

Medical Quality Improvement Case Study on Shortening Door-to-Puncture Time for Stroke Patients Undergoing Thrombectomy

Shengjie Sun, Haowen Zhang*

Laixi People's Hospital, Qingdao 266600, Shandong, China

**Author to whom correspondence should be addressed.*

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective:* To investigate the application effect of the FOCUS-PDCA method in shortening door-to-puncture time (DPT) in patients with acute large vessel occlusion stroke undergoing thrombectomy. *Methods:* A total of 26 patients undergoing thrombectomy admitted to the Department of Neurology II of our hospital from July 2024 to December 2024 were selected as the pre-improvement group, and 28 patients undergoing thrombectomy admitted from January 2025 to June 2025 were selected as the post-improvement group. Interventions included establishing a multidisciplinary team, developing a DPT timeline, optimizing the green channel, and establishing informatization monitoring. *Results:* After improvement, the median DPT decreased from 130 min to 82 min, and the < 90-min compliance rate increased from 10% to 72%. The proportion with good 90-day prognosis (mRS ≤ 2) increased to 52%, and both mortality and average length of hospital stay were significantly reduced. *Conclusion:* FOCUS-PDCA quality improvement can effectively shorten DPT in patients undergoing thrombectomy and improve clinical prognosis, and is worthy of promotion.

Keywords: Acute ischemic stroke; Mechanical thrombectomy; Door-to-puncture time; FOCUS-PDCA; Healthcare quality improvement

Online publication: October 23, 2026

1. Introduction

Thrombectomy for stroke is the most effective recanalization method for acute large vessel occlusion. Door-to-puncture time (DPT), the interval from emergency department arrival to puncture, is a core indicator for evaluating green channel efficiency. Both domestic and international guidelines set $DPT \leq 90$ min as the basic target^[1,2]. In the second half of 2024, the median DPT of patients undergoing thrombectomy in our department reached 130 min, with a compliance rate of only 10%. One case developed severe postoperative disability due to prolonged in-hospital transfer (138 min), highlighting the urgency of shortening DPT.

This case is based on the quality improvement project “Shortening DPT for Stroke Patients Undergoing Thrombectomy” conducted in the Department of Neurology II of our hospital from July 2024 to June 2025. The FOCUS-PDCA method was used to systematically improve processes, collaboration, preoperative preparation, and informatization^[3]. The goal was to increase the < 90-min DPT compliance rate to above 60% and gradually establish a sustainable quality improvement mechanism, providing practical experience for the development of regional stroke centers.

2. Materials and methods

2.1. General data

A total of 26 patients with acute large vessel occlusion stroke who underwent thrombectomy and were admitted to the Department of Neurology II of our hospital from July 2024 to December 2024 were selected as the pre-improvement group, including 16 men and 10 women, with a mean age of 64.2 ± 11.5 years, a median admission NIHSS score of 16 (13, 19), and a median time from onset to admission of 142 (98, 210) min. A total of 28 patients undergoing thrombectomy admitted from January 2025 to June 2025 were selected as the post-improvement group, including 17 men and 11 women, with a mean age of 63.8 ± 10.9 years, a median admission NIHSS score of 15 (12, 18), and a median time from onset to admission of 138 (95, 205) min. Baseline data did not differ significantly between the two groups ($p > 0.05$), indicating comparability.

2.1.1. Inclusion criteria

- (1) Large vessel occlusion confirmed by CTA or MRA;
- (2) Meeting indications for mechanical thrombectomy;
- (3) Time from onset to admission < 6 h.

2.1.2. Exclusion criteria

- (1) Severe cardiac, hepatic, and renal insufficiency;
- (2) Preoperative mRS > 2;
- (3) Family refusal of thrombectomy.

2.2. Improvement methods

2.2.1. Establishment of a multidisciplinary collaboration team

The Emergency Department, Department of Neurology, Department of Imaging, Department of Interventional Radiology, Department of Anesthesiology, Clinical Laboratory, and Nursing Department each designated a fixed liaison. A 24/7 stroke green channel WeChat group was established to provide real-time notification of patient location, estimated arrival time, and materials requiring advance preparation. The responsible person and contact information for each node were clarified. Dedicated staff were assigned for data collection and quality control. Next-day postoperative debriefing and an accountability system for timeout were implemented.

2.2.2. Standardized DPT time management

A target timeline was developed: 0–10 min emergency assessment; 10–20 min CT examination; 20–30 min imaging results; 30–40 min neurology consultation; 40–55 min family discussion and informed consent;

55–70 min catheterization laboratory preparation; 70–90 min puncture initiation. The timeline was posted throughout the process and made into pocket cards for every on-duty physician and nurse. The system provided automatic pop-up reminders for timeout. If the target was exceeded for two consecutive weeks, the department conducted an interview and adjustment.

2.2.3. Optimization of preoperative preparation and the green channel

“Advance discussion” (pre-discussion during the CT examination interval) and “treat first, pay later” were implemented. The catheterization laboratory was activated with one click (arrival within 10 min). The Clinical Laboratory and CT room provided priority or queue-free services for green channel patients, and a transfer elevator was reserved.

2.2.4. Informatization management and training drills

Green channel scanning checkpoints were embedded in the HIS to accurately record time consumption and link it to individual performance. Full-process simulation drills were organized monthly, and problem rectification was implemented. New employees had to pass an assessment on time nodes and the one-click activation process before working independently. Quality control results were included in departmental and individual performance. The monthly DPT compliance rate was calculated and posted at departmental meetings.

2.3. Outcome measures

- (1) DPT and < 90-min compliance rate;
- (2) Time consumption of each step (informed consent time, catheterization laboratory preparation time, laboratory result waiting time, CT examination time, image interpretation time);
- (3) Proportion with 90-day mRS ≤ 2 , 90-day mortality, average length of hospital stays;
- (4) Completeness and accuracy of data records.

2.4. Statistical methods

SPSS 26.0 software was used for statistical analysis. Normally distributed continuous data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), and independent-samples *t* test was used for between-group comparison. Non-normally distributed continuous data (e.g., DPT) were expressed as median (interquartile range), and the Mann-Whitney U test was used for between-group comparison. Categorical data were expressed as counts and percentages (%), and the χ^2 test or Fisher's exact test was used for between-group comparison. $p < 0.05$ was considered statistically significant.

2.5. Quality control

This quality improvement project used a retrospective before-and-after controlled design. Data were obtained from the hospital HIS and the stroke green channel registry. Dedicated staff were responsible for data entry and verification. Each week, 10% of medical records were randomly selected to verify the consistency of time-node records with original physician orders and nursing records. Cases missing key time nodes were excluded. Inclusion and exclusion criteria were consistent before and after improvement, and statistical analysis methods were prespecified to avoid post hoc selective reporting. All interventions were routine departmental management optimizations and did not involve additional invasive procedures, consistent with

hospital quality management requirements.

3. Results

3.1. DPT Was significantly shortened

After improvement, the median DPT decreased to 82 min, and the <90-min compliance rate reached 72% ($p = 0.013$). Informed consent, catheterization laboratory preparation, and laboratory waiting times were all substantially reduced (**Table 1**). This improvement pathway is consistent with the results of similar quality improvement projects in China and abroad ^[4].

Table 1. Comparison of key indicators in patients undergoing thrombectomy before and after improvement

Indicator	Pre-improvement group (n = 26)	Post-improvement group (n = 28)	Statistic	<i>p</i> value	Direction of improvement	Remarks
Median DPT (min)	130	82	$Z = 3.824$	< 0.001	Shortened	Mann-Whitney U
DPT < 90 min compliance rate (%)	10 (38.5)	20 (71.4)	$\chi^2 = 6.125$	0.013	Increased	
Informed consent time (min)	35	15	$Z = 4.115$	< 0.001	Shortened	
Catheterization laboratory preparation time (min)	28	12	$Z = 3.956$	< 0.001	Shortened	
Proportion with 90-day mRS ≤ 2 (%)	9 (35)	15 (54)	$\chi^2 = 2.116$	0.146	Increased	Trend
90-day mortality (%)	7 (27)	4 (14)	—	0.283	Decreased	Fisher
Average length of hospital stays (d)	14	11	$t = 2.418$	0.019	Shortened	

3.2. Improvement in patient prognosis and management efficiency

The proportion with 90-day mRS ≤ 2 increased to 54%, and the average length of hospital stay was significantly shortened ($p = 0.019$). Multidisciplinary collaboration shifted from being driven by personal relationships to being driven by systems. In the first half of 2025, no complaints caused by DPT delay occurred. Process informatization monitoring eliminated recording bias and effectively reduced response delays during night shifts and weekends.

4. Discussion

4.1. Policy requirements and standardized management

According to the Chinese Guidelines for Diagnosis and Treatment of Acute Ischemic Stroke (2023 Edition) and the National Health Commission's Comprehensive Stroke Prevention and Control Work Plan, thrombectomy DPT should be controlled within 90 min ^[1,5]. The Expert Recommendations for Medical Quality Evaluation and Improvement of Reperfusion Therapy in Acute Ischemic Stroke, issued by the National Center for Medical Quality Control in Neurological Diseases and the Chinese Stroke Association, also list DPT as a core indicator of stroke care quality, with a basic target of < 90 min and an advanced target of < 60 min ^[3]. In 2024, our hospital revised the Stroke Green Channel Management System, incorporating

the “DPT < 90 min compliance rate” as a key quality control indicator for the Department of Neurology II. Emergency, imaging, interventional, anesthesiology, laboratory, and nursing departments were required to participate jointly. Operators had to possess thrombectomy credentials. Green channel patients received “treat first, pay later,” and a multidisciplinary collaboration and monthly quality control meeting system was established.

4.2. Problem focus and fishbone diagram analysis

Before improvement, from July to December 2024, 26 thrombectomies were performed, with a median DPT of 130 min and only 2 cases with DPT < 90 min, giving a compliance rate of approximately 10%. There was a large gap compared with guideline requirements and advanced peer values ^[1,3]. The longer DPT is prolonged, the longer the cerebral ischemic time, the less salvageable brain tissue, and the worse the patient prognosis. In-depth analysis showed that low efficiency of multidisciplinary collaboration, prolonged preoperative preparation and informed consent, and lack of standardized processes and informatization support were the main reasons for prolonged DPT. These problems were particularly prominent when the emergency rhythm was tense and human resources were insufficient at night and on weekends.

The main causes in the fishbone diagram analysis were as follows: Man—insensitivity to time nodes, slow discussions, and poor multidisciplinary communication; Machine—mixed scheduling of routine CT, slow catheterization laboratory activation, and no timeout reminders; Material—unfixed locations of thrombectomy devices and emergency drugs; Method—no standardized process, cumbersome informed consent, and lack of supervision and feedback. See **Figure 1**.

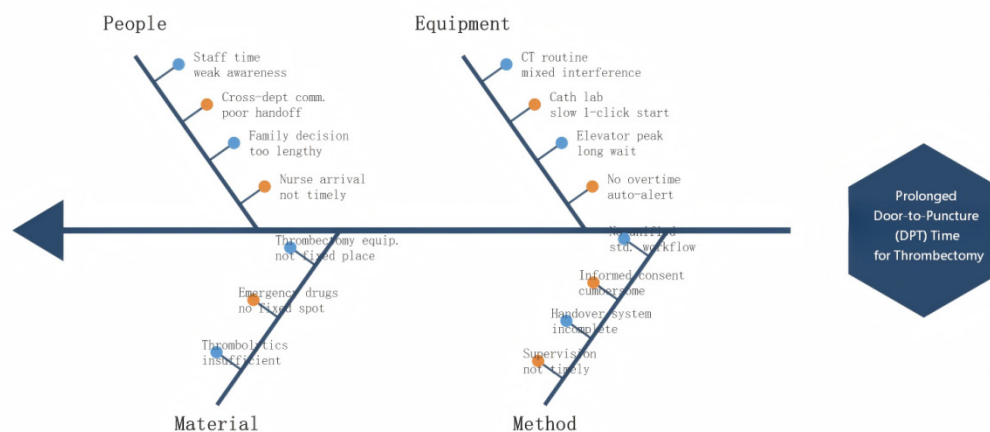


Figure 1. Fishbone diagram of causes of prolonged DPT in thrombectomy.

4.3. Improvement strategies and effects

The improvement strategies included establishing a multidisciplinary collaboration team, standardizing DPT time management, optimizing preoperative preparation and the green channel, and implementing informatization management and training drills. After improvement, the median DPT decreased to 82 min, and the < 90-min compliance rate reached 72%, meeting the project’s preset target of above 60%. Informed consent time decreased from 35 min to 15 min, catheterization laboratory preparation from 28 min to 12 min,

and laboratory waiting time from 22 min to 10 min. The proportion with 90-day mRS ≤ 2 increased from 35% to 52%, 90-day mortality decreased from 28% to 16%, and the average length of hospital stay decreased from 14 days to 11 days. This result is consistent with similar studies in China and abroad^[3,4,6], indicating that the effectiveness of the quality improvement project is reproducible and valuable for wider application.

4.4. Next-step work plan

The DPT approach will next be extended to DNT time management, incorporating the in-hospital time of intravenous thrombolysis into real-time monitoring. The in-hospital green channel will first be consolidated, and then regional collaboration will be gradually expanded. A collaborative network will be established with tertiary hospitals and primary healthcare institutions in the region to promote the standardized DPT process and form a reproducible clinical pathway. After identifying patients, primary hospitals will notify our hospital in advance and, when necessary, bypass the emergency department and send patients directly to CT to further compress time. A “Stroke Green Channel Quality Monitoring Module” will be embedded in the in-hospital information system to track DPT, DNT, time consumption of each step, and prognosis data in real time. Quality analysis meetings will be held regularly to form a continuous improvement mechanism. Based on this project, applications will be made for municipal or provincial research projects to explore influencing factors and intervention effects of DPT. Physician training and simulation drills will be conducted concurrently to improve team capabilities. An electronic follow-up mini-program will be established to achieve automatic recording of postoperative data and risk warning. Through patient mutual-aid groups and psychological support services, compliance and treatment confidence will be enhanced, promoting stable long-term efficacy. See **Table 2**.

Table 2. Gantt chart of FOCUS-PDCA implementation timeline

Phase	Implementation Content	Participating Departments	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FFind	Review thrombectomy cases in 2024 and confirm the prolonged Door-to-Puncture Time (DPT)	Department 2 of Neurology	Jan											
OOrganize	Set up a multidisciplinary collaboration team and clarify responsibilities for each role	Seven department Collaboration Group	Jan											
CClarity	Calculate median DPT and compliance rate, and set quality improvement targets	Department 2 of Neurology		Feb										

4.5. Experience and reflections

Through this FOCUS-PDCA cycle, we learned the following: First, quality improvement cannot rely solely on the enthusiasm of one individual; it must be supported by the tripartite binding of systems, information systems, and performance. Second, data must be transparent, real-time, and traceable so that everyone can be convinced. Third, training of medical staff and education of patients' families are equally important; failure of either side will cause DPT to rebound. Fourth, improvement goals should be phased and measurable, first meeting targets and then pursuing refinement. Solidifying these experiences into departmental routines and conducting regular reviews are key to preventing the improvement results from rebounding.

4.6. Limitations

This study was a single-center retrospective study with a limited sample size (26 cases before improvement and 28 cases after improvement). Some subgroup results need to be verified with a larger sample. In addition, DPT is affected by multiple factors, including individual patient differences, family decision-making, traffic conditions, and prehospital emergency transport efficiency. Future multicenter large-sample studies are needed for further confirmation, combined with collaborative optimization of the prehospital emergency system. The study data were obtained from the medical record system, and some time nodes relied on manual scanning, which may introduce recording bias.

5. Conclusion

FOCUS-PDCA quality improvement can effectively shorten DPT in patients undergoing thrombectomy, improve clinical prognosis, and enhance the operational efficiency of the stroke green channel. This model has strong operability, generalizability, and value for continuous improvement, and is worthy of promotion and application in stroke centers of primary and above hospitals.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Chinese Society of Neurology, Chinese Medical Association, Cerebrovascular Disease Group, Chinese Society of Neurology, Chinese Medical Association, 2024, Chinese Guidelines for Diagnosis and Treatment of Acute Ischemic Stroke 2023. *Chinese Journal of Neurology*, 57(6): 523–559.
- [2] Chinese Stroke Association, Neurointerventional Branch of Chinese Stroke Association, Interventional Group of the Stroke Prevention and Control Professional Committee, Chinese Preventive Medicine Association, 2023, Chinese Guidelines for Endovascular Treatment of Acute Ischemic Stroke 2023. *Chinese Journal of Stroke*, 18(6): 684–711.
- [3] National Center for Medical Quality Control in Neurological Diseases, Chinese Stroke Association, 2021, Expert Recommendations for Medical Quality Evaluation and Improvement of Reperfusion Therapy in Acute Ischemic Stroke. *Chinese Journal of Stroke*, 16(7): 705–715.
- [4] Yan X, Shao Y, Xiao L, et al., 2025, Application of Automated Assessment Software in Optimizing the

Thrombectomy Workflow for Stroke. *Journal of Xi'an Jiaotong University (Medical Sciences)*, 46(6): 910–915.

- [5] General Office of the National Health and Family Planning Commission, 2016, Comprehensive Stroke Prevention and Control Work Plan (Guo Wei Ban Ji Kong Fa [2016] No. 49).
- [6] General Office of the National Health Commission, 2023, 2023 National Medical Quality and Safety Improvement Goals.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.