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# Nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment: A Delphi study

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## Abstract

**Background:** Thrombectomy treatment is a critical procedure that emerged a few years ago, and nurses play a crucial role in the process, particularly in preventing complications and improving outcomes. Therefore, determining the quality of nursing care with best-fit quality indicators in patients with ischemic stroke receiving thrombectomy is necessary. However, no research has determined the nursing outcome quality indicators for these patients.
**Objective:** This research aimed to identify the nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment.
**Methods:** Nineteen experts involved with patients with ischemic stroke receiving thrombectomy treatment were recruited. The Delphi method was implemented with three rounds between October 2021 to February 2022. Medians and interquartile ranges were analyzed.
**Results:** Twenty-eight nursing outcome quality indicators were developed and grouped into three components, including 1) pre-procedure (five indicators), 2) intra-procedure (six indicators), and 3) post-procedure (17 indicators).
**Conclusion:** This study revealed that the post-procedure of thrombectomy treatment had a greater number compared to pre and intra-procedures. The quality indicators developed in this research are practical and appropriate for nursing practice to enhance the quality of nursing care for patients with ischemic stroke receiving thrombectomy treatment.

## Keywords

quality indicator; nursing outcome; ischemic stroke; thrombectomy; Delphi

## Background

Stroke is the leading cause of death and disability in Thailand (Chantkran et al., 2021). In 2014, 2015, and 2018, a nationwide survey in Thailand indicated that stroke prevalence remained stable, with rates of 4.0, 3.8, and 3.9 percent, respectively (Chantkran et al., 2021). Intravenous recombinant tissue plasminogen activator (IV rt-PA) is a gold-standard treatment for acute ischemic stroke (Hacke et al., 2008). Because of the benefit of a significant reduction in death and disability, intravenous alteplase is indicated for a patient with ischemic stroke who arrives at the hospital within 4.5 hours from the onset of symptoms if there are no contraindications (Powers et al., 2019). Thrombectomy is recommended to proceed between 4.5 and 6 hours after the onset of symptoms in a patient with stroke with large artery occlusion (Powers et al., 2018).

Thrombectomy is superior to an intravenous thrombolytic agent in patients with stroke with large vessel occlusion, according to five randomized controlled trials (RCTs): ESCAPE, EXTEND IA, MR CLEAN, REVASCAT, and SWIFT PRIME (Goyal et al., 2016). At 90 days after the onset of stroke, endovascular thrombectomy significantly improved functional outcomes (mRS of 0-2) (Goyal et al., 2016; Saver et al., 2015). The large vessel occlusions in ischemic stroke with the onset of symptoms between 6-16 hours (Albers et al., 2018) and 6-24 hours (Nogueira et al., 2018) who meet the aforementioned clinical-imaging mismatch criteria proceed with thrombectomy is recommended. Thrombectomy is, therefore, a feasible option for reducing morbidity and mortality while enhancing the quality of life.

Pre-procedure, intra-procedure, and post-procedure nursing care for ischemic stroke receiving thrombectomy is the responsibility of interventional radiology nurses (de Sousa, 2016). Nurses anticipate the patient's needs, recognize potential procedural complications, and promote patient safety. Ischemic stroke with large vessel occlusions leads to debilitating symptoms such as neurological disorders, hemodynamic disturbances, and airway compromise. The interventional radiology nurse is responsible for early detection and observing the decline of signs and symptoms, medication administration, during procedure documentation, and pre-and post-procedural communication in the transitional care with

the emergency unit, referral center, and intensive care unit staff during the thrombectomy procedure. Consequently, nurses play a crucial role in a patient with stroke receiving thrombectomy treatment, particularly in preventing complications and improving outcomes by focusing on patient safety and nursing care quality (de Sousa, 2016). Nursing professionals must be able to work independently and cooperatively with a multidisciplinary intervention team in these circumstances. However, quality of care measurements will provide a tremendous amount of information to ensure that patients with stroke receive quality thrombectomy nursing care, referred to as nursing outcome quality indicators, after providing nursing care for the stroke patient receiving thrombectomy treatment.

To the best of our knowledge, no research has determined the nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment. Therefore, it is urgent to explore and identify nursing outcome quality indicators. Furthermore, this information is a crucial necessity to confirm the possible outcomes that the patients achieve. Therefore, this research aimed to identify the nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment.

# Methods

### Study Design

The Delphi method is a technique used with expert opinions to extract and gather information. It has been described as a technique for organizing the communication processes of expert opinion. It is a multi-stage iterative process designed to combine expert opinions with the consensus, judgment, or choice to reach the final goal (Hasson et al., 2000). The Delphi technique, which has been used to solve cost and time constraints, consists of the systematic data gathering and combining of well-informed decisions on specific questions and issues from a large group of experts (Goodman, 1987; Skews et al., 2000). The original classical Delphi used four rounds (Young & Hogben, 1978). However, many have modified this to suit individual research aims, and, in some cases, it has been shortened to two or three rounds (Green et al., 1999).

### Participants

This research included 19 experts. Generally, the appropriate sample size ranged from 17 to 25 experts (Macmillan, 1971). Purposive sampling and snowballing were used to select three groups of experts: two interventionists with direct experience in thrombectomy intervention for patients with ischemic stroke, three interventional radiology nurses, and fourteen stroke nurses. The experts' inclusion criteria included: 1) a bachelor's degree or higher; 2) the capacity and agreement to participate in the study; and 3) more than five years of having direct experience in patients with ischemic stroke receiving thrombectomy treatment.

### Instruments and Data Collection

The Delphi technique with three rounds was employed between October 2021 to February 2022 in this study:

*Round One.* To identify nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment, a combination of semi-structured interviews, an open-ended questionnaire survey, and the Delphi technique were employed. The questionnaires consisted of two semi-structured interviews and an open-ended questionnaire, including 1) In your opinion, what are the nursing outcomes quality indicator components in patients with ischemic stroke receiving thrombectomy treatment? and 2) Based on the previous question, what indicators must be contained in each component? The experts answered the information for about 30-40 minutes. The interviews were mostly done via telephone. The transcripts were transcribed verbatim after the semi-structured interview, and an open-ended questionnaire was collected. The content analysis was used to determine the nursing outcome quality indicators. The researchers grouped all similar statements into areas. They then examined each area for statements that were either exactly the same and could be collapsed into one statement or which were identical. If comments were similar, a decision was made on whether they could be collapsed into one statement without changing the meaning or whether they were sufficiently different to warrant returning them as other statements in Round Two. Three investigators developed the codes and themes independently to confirm reliability and accuracy. The results of content analysis and themes were used to construct the Delphi questionnaire in this round. The questionnaire was returned via email to the experts for consensus to agree and disagree on items.

*Round Two.* In the second round, the indicators of this round were used to construct the Delphi question. The second round of questionnaires was sent via email to rate the importance of each using a 5-point Likert scale by the experts, which was performed, ranging from the most important to the least important. The agreement and disagreement points were documented. In this round, the nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment were presented to the participant's responses, and a consensus was achieved. The time for responding from the expert was two weeks. A reminder was sent one week after the initial mailing.

*Round Three.* In this round, the experts were again asked about their Round Two responses via email, and they could see their previous scores, median scores from the experts' panel, and interquartile range scores. Confirming their opinions on each indicator was performed in this round. If their views differed from the other experts, they needed to explain the reason. However, they could change their opinions. Experts were allowed to add additional quality indicators to each round or at the end of the questionnaire and add their suggestions. It is noted that, in each round, the number of experts' recommendations was employed as the criterion for adding other indicators. It was then added if more than three experts offered the same indicator. The responding and reminder times were the same in Round Two.

### Data Analysis

The median and interquartile range (IQR) calculation was implemented for each indicator to examine the nursing outcome quality indicator of patients with ischemic stroke receiving thrombectomy treatment (De Vet et al., 2005). The expert's consensus was accepted if the median was equal to or greater than 3.50. The IQR was used to measure the

difference between an expert's opinion and the entire panel's opinion (median). An IQR of 1.5 or less means that more than 75% of all experts fall on a specific point on the scale adopted for consensus criteria. The complete agreement was indicated by an IQR of zero; the greater the IQR, the higher the data dispersion. Furthermore, the high median showed a high level of support (Scheibe et al., 1975).

**Ethical Considerations**

The study was approved by the appropriate ethics committees at the Neurological Institute of Thailand (No.046/2563). Before data collection, informed consent was obtained from all study participants. Anonymity was assured.

# Results

The Delphi experts' average age was 35.28 years, with 52.63 percent having more than fifteen years of experience and 89.47 percent having a bachelor's degree. The details of each round are presented in **Table 1**.

**Table 1** Details of the Delphi method results in each round

| Issue | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| Number of experts | 19 | 19 | 19 |
| Rate of the respondents | 100% (19) | 100% (19) | 100% (19) |
| Quality aspects | 3 | 3 | 3 |
| Pre-determined indicators | 34 | 28 | 28 |
| Revised indicators | 26 | 28 | 28 |
| Added indicator | 2 | - | - |

The duration between Round One and Two was one month, and between Round Two and Three was two weeks. The results from the Delphi technique were explained as follows:

*Round One*. Three components with the pre-determined 34 quality care indicators were indicated through content analysis, and the consensus of experts agreed with 26 indicators after the investigation. Eight of the pre-determined nursing outcome quality indicators were excluded because of not reach the experts' consensus. In addition, another two nursing outcome quality indicators were added (no deep vein thrombosis by assessing pale skin, leg pain, edema, cold toes, etc., and no pressure sore by turning the position every two hours), and five revised of the pre-determined indicators were performed for the next round. Therefore, three components with 28 nursing outcome quality indicators were used in the Round Two questionnaire. Each component consisted of a different number of nursing outcome quality components, including 1) pre-procedure (5 indicators), 2) intra-procedure (6 indicators), and 3) post-procedure (15 indicators).

*Round Two.* The nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment still existed from Round Two. The number of revised indicators in this round was 4. The nursing outcome quality indicators accepted for each component included 1) pre-procedure (5 indicators), 2) intra-procedure (6 indicators), and 3) post-procedure (17 indicators).

*Round Three*. The remaining twenty-eight nursing outcome quality indicators achieved the expert's consensus. The nursing outcome quality indicators accepted in this round were still the same as in Round Two, but three of the pre-determined indicators had minor revisions. Several nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment in each round were presented in **Table 2**, and details of the final nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment in each component were shown in **Table 3**.

**Table 2** The components and numbers of nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment

| Components | Number of indicators | | |
|---|---|---|---|
| | Round 1 | Round 2 | Round 3 |
| 1) nursing outcome quality indicators for patients with ischemic stroke **before** receiving thrombectomy treatment | 5 | 5 | 5 |
| 2) nursing outcome quality indicators for patients with ischemic stroke **during** receiving thrombectomy treatment | 6 | 6 | 6 |
| 3) nursing outcome quality indicators for patients with ischemic stroke **after** receiving thrombectomy treatment | 15 | 17 | 17 |
| **Total** | **26** | **28** | **28** |

# Discussion

Currently, in Thailand, all thrombectomy is provided by the hospital located in central Thailand, university hospitals, and some provincial hospitals. The Ministry of Public Health plans to expand to cover all regions of Thailand. Therefore, interventional radiology and stroke nurses involved in the process of thrombectomy care must be knowledgeable and competent in caring for patients with ischemic stroke receiving thrombectomy treatment. The quality of nursing care is indicated by the result of the patient, which is called the outcome of patient care. Unfortunately, the nursing outcome quality indicator of patients with ischemic stroke receiving thrombectomy treatment does not exist as a literature review. Therefore, this is the first study regarding this issue, which was very important for nurses who cared for patients with ischemic stroke receiving thrombectomy treatment.

The nursing outcome quality indicators identified in this study were divided into pre-procedure, intra-procedure, and post-procedure. The quality indicators for the pre-procedure of thrombectomy treatment nursing outcome were history taking, pre-operative care, and psychological support. These are critical issues for stroke nurses to communicate to the interventional radiology nurse before thrombectomy treatment (de Sousa, 2016). The intra-procedure nursing outcomes quality indicators highlighted strict vital sign observation to monitor the status change of the patients and contrast media complications such as contrast allergy and contrast-induced acute kidney injury. Complications from medications such as analgesic medications and imaging contrast may arise during

the thrombectomy procedure, such as changing the pulse rate and blood pressure, and even an allergic reaction response (Rodgers et al., 2021). Nephropathy induced by contrast may also occur (Balami et al., 2018).

**Table 3** The details of the final nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment in each component

| No. | Indicator detail | Median | IQR | The percentage of answers change |
|---|---|---|---|---|
| **1. Nursing outcome quality indicators for patients with ischemic stroke before receiving thrombectomy treatment** | | | | |
| 1.1 | Patients and relatives don't have anxiety after preparing readiness for physical and psychological perspectives. | 5 | 1 | 10.53 |
| 1.2 | Patients and relatives understand the usefulness, risk, and complication that may happen during and after thrombectomy treatment. | 5 | 1 | 5.26 |
| 1.3 | Patients and relatives understand the practical during and after thrombectomy treatment. | 5 | 1 | 10.53 |
| 1.4 | No abnormality of vital signs before thrombectomy treatment, especially blood pressure, should be ≤ 185/110 mmHg. | 5 | 1 | 10.53 |
| 1.5 | A history of taking an allergy to medication, seafood, and contrast to prevent a contrast allergy. | 5 | 0 | 0 |
| **2. Nursing outcome quality indicators for patients with ischemic stroke during receiving thrombectomy treatment** | | | | |
| 2.1 | No complications from cardiac arrhythmias, such as atrial fibrillation and acute myocardial infarction, by monitoring the rate and rhythm of the heartbeat by ECG monitoring. | 5 | 0 | 10.53 |
| 2.2 | No contrast allergy after injecting to the artery, such as skin rash, urticaria, itching, edema around the eyes, edema under the skin, larynx swelling, shallow breathing, etc. | 5 | 0 | 10.53 |
| 2.3 | No abnormality of vital signs or neurological signs during thrombectomy treatment by measuring a vital sign every 15 minutes. | 5 | 0 | 5.26 |
| 2.4 | No vasospasm after receiving intravenous nimodipine by measuring blood pressure every 5 minutes. | 5 | 0 | 5.26 |
| 2.5 | No cyanosis during thrombectomy treatment by assessing oxygen saturation ≥ 95% | 5 | 0 | 5.26 |
| 2.6 | No contrast-induced acute kidney injury during thrombectomy treatment by assessing signs and symptoms such as oliguria, hypertension, edema, heart congestion, pulmonary edema, etc. | 5 | 0 | 10.53 |
| **3. Nursing outcome quality indicators for patients with ischemic stroke after receiving thrombectomy treatment** | | | | |
| 3.1 | No hemorrhage and hematoma at the catheter site within 1-3 days. | 5 | 0.75 | 0 |
| 3.2 | No peritonitis by assessing signs and symptoms such as abdominal pain, guarding, back pain, nausea, vomiting, etc. | 5 | 0.75 | 0 |
| 3.3 | No brain hemorrhage after receiving thrombectomy treatment by assessing neurological signs. | 5 | 0 | 10.53 |
| 3.4 | No change of neurological signs, such as no decrease of GCS ≥ 1 score; pupils show equal size, shape, and reaction in both sizes. | 5 | 0.75 | 10.53 |
| 3.5 | No complication of hypertension by controlling systolic blood pressure = 90-139 mmHg and DBP = 60-89 mmHg. | 5 | 0.75 | 0 |
| 3.6 | No complication from blood glucose changes by hypoglycemia; blood sugar < 80 mg%, hyperglycemia; blood sugar > 160 mg% after controlling blood glucose as prescribed. | 5 | 0 | 0 |
| 3.7 | Receiving assessment of headache and projectile vomiting to prevent brain edema. | 5 | 0 | 5.26 |
| 3.8 | Receiving assessment of headache, projectile vomiting, and crushing's triad to prevent increased intracranial pressure. | 5 | 0 | 5.26 |
| 3.9 | No limb ischemia by palpating the pulse at the dorsalis pedis or posterior tibial on both sides compared to before and after the treatment. | 5 | 0 | 10.53 |
| 3.10 | No deep vein thrombosis by assessing pale skin, leg pain, edema, cold toes, etc. | 5 | 0 | 10.53 |
| 3.11 | No contrast-induced acute kidney injury after recording body intake and output and monitoring BUN, Cr within 48-72 hours. | 5 | 0 | 10.53 |
| 3.12 | No delay in administering antiplatelet via a nasogastric tube in case of patient inserts a stent with blood vessel occlusion. | 5 | 0 | 10.53 |
| 3.13 | No body infection such as pneumonia, catheter-associated urinary tract infection (CAUTI), or sepsis by controlling body temperature < 37.5°C | 5 | 0 | 5.26 |
| 3.14 | No pressure sore by turning the position every 2 hours. | 5 | 0 | 10.53 |
| 3.15 | Patient and relative understand the self-care for preparing readiness of discharge following D-METHOD-P | 5 | 0 | 10.53 |
| 3.16 | Patients and relatives understand and give the importance of taking an antiplatelet, anticoagulant, or underlying disease medication when discharged from the hospital. | 5 | 0 | 10.53 |
| 3.17 | No progressive stroke in a patient with NIHSS ≥ 4 scores after monitoring and caution following the organization. | 5 | 0 | 0 |

Finally, the post-procedure nursing outcome quality indicator of thrombectomy treatment seemed to have the greatest number in this study because complications following thrombectomy treatment are most common, particularly neurological complications such as brain hemorrhage and edema. According to current data, a repeated neurological

assessment should be completed immediately after the procedure (Hill et al., 2018). According to the recommendations, monitoring vital signs and neurological status after thrombectomy is reasonable for patients with IV rt-PA (Hill et al., 2018; Summers et al., 2009). Although standardization reduces errors, nurses must continue to monitor vital signs and neurological status according to current standards of ICU care (Rodgers et al., 2021). Nurses must also be aware that hemorrhage and hematoma at the catheter site are serious complications. Manual compression or a closure device can be used to establish hemostasis. Manual pressure should be applied for 15 to 20 minutes for a femoral artery approach. The duration of immobilization of the affected extremity is determined by the vascular access location and whether hemostasis was performed with manual pressure or a closure device (Hill et al., 2018). When using a band compression for the transradial approach, nurses must release pressure according to the manufacturer's instructions (Rodgers et al., 2021). The current practice encourages frequent performance and documentation of vascular access sites and neurovascular assessments (Starke et al., 2020).

### Strengths and Limitations

Some limitations must be indicated for consideration when interpreting the results. Firstly, the experts were not representing all levels of the hospital because the hospitals that could implement the thrombectomy treatment were only the university hospitals, neurological hospitals, and some tertiary hospitals in Thailand. Secondly, the semi-structured interviews could only be performed by telephone because of the COVID-19 pandemic. The Delphi technique with face-to-face interviews would be more effective.

### Implications and Recommendations

The findings of this study have a variety of implications for nursing practice. Healthcare providers who would like to investigate and improve the care of patients with ischemic stroke receiving thrombectomy treatment must be focused on quality indicators of nursing outcomes, given the potential for improvement in this study. Furthermore, these indicators should be integrated into routine nursing practice to promote and improve the quality of nursing outcomes for patients with ischemic stroke receiving thrombectomy treatment. The result of the indicators must be very consistent. The validity of the indicators could be strengthened by analyzing the correlation between the indicator values obtained by trying to implement the indicators.

## Conclusion

This research revealed the final 28 nursing outcome quality indicators grouped into three components for patients with ischemic stroke receiving thrombectomy treatment in this study. It covers the pre-procedure, intra-procedure, and post-procedure stages of thrombectomy treatment. The most important aspect of thrombectomy treatment after the procedure is to prevent neurological and catheter-site complications. Therefore, the final indicators developed in this study are beneficial and can be used to define nursing outcome quality indicators for patients with ischemic stroke receiving thrombectomy treatment.

## Declaration of Conflicting Interest

The authors declare no conflicts of interest with respect to the authorship and publication of this article.

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## Authors' Contributions

All authors contributed equally in substantial contributions to the conception and design, acquisition of data, and analysis and interpretation of data. In addition, all authors participated in drafting the manuscript or revising it critically for important intellectual content and were given final approval of the version to be submitted and any revised versions, as well as agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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## Data Availability

The data generated during and analyzed during the current study is available from the corresponding author upon reasonable request.

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