and relatively small sample size. Therefore, future multicenter studies with larger sample sizes are recommended to improve the generalizability of the findings.

5.2. Conclusions

The quality of VA procedures among the studied patients was satisfactory, with most procedures successfully performed on the first attempt and appropriate fixation by both nurses and physicians; all indicators were above 90%. In addition, a significant positive association was observed between VA adequacy and patient companion satisfaction. However, VA adequacy was not significantly associated with treatment outcomes.

Footnotes

AI Use Disclosure: For the purpose of Translation, the Gabgt was used Substantial in the Etc section.

Authors' Contribution: M. K., M. B., S. E., H. T., and B. N. conceived and designed the study, performed the study, collected the data, discussed the results, and supervised, directed, and managed the study. All authors reviewed and approved the final manuscript and agreed to be accountable for all aspects of the work.

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Data Availability: The dataset presented in the study is available on request from the corresponding author

during submission or after publication.

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Informed Consent: Written informed consent was obtained from the patient's legal guardian to participate in this study.

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