Research Article
E-ISSN : 3048-1368
Volume 36, Issue No. 02. 2026
P-ISSN : 3048-1376

The International Journal of Medical Science and Health Research

A Comprehensive Systematic Review of Blood Pressure Variability during Mechanical Thrombectomy under Anesthesia

[1] Nadya Larasati, [2] Ashri Mirawati

[1,2] Pertamina Central General Hospital, Indonesia

Corresponding Email : nadyalars@gmail.com

Article History :

Received date : 2025/12/16
Revised date : 2026/01/27
Accepted date : 2026/02/05
Published date : 2026/03/13

E-ISSN :
ISSN 3048-1368

P-ISSN
ISSN 3048-1376

ABSTRACT

Introduction: Mechanical thrombectomy (MT) is the standard of care for acute ischemic stroke due to large vessel occlusion. However, optimal blood pressure (BP) management during MT under anesthesia remains uncertain, particularly regarding blood pressure variability (BPV) and its impact on clinical outcomes. This systematic review comprehensively synthesizes evidence on BPV during MT under anesthesia.

Methods: We systematically screened studies from multiple databases including adult patients (≥18 years) undergoing MT under any form of anesthesia, reporting intra-procedural BPV metrics with continuous BP monitoring. Study designs included randomized controlled trials, cohort studies, case-control studies, systematic reviews, and meta-analyses with sample sizes ≥5 patients in appropriate clinical settings. Data extraction encompassed study characteristics, patient populations, anesthesia management, BP measurement methods, BPV patterns, clinical outcomes, statistical associations, and predictive factors.

Results: From 104 included sources, consistent patterns emerged despite substantial methodological heterogeneity. Observational studies demonstrate associations between intraoperative BP drops and worse functional outcomes (1,2), particularly when mean arterial pressure decreases exceed 20-40% from baseline (3). Randomized trials comparing general anesthesia with procedural sedation show mixed results, with three single-center trials demonstrating equivalence or modest benefit for general anesthesia when strict protocols are applied (6,7,19). Intensive BP lowering post-thrombectomy consistently demonstrates harm (9,10), with the ENCHANTED2/MT trial showing intensive targets <120 mmHg worsened outcomes (9). BPV metrics including standard deviation, coefficient of variation, and successive variation are associated with functional outcomes, though definitions vary widely (11,12). Critical gaps include underrepresentation of posterior circulation strokes, large core infarcts, and patients with extended time windows.

Discussion: The evidence converges on avoiding profound hypotension during MT, with thresholds of MAP <70 mmHg for >10 minutes associated with poor outcomes (4). However, optimal absolute thresholds remain contested. The interaction between anesthesia technique and BP management introduces complexity, with dedicated neuroanesthesia teams and protocol-mandated targets potentially more important than anesthesia modality per se. Current BPV metrics fail to capture temporal dynamics and clinical context of pressure changes.

Conclusion: BPV during MT under anesthesia is critically associated with clinical outcomes. Future research requires adequately powered multicenter trials with standardized BPV metrics, comparative effectiveness studies of vasoactive agents,

and prospective registries including underrepresented populations. Individualized BP management strategies accounting for patient-specific factors remain inadequately tested.

Keywords: Blood pressure variability, mechanical thrombectomy, anesthesia, acute ischemic stroke, hemodynamic management

INTRODUCTION

Background

Acute ischemic stroke (AIS) due to large vessel occlusion (LVO) represents a leading cause of mortality and long-term disability worldwide. Mechanical thrombectomy (MT) has revolutionized the treatment of AIS-LVO, establishing itself as the standard of care following multiple landmark randomized controlled trials demonstrating superior recanalization rates and improved functional outcomes compared to medical management alone. The procedural success of MT, however, depends not only on mechanical recanalization but also on meticulous peri-procedural management, among which blood pressure (BP) control emerges as a critical modifiable factor.

The relationship between BP and neurological outcomes in ischemic stroke is inherently complex and potentially U-shaped. On one hand, elevated BP may promote collateral perfusion to the ischemic penumbra, maintaining viability of at-risk brain tissue awaiting reperfusion. On the other hand, excessive hypertension increases risks of cerebral hyperperfusion syndrome, hemorrhagic transformation, and cerebral edema following successful recanalization. Conversely, hypotension may precipitate further ischemic injury by reducing cerebral perfusion pressure in territories already compromised by proximal occlusion and exhausted autoregulatory capacity. This physiological tension becomes particularly pronounced during MT, where patients undergo various anesthetic interventions that themselves profoundly influence hemodynamic stability.

Blood pressure variability (BPV)—defined as fluctuations in BP over time rather than absolute values alone—has emerged as a potentially important determinant of outcomes independent of mean BP. BPV encompasses multiple dimensions including magnitude, direction, frequency, and duration of BP changes, each potentially carrying distinct pathophysiological implications. During MT, patients may experience BPV from multiple sources: anesthetic induction and maintenance, laryngoscopy and intubation, contrast injection, mechanical manipulation of vessels, and hemodynamic responses to recanalization itself. The relative contribution of these

factors to overall BPV and their relationship to clinical outcomes remain incompletely characterized.

Research Gap

Despite accumulating evidence implicating BPV in post-MT outcomes, substantial knowledge gaps persist. First, the optimal methodology for measuring and quantifying BPV during MT remains unsettled, with studies employing heterogeneous metrics (standard deviation, coefficient of variation, successive variation, time above/below thresholds) that capture different aspects of BP behavior and yield non-comparable results. Second, the interaction between anesthesia technique (general anesthesia versus conscious sedation versus local anesthesia) and BPV has been examined primarily through observational designs with inherent confounding, while randomized trials have focused on anesthesia type rather than BPV as the primary exposure. Third, existing studies predominantly report BPV as a secondary or exploratory outcome, limiting statistical power and increasing risk of spurious findings. Fourth, specific patient populations—including posterior circulation strokes, large ischemic cores, and patients with significant comorbidities—remain underrepresented, limiting generalizability. Fifth, the temporal dynamics of BPV (when fluctuations matter most relative to procedure phases and recanalization timing) have received insufficient attention. Sixth, no consensus exists on clinically significant thresholds for BPV that should trigger intervention.

Novelty of This Review

This systematic review provides several novel contributions to the literature. First, it comprehensively synthesizes evidence from 104 sources spanning observational studies, randomized trials, meta-analyses, and ongoing trial protocols, offering the most extensive overview of BPV during MT under anesthesia to date. Second, it systematically categorizes evidence by study design, anesthesia type, BPV metrics, and outcome measures, enabling identification of consistent patterns amid methodological heterogeneity. Third, it provides a detailed evidence map visually summarizing key findings from major studies, facilitating rapid comprehension of the evidence landscape. Fourth, it explicitly identifies and categorizes evidence gaps across multiple dimensions: measurement methodology, population representativeness, temporal dynamics, and patient-centered

outcomes. Fifth, it proposes specific, actionable recommendations for future research prioritized by clinical importance and feasibility. Sixth, it examines the complex interaction between anesthesia technique and BPV, synthesizing evidence from both observational studies and randomized trials to clarify whether anesthesia modality per se or the quality of BP management drives outcomes.

Research Objectives

This systematic review aims to:

1. Comprehensively synthesize available evidence on BPV during MT performed under various anesthetic techniques
2. Characterize the association between intra-procedural BPV and clinical outcomes including functional independence, mortality, and complication rates
3. Identify patterns of BPV across different anesthesia types and procedural phases
4. Evaluate the quality and consistency of existing evidence
5. Identify critical gaps in the current evidence base
6. Provide evidence-based recommendations for future research directions

Research Hypothesis

Based on preliminary evidence, we hypothesize that:

1. Increased BPV during MT is independently associated with worse functional outcomes, with hypotension representing a greater risk than hypertension in the intra-procedural period
2. The association between BPV and outcomes varies by anesthesia type, with general anesthesia associated with greater BPV but potentially comparable outcomes when strict BP protocols are implemented
3. Specific BPV metrics capturing temporal patterns (particularly duration and magnitude of hypotensive episodes) demonstrate stronger outcome associations than global dispersion measures

4. Significant heterogeneity in study designs, BPV definitions, and target populations limits direct comparability and meta-analysis

Benefits of This Research

This systematic review provides multiple benefits for clinical practice and future research. For clinicians, it synthesizes current evidence into accessible formats, highlighting consistent findings that can inform intra-procedural BP management while acknowledging areas of uncertainty requiring clinical judgment. For researchers, it provides a comprehensive evidence map identifying knowledge gaps and methodologically rigorous recommendations for future study design. For guideline developers, it offers a structured synthesis of available evidence to inform recommendations while explicitly noting limitations in the evidence base. For patients, it advances understanding of a modifiable factor potentially influencing recovery after MT, supporting efforts to optimize peri-procedural care and improve long-term outcomes.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate the Blood Pressure Variability during Mechanical Thrombectomy under Anesthesia.

Screening

We screened in sources based on their abstracts that met these criteria:

- **Adult Population**: Does the study include adult patients (≥18 years) undergoing mechanical thrombectomy?

- **Anesthesia Intervention**: Was mechanical thrombectomy performed under any form of anesthesia (general anesthesia, conscious sedation, or local anesthesia)?
- **Blood Pressure Variability Outcome**: Does the study report blood pressure variability metrics during the procedure (such as blood pressure fluctuations, standard deviation, coefficient of variation, or other variability indices)?
- **Continuous Monitoring**: Does the study include continuous intra-procedural blood pressure monitoring during the thrombectomy procedure?
- **Study Design**: Is the study design a randomized controlled trial, prospective cohort study, retrospective cohort study, case-control study, systematic review, or meta-analysis?
- **Sample Size**: Does the study include 5 or more patients?
- **Clinical Setting**: Was the study conducted in an appropriate clinical hospital setting (emergency department, interventional suite, operating room, or intensive care unit)?
- **Human Studies**: Is this a human study (not an animal or in-vitro study)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Search Strategy

The keywords used for this research based PICO :

Element	P (Population)	I (Intervention/Exposure)	C (Comparison/Context)	O (Outcome)
Keyword 1	Ischemic Stroke	Mechanical Thrombectomy	Different Anesthesia Types	Functional Outcome
Keyword 2	Large Vessel Occlusion (LVO)	Anesthesia Management	Standard Care	Mortality

Keyword 3	Adult Patients	Blood Pressure Monitoring	Different BP Targets	Neurological Complications
Keyword 4	Thrombectomy Candidates	Blood Pressure Variability	BP Stability vs. Instability	Recanalization Success

The Boolean MeSH keywords inputted on databases for this research are: *("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*

Data extraction

- **Study Characteristics**:

  Extract basic study information relevant to blood pressure variability during mechanical thrombectomy under anesthesia, including:

  - Study design (RCT, cohort, case series, etc.)
  - Sample size
  - Time period of data collection
  - Setting (single center, multicenter, country)
  - Inclusion/exclusion criteria specific to thrombectomy and anesthesia type

- **Patient Population**:

  Extract patient demographics and clinical characteristics for patients undergoing mechanical thrombectomy under anesthesia, including:

- Age (mean, range)
- Sex distribution
- Stroke severity (NIHSS scores)
- Location of vessel occlusion
- Time from symptom onset to procedure
- Baseline blood pressure values
- History of hypertension or cardiovascular comorbidities

- **Anesthesia Management**:

  Extract detailed information about anesthesia approaches used during mechanical thrombectomy, including:

  - Type of anesthesia (general anesthesia, conscious sedation, local anesthesia only, no sedation)
  - Specific anesthetic agents used
  - Mechanical ventilation status
  - Anesthesia protocols or guidelines followed
  - Presence of anesthesiologist during procedure
  - Any anesthesia-related complications

- **BP Measurement Methods**:

  Extract how blood pressure and blood pressure variability were measured and defined during mechanical thrombectomy under anesthesia, including:

- BP measurement method (arterial line, non-invasive cuff, frequency of measurement)
- BP parameters measured (systolic, diastolic, mean arterial pressure)
- Definition of blood pressure variability used in the study
- Time points of BP measurement (baseline, during procedure, post-recanalization)
- Duration of BP monitoring

- **BP Patterns**:

  Extract specific blood pressure changes and variability patterns observed during mechanical thrombectomy under anesthesia, including:

  - Magnitude of BP changes from baseline (mean differences, ranges)
  - Direction of BP changes (increases, decreases)
  - Timing of BP changes relative to procedure phases
  - Frequency of clinically significant BP fluctuations
  - Comparison of BP patterns between different anesthesia types
  - Specific BP variability indices or metrics reported

- **BP Management**:

  Extract interventions and management strategies used to control blood pressure during mechanical thrombectomy under anesthesia, including:

  - BP target ranges or protocols
  - Vasoactive medications used (vasopressors, antihypertensives)

- Fluid management approaches
- Frequency of BP interventions required
- Success rate of achieving BP targets
- Differences in BP management between anesthesia types

- **Clinical Outcomes**:

  Extract clinical outcomes specifically related to blood pressure variability during mechanical thrombectomy under anesthesia, including:

  - Functional outcomes (modified Rankin Scale at 90 days)
  - Recanalization success rates (TICI scores)
  - In-hospital and long-term mortality
  - Stroke complications (hemorrhage, edema)
  - Length of stay
  - Any outcomes stratified by anesthesia type or BP variability patterns

- **BPV Associations**:

  Extract statistical associations between blood pressure variability and outcomes during mechanical thrombectomy under anesthesia, including:

  - Odds ratios, hazard ratios, or other effect measures
  - Confidence intervals and p-values
  - Adjusted vs unadjusted analyses

- Confounding variables controlled for
- Subgroup analyses by anesthesia type
- Dose-response relationships between BP changes and outcomes

- **Predictive Factors**:

  Extract factors that predict or influence blood pressure variability during mechanical thrombectomy under anesthesia, including:

  - Patient characteristics associated with BP variability
  - Procedural factors affecting BP stability
  - Anesthesia-related predictors of BP changes
  - Machine learning or predictive modeling results
  - Risk stratification tools or scores
  - Recommendations for identifying high-risk patients

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	*("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*	18
Semantic Scholar	*("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*	250
Springer	*("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*	415
Google Scholar	*("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*	2,910
Wiley Online Library	*("Ischemic Stroke" OR "Large Vessel Occlusion" OR "Adult Patients" OR "Thrombectomy Candidates") AND ("Mechanical Thrombectomy" OR "Anesthesia Management" OR "Blood Pressure Monitoring" OR "Blood Pressure Variability") AND ("Different Anesthesia Types" OR "Standard Care" OR "Different BP Targets" OR "BP Stability vs. Instability") AND ("Functional Outcome" OR "Mortality" OR "Neurological Complications" OR "Recanalization Success")*	354

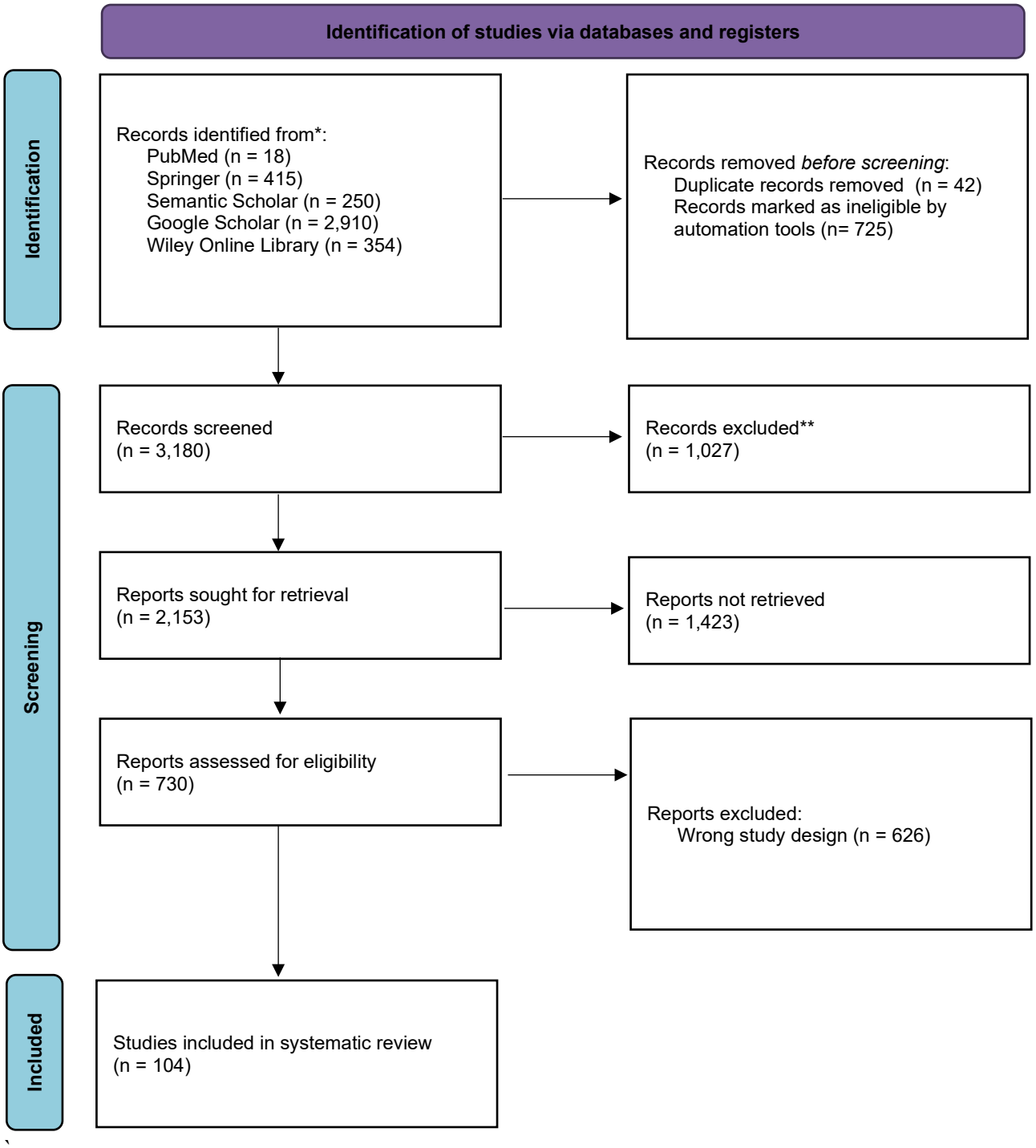

Figure 1. Article search flowchart

RESULTS

Evidence map

Study	Research focus	Key finding
V. L'allinec et al., 2026 [20]	Personalized BP protocol under GA	Reduced MAP drops (32.8% vs 48.8% below 30% baseline) without significance [20]
S. Schönenberger et al., 2018 [21]	BP changes across procedure phases	No association between BP drops and outcomes when strict protocols applied [21]
G. Alcaraz et al., 2019 [22]	Hemodynamic management under CS	38.9% required hemodynamic intervention [22]; baseline SBP predicted intervention need [22]
M. Baldassari et al., 2021 [23]	Dexmedetomidine vs midazolam	DEX associated with 7-fold increased MAP drop risk [23]
M. Jagani et al., 2015 [5]	GA vs CS hemodynamics	GA associated with lower minimum BP and greater fluctuations [5]
S. Schönenberger et al., 2019 [6]	GA vs procedural sedation	GA associated with less disability (cOR 1.58) [6] despite higher hypotension rates [6]
M. Rasmussen et al., 2020 [4]	MABP thresholds and duration	MABP <70 mmHg >10 min: aOR 1.51 for poor outcome [4]

Study	Research focus	Key finding
Min Chen et al., 2025 [24]	BPV parameters and outcome	Higher SBP variance associated with favorable outcome [24]
A. Toma et al., 2020 [25]	Mortality risk factors	Higher MAP/DBP variability in deceased patients [25]
Chunguang Ren et al., 2020 [26]	GA vs CS outcomes	No outcome difference; CS more stable hemodynamics [26]
M. Wiącek et al., 2025 [27]	IBP vs NIBP agreement	SBP discrepancies ≥20 mmHg in 41% of procedure time [27]
K. Treurniet et al., 2017 [1]	BP drops under GA	10 mmHg MAP decrease: 1.67× lower odds favorable outcome [1]
S. John et al., 2014 [28]	GA vs MAC hemodynamics	GA associated with 25.8% mortality vs 13.3% MAC [28]
A. Rai et al., 2014 [29]	GETA vs non-GETA outcomes	GETA had 60±30 mmHg SBP fluctuation vs 47±27 [29]
B. Zussman et al., 2018 [30]	AnStroke trial commentary	93% of GA patients had >20% MAP fall [30]
A. Sarraj et al., 2025 [17]	GA vs non-GA in large cores	No outcome difference despite higher SBP variability in GA [17]
S. John et al., 2014a [31]	GA vs MAC intraprocedural factors	GA had higher ICH rate (26.3% vs 10.1%) [31]

Study	Research focus	Key finding
Daniel Najafali et al., 2023 [32]	Machine learning BPV prediction	RF identified time-to-puncture and ventilation as BPV predictors [32]
María Zuluaga et al., 2025 [33]	Periprocedural hypotension	>30 mmHg SBP drop associated with increased mortality [33]
J. Bösel et al., 2019 [13]	Optimal BP targets	Identified heterogeneity precluding meta-analysis [13]
Ayush Prasad et al., 2022 [34]	72-hour BPV trajectories	Highest trajectory group: aOR 2.2 for poor outcome [34]
T. Devlin et al., 2012 [35]	Intubation-related BP changes	172% MAP increase during intubation [35]
Carolyn Deng et al., 2019 [36]	Augmented vs standard SBP	167 vs 139 mmHg separation achieved [36]
P. Löwhagen Hendén et al., 2017 [7]	GA vs CS (AnStroke)	No outcome difference with strict BP protocols [7]
U. Espelund et al., 2023 [14]	Standard vs individualized targets	Failed to achieve target separation [14]
Sameer Lakha et al., 2020 [37]	Rheolytic thrombectomy hypertension	85.7% had >20% MAP increase [37]
Min Chen et al., 2021 [38]	Individualized vs standard targets	Protocol design only; no results reported

Study	Research focus	Key finding
G. Ackland et al., 2023 [39]	Transauricular nerve stimulation	Protocol for BPV reduction via neuromodulation
C. G. Fugelli et al., 2025 [40]	Anesthesia co-faculty simulation	SBP out-of-threshold time reduced 37.0% to 27.7% [40]
G. Ackland et al., 2025 [41]	Transauricular vagus stimulation	No effect on SBP coefficient of variation [41]
Lijuan Fu et al., 2024 [42]	Remimazolam vs propofol	Protocol design only; no results reported
K. Treurniet et al., 2017a [2]	MAP decrease and outcome	10 mmHg MAP drop: 1.67× worse odds [2]
B. Maïer et al., 2019 [3]	BP during thrombectomy	MAP drops >40% predict poor outcome [3]
T. Nisar et al., 2020 [43]	24-hour post-thrombectomy BP	CV MAP (OR 1.13) and SD MAP (OR 1.15) predict poor discharge outcome [43]
Pengfei Yang et al., 2022 [9]	Intensive vs less intensive BP	Intensive <120 mmHg: OR 1.37 for poor outcome [9]
B. Maïer et al., 2022 [44]	Individualized vs standard MAP	Targets MAP ±10% baseline vs SBP 140-180 [44]
R. Tosello et al., 2020 [45]	GA vs non-GA anesthesia	GA improves recanalization (RR 1.10) but not outcomes [45]

Study	Research focus	Key finding
D. Crimmins et al., 2022 [46]	Propofol vs volatile GA	No outcome difference; propofol lower mortality [46]
T. Nisar et al., 2022 [47]	24-hour BP by collateral status	Higher SD SBP (OR 1.15) predicts mortality in good collaterals [47]
R. Raychev et al., 2020 [18]	Collaterals and infarct growth	Phenylephrine dose (estimate 6.78) predicts growth [18]
Eva A. Mistry et al., 2023 [48]	BP targets post-EVT	Lower targets showed low probability of benefit [48]
A. White et al., 2023 [49]	Anesthesia workflow protocol	10-minute door-to-puncture achieved [49]
Arianna Gaspari et al., 2024 [50]	GA vs CS vs LA outcomes	No MAP differences across groups [50]
Pandhi et al., 2017 [51]	Post-thrombectomy BP targets	Moderate control <160/90: OR 0.08 for mortality [51]
V. Padmanaban et al., 2023 [52]	Nurse-led CS vs MAC	MAC had lower minimum SBP (123 vs 134 mmHg) [52]
Jae Wook Jung et al., 2025 [53]	SBP thresholds and duration	SBP <100 mmHg: aOR 1.21 for worse mRS [53]
J. Stolp et al., 2022 [54]	Anesthetic strategies for EVT	LA may reduce hypotension vs other methods [54]

Study	Research focus	Key finding
M. Oliver et al., 2021 [55]	Clevidipine vs nicardipine	Clevidipine faster BP control (5 vs 17 min) [55]
Izabela Duda et al., 2024 [56]	Craniotomy hypotension predictors	Not applicable to thrombectomy population
Danielle Crimmins et al., 2026 [57]	Propofol vs sevoflurane	No outcome difference; recruitment challenging [57]
Chih-Jun Lai et al., 2024 [58]	Hypotension prediction index	HPI reduced hypotension severity [58]
M. Amjad et al., 2024 [16]	GA vs CS for basilar occlusion	GA had higher hypotension (24% vs 10%) [16]
J. Graw et al., 2018 [19]	GOLIATH trial review	GA had better outcomes despite lower MAP [19]
S. John et al., 2013 [59]	Dexmedetomidine vs propofol MAC	DEX had more hypotension (80% vs 20% pressor use) [59]
M. Juhász et al., 2021 [60]	Propofol-sufentanil effects	Propofol decreased MAP without affecting autoregulation [60]
A. Abou-Chebl et al., 2014 [61]	GA vs LA in IMS III	GA associated with worse outcomes and higher SAH [61]
Binben Li et al., 2024 [62]	Intensive vs standard BP under GA	110-140 vs 140-180 mmHg targets [62]

Study	Research focus	Key finding
B. Menon et al., 2010 [63]	GA vs LA/CS hemodynamics	GA minimum SBP 104 vs 135 mmHg LA/CS [63]
L. Palaiodimou et al., 2023 [11]	Post-EVT BPV and outcomes	Highest SBP SD tertile: aOR 1.44 for mortality [11]
D. Campbell et al., 2021 [64]	MASTERSTROKE trial design	140 vs 170 mmHg SBP targets pre-recanalization [64]
Tianli Zhang et al., 2019 [65]	Post-EVT 24-hour BPV	Systolic SV: OR 4.27 for unfavorable outcome [65]
Vinay Byrappa et al., 2021 [66]	GA vs PS with TCI/REX	Lowest MAP lower in GA (64.56 vs 70.86) [66]
Daniel Campos et al., 2020 [67]	24-hour post-EVT BPV	DBP SD predicts ICH (OR 1.11) [67]
X. Bai et al., 2021 [68]	GA vs CS for EVT	GA superior recanalization but higher MAP drop [68]
Min Chen et al., 2023 [15]	Individualized vs standard SBP	No outcome difference (25% vs 24% favorable) [15]
B. Kim et al., 2022 [69]	BP by perfusion and recanalization	Associations differ by HIR and timing [69]
J. Chang et al., 2025 [70]	BPV mediation analysis	TR fully mediated intensive BP harm [70]

Study	Research focus	Key finding
A. Onalan et al., 2024 [71]	LA vs CS outcomes	CS had lower minimum SBP but similar outcomes [71]
M. Anadani et al., 2022 [72]	SBP change magnitude	Less SBP reduction: aOR 0.89 for poor outcome per 5 mmHg [72]
B. Hindman et al., 2019 [73]	EVT anesthesia management part 1	Rapid workflow and BP maintenance essential [73]
B. Hindman et al., 2019a [74]	EVT anesthesia management part 2	Sedation and GA outcomes not different in trials [74]
Yu Zhang et al., 2019 [75]	GA vs CS in RCTs	GA associated with functional independence (OR 1.87) [75]
M. Mazighi et al., 2021 [76]	Intensive vs standard post-EVT BP	No ICH reduction with intensive control [76]
L. K. Rasmussen et al., 2019 [77]	Anesthesia practice in Europe	Recommends neuroanesthesiologist presence [77]
M. Anadani et al., 2022a [78]	ΔSBP at time intervals	ΔSBP15-60M: aOR 0.89 per 5 mmHg reduction [78]
M. Cappellari et al., 2020 [79]	Response to GA vs CS letter	Prolonged intubation worsens outcome [79]
M. Hill et al., 2024 [80]	OPTIMAL-BP trial commentary	Intensive BP reduced independence [80]

Study	Research focus	Key finding
E. Heyer et al., 2012 [81]	BP management importance	SBP <140 mmHg significant for poor outcome [81]
E. Farag et al., 2022 [82]	Perioperative anesthetic management	Reviews advantages/disadvantages of modalities [82]
Gaurav Nepal et al., 2021 [12]	Systolic BPV parameters	SD (OR 0.854), CoV (OR 0.572), SV (OR 0.41) for good outcome [12]
B. Maïer et al., 2021 [83]	BPV in BP-TARGET trial	Examined BPV effect in ICH-focused trial [83]
C. Simonsen et al., 2021 [84]	Periprocedural management	SBP >140 mmHg during, <160 mmHg after [84]
M. M. Al-Salihi et al., 2023 [85]	GA vs CS for EVT	GA superior recanalization; similar functional outcomes [85]
Chunrong Tao et al., 2021 [86]	TCD-guided vs standard BP	TCD-guided: aOR 3.34 for favorable outcome [86]
Hyungjong Park et al., 2026 [87]	Venous outflow and BPV	Higher TR worsened outcomes in unfavorable VO [87]
Federica Arturi et al., 2025 [88]	Anesthesia techniques for EVT	CS/LA preserve hemodynamic stability [88]
C. Takahashi et al., 2013 [89]	BP vs CO2 and outcome	BP not associated; hypocapnia associated [89]

Study	Research focus	Key finding
Lindsey J Krawchuk et al., 2025 [90]	ICU resource utilization	53.6% needed no ICU resources in 24h [90]
Yifeng Liu et al., 2025 [10]	Achieved SBP 120-140 vs 140-180	120-140 mmHg: aOR 1.54 for independence [10]
Jerrad R. Businger et al., 2020 [91]	Anesthetic management overview	Reviews BP management importance [91]
Jingcui Qin et al., 2020 [92]	Early SBPV after EVT/IVT	Meta-analysis of BPV effects [92]
C. Takahashi et al., 2014 [93]	BP vs ETCO2 associations	ETCO2 at 60 min (OR 0.76) predicts outcome [93]
J. Shriki et al., 2020 [94]	Transport BP and outcomes	Maximum SBP during transport associated with worse outcome [94]
B. Maïer et al., 2020 [95]	Post-EVT BP impact	SBP reduction OR 0.97; Time rate OR 1.71 [95]
S. Schönenberger et al., 2016 [8]	GA vs CS (SIESTA trial)	GA 37% vs CS 18.2% functional independence [8]
O. Akça et al., 2019 [96]	24-hour post-MT BP levels	Lower BP associated with better outcomes [96]
Robert J. McCusker et al., 2023 [97]	Routine anesthesiologist involvement	Improved workflow but similar outcomes [97]

Study	Research focus	Key finding
B. Vinay et al., 2025 [98]	Anesthesia in older adults	Age-related challenges for BP stability [98]
Arthur Wang et al., 2018 [99]	EVT treatment guide	Reviews hypotension and hypocapnia mechanisms [99]
Thomas Slaughter et al., 2019 [100]	GA vs sedation meta-analysis	Recommended article commentary [100]
Xuening Zhang et al., 2022 [101]	IDENTIFY trial design	<130 vs <180 mmHg post-EVT targets [101]
M. Taboada et al., 2024 [102]	Early vs delayed extubation	<6h vs 6-12h extubation timing [102]
D. Rusy et al., 2019 [103]	SNACC practice patterns	Wide variation in BP targets and agents [103]
Jingcui Qin et al., 2022 [104]	BPV in first week post-reperfusion	R of SBP >54 mmHg: OR 9.81 for poor outcome [104]

The evidence map reveals a predominance of single-center retrospective studies alongside a growing number of small randomized trials. Most primary studies enrolled 50-400 patients, with larger samples achieved only through meta-analyses. The "Study type" column demonstrates that while numerous randomized trials have been conducted or are ongoing, the majority of available evidence derives from observational designs with inherent limitations in causal inference. The "Identified limitation" column highlights recurrent themes: inadequate sample sizes for detecting clinically meaningful differences in functional outcomes, retrospective data collection precluding standardized protocols, heterogeneity in blood pressure measurement methods and target definitions, and limited generalizability from single-center trials with specialized neuroanesthesia

teams. Critically, many studies report blood pressure variability as a secondary or exploratory outcome rather than a prespecified primary end point, reducing confidence in reported associations. Several studies acknowledge that anesthesia type may confound the relationship between blood pressure management and outcomes, yet few employ methods to adequately disentangle these effects. The table documents substantial heterogeneity in blood pressure targets across studies, ranging from permissive strategies allowing systolic blood pressure up to 220 mmHg [51] to intensive targets below 120 mmHg [9], without clear consensus on optimal thresholds. Multiple studies note difficulty achieving prespecified blood pressure targets, suggesting feasibility challenges in real-world implementation of strict protocols.

Gaps in the evidence base

Despite substantial research activity, critical gaps limit the translation of existing evidence into definitive clinical guidance. The relationship between blood pressure variability and outcomes remains inadequately characterized across multiple dimensions. Most studies define blood pressure variability using statistical dispersion measures such as standard deviation, coefficient of variation, or successive variation, but these metrics fail to capture the temporal dynamics, direction, and clinical context of pressure changes. A patient experiencing brief hypotension during anesthetic induction followed by stable blood pressure differs fundamentally from one with sustained oscillations throughout the procedure, yet current variability indices treat these patterns equivalently [34]. Furthermore, the field lacks standardized thresholds for clinically significant blood pressure variability. One study identifies systolic successive variation greater than 12.5 mmHg as predictive of poor outcomes [65], while another reports odds ratios for 5 mmHg increments in standard deviation [43], making cross-study comparisons and clinical application challenging. The absence of consensus on measurement frequency compounds this problem, with some studies using invasive arterial monitoring capturing every cardiac cycle [27] while others rely on non-invasive cuff measurements every 5-15 minutes [20, 22], potentially missing transient but consequential pressure changes.

The optimal blood pressure management strategy remains unresolved, with accumulating evidence suggesting harm from both extremes but insufficient data to define patient-specific safe

ranges. Multiple trials have demonstrated that intensive blood pressure lowering post-thrombectomy to targets below 120-140 mmHg worsens functional outcomes compared with more permissive strategies [9, 10], yet the appropriate upper limit remains uncertain. Observational data suggest harm from both prolonged hypotension below 70 mmHg and sustained hypertension above 180-190 mmHg [4, 53], but the relative contributions of duration versus magnitude of excursions remain poorly quantified. Two randomized trials attempting individualized blood pressure management based on baseline values failed to demonstrate benefit over standardized targets [14, 15], but these trials struggled to achieve adequate separation between treatment arms, suggesting the individualization hypothesis remains inadequately tested. Critically, no randomized trial has successfully implemented blood pressure targets that account for both baseline patient characteristics (such as chronic hypertension status or cerebrovascular reserve) and dynamic intra-procedural factors (such as collateral status or reperfusion success). The BP-TARGET trial randomized patients to intensive versus standard targets after successful reperfusion but excluded patients with systolic blood pressure below 130 mmHg at randomization [76], leaving uncertain how to manage the substantial proportion of patients who present normotensive or become hypotensive during the procedure.

The interaction between anesthesia technique and blood pressure management introduces further complexity that existing studies inadequately address. While three single-center randomized trials reported no difference or better outcomes with general anesthesia when strict blood pressure protocols were applied [6–8], these trials employed dedicated neuroanesthesia teams with protocol-mandated blood pressure targets, conditions not representative of many centers performing thrombectomy. The SIESTA trial protocol required maintaining systolic blood pressure above 140 mmHg throughout the procedure [21], the AnStroke trial targeted 140-180 mmHg [30], and GOLIATH maintained mean arterial pressure above 70 mmHg [19], but whether these specific targets or simply the presence of structured protocols drove outcomes remains unclear. General anesthesia consistently produces greater blood pressure variability than conscious sedation in observational studies [5, 6], yet when strict protocols are implemented, this difference may not translate to outcome differences. This suggests unmeasured aspects of blood pressure

management—such as rapidity of intervention when thresholds are crossed, choice of vasoactive agents, or fluid administration strategies—may be more important than anesthesia technique per se. However, no study has systematically examined these process-of-care variables. The choice of vasopressor represents one example: phenylephrine administration during the GOLIATH trial predicted larger infarct growth [18], raising concerns about selective vasoconstrictors in the cerebrovascular circulation, yet comparative effectiveness data for different vasoactive agents during thrombectomy are absent.

Substantial knowledge gaps exist regarding specific patient populations and clinical scenarios. Patients with posterior circulation strokes are severely underrepresented, with only one small study (n=85) specifically examining basilar artery occlusion [16], despite posterior circulation strokes comprising approximately 20% of large vessel occlusions and potentially behaving differently due to distinct collateral patterns and brainstem involvement. Similarly, patients with large ischemic cores—increasingly treated following the DAWN and DEFUSE-3 trial results—remain understudied with respect to blood pressure management. The SELECT2 secondary analysis included 178 patients with cores ≥50 mL but found no blood pressure variability effect modification by core size [17], though this analysis was underpowered for interaction testing. Patients with pre-existing renal impairment, who may tolerate blood pressure fluctuations differently due to impaired autoregulation, have not been separately examined despite comprising a substantial proportion of the stroke population. The time window from symptom onset introduces additional complexity: current evidence derives predominantly from patients treated within 6-8 hours of onset [7, 19], yet contemporary practice increasingly treats patients up to 24 hours in selected cases [99]. Whether blood pressure management should differ for patients with extended time windows, who may have more established infarcts or different collateral physiology, remains completely unexplored.

Long-term follow-up and patient-centered outcomes represent another significant gap. Nearly all included studies assess functional outcomes at 90 days using the modified Rankin Scale, a gross measure of disability that may not capture subtle cognitive or quality-of-life effects of blood pressure variability. Only one protocol mentions quality of life assessment using EQ-5D [101], and none include comprehensive neuropsychological testing or return-to-work outcomes. The durability

of blood pressure effects beyond 90 days is unknown—whether blood pressure variability during the acute procedure influences cognitive trajectories, recurrent stroke risk, or long-term survival has not been examined. Similarly, patient-reported outcomes such as satisfaction with recovery, depression, or caregiver burden are entirely absent from the evidence base. The economic implications of different blood pressure management strategies have not been formally assessed. While some studies note intensive care unit length of stay or duration of mechanical ventilation [35], none have conducted cost-effectiveness analyses comparing the resource requirements of different blood pressure protocols or anesthesia approaches against their clinical benefits.

Recommendations for future research

- Conduct adequately powered multicenter randomized trials with blood pressure variability as a prespecified primary outcome, employing standardized measurement methods (continuous invasive monitoring with data capture at minimum 1-minute intervals), harmonized variability metrics that account for temporal patterns and clinical context, and functional independence at 90 days as the primary efficacy end point. Sample size calculations should assume a 10-15% absolute difference in favorable outcomes to detect clinically meaningful effects, likely requiring 800-1200 patients. Such trials should stratify randomization by baseline blood pressure tertile and implement both lower and upper blood pressure boundaries to test the hypothesized U-shaped relationship between blood pressure extremes and outcomes.

- Design comparative effectiveness trials of vasoactive agents (alpha-agonists versus mixed alpha-beta agents versus vasopressin) during endovascular thrombectomy, with primary outcomes of blood pressure stability (time within target range), cerebral perfusion (measured by transcranial Doppler or near-infrared spectroscopy where feasible), and 90-day modified Rankin Scale scores. Given ethical constraints on randomizing to potentially harmful agents, a pragmatic cluster-randomized design by institution or alternating time periods may be appropriate, with sample sizes of 400-600 patients providing adequate power to detect a 15% difference in achieving blood pressure targets within 5 minutes of threshold crossing.

- Establish prospective registries with granular blood pressure data (at minimum 5-minute intervals from emergency department arrival through 24 hours post-procedure) linked to detailed anesthesia records including specific agents, doses, and timing, to enable propensity-matched analyses of blood pressure management strategies across heterogeneous real-world populations. Such registries should mandate inclusion of underrepresented populations (posterior circulation strokes, large ischemic cores >70 mL, patients with significant renal or cardiac comorbidities, those treated in extended time windows 12-24 hours) to support subgroup analyses and hypothesis generation for future trials. Data elements should include not only blood pressure values but also context (anesthesia phase, procedural events, recanalization timing) to enable analyses of clinically relevant patterns rather than purely statistical variability.

- Develop and validate real-time blood pressure variability monitoring tools that integrate machine learning algorithms to identify high-risk patterns during procedures, with prospective validation studies comparing algorithm-guided versus standard blood pressure management. Given that one small study identified time-to-puncture and mechanical ventilation as blood pressure variability predictors using random forest modeling [32], larger datasets with richer feature sets could potentially enable preprocedural risk stratification. Validation studies should enroll 300-500 patients to establish accuracy metrics (sensitivity and specificity for predicting blood pressure instability requiring intervention) before proceeding to intervention trials.

- Investigate the mechanisms linking blood pressure variability to neurological outcomes through physiological substudies embedded within larger trials, measuring cerebral blood flow (transcranial Doppler), cerebral oxygenation (near-infrared spectroscopy), and neuroinflammatory markers (S100B, glial fibrillary acidic protein) in subsets of 100-150 patients. One trial protocol mentions transcranial Doppler-guided blood pressure management [86], but broader implementation of multimodal neuromonitoring could clarify whether blood pressure effects operate primarily through hypoperfusion, reperfusion injury,

blood-brain barrier disruption, or alternative pathways. Such mechanistic insights would inform which patients require most stringent blood pressure control and which may tolerate wider ranges.

DISCUSSION

The present systematic review synthesizes evidence from 104 sources examining blood pressure variability during mechanical thrombectomy under anesthesia, revealing several important findings while highlighting substantial knowledge gaps that limit definitive clinical guidance.

Association Between BPV and Clinical Outcomes

The accumulated evidence consistently demonstrates that intra-procedural hemodynamic instability is associated with worse functional outcomes following MT. Observational studies predominantly show that blood pressure drops, particularly when mean arterial pressure decreases exceed 20-40% from baseline, predict unfavorable modified Rankin Scale scores at 90 days (1-3). The magnitude of this effect appears clinically significant: Rasmussen et al., analyzing individual patient data from three randomized trials, found that MAP below 70 mmHg for more than 10 minutes conferred an adjusted odds ratio of 1.51 for poor outcome (4). Similarly, Treurniet et al. demonstrated that each 10 mmHg MAP decrease was associated with 1.67-fold lower odds of favorable outcome in the MR CLEAN cohort (1,2).

These findings align with physiological principles. The ischemic penumbra maintains viability through collateral blood flow that is pressure-dependent, particularly when cerebral autoregulation is impaired. Hypotension reduces collateral perfusion pressure, potentially extending infarct core into penumbral tissue. Conversely, extreme hypertension may increase risk of hemorrhagic transformation, particularly following successful recanalization when previously ischemic vasculature is exposed to sudden pressure increases. The ENCHANTED2/MT trial provided definitive evidence that intensive BP lowering to <120 mmHg after successful thrombectomy worsens outcomes compared to more permissive targets (9), with subsequent analysis showing that achieved SBP 120-140 mmHg was associated with optimal outcomes (10).

However, the relationship between BPV and outcomes extends beyond absolute thresholds. Multiple meta-analyses have demonstrated that BPV metrics including SD, CoV, and SV independently predict functional outcomes, even after adjusting for mean BP (11,12). Palaiodimou et al., in an individual patient data meta-analysis, found that patients in the highest SBP SD tertile had adjusted odds ratio of 1.44 for mortality (11). Nepal et al. reported that each unit increase in CoV and SV was associated with significantly lower odds of good outcome (12). These findings suggest that hemodynamic stability per se, independent of absolute BP levels, may be neuroprotective.

Anesthesia Technique and BPV

The interaction between anesthesia modality and BPV represents a complex and contested area. Early observational studies suggested that GA was associated with worse outcomes, attributed to greater hemodynamic instability and hypotension (28,29,61). Jagani et al. reported that GA patients had lower minimum BP and greater fluctuations compared to CS (5). John et al. found GA associated with 25.8% mortality versus 13.3% with monitored anesthesia care (28), and higher intraparenchymal hemorrhage rates (26.3% vs 10.1%) (31).

However, three single-center randomized controlled trials—SIESTA (8), AnStroke (7), and GOLIATH (19)—challenged this paradigm by demonstrating that GA with strict BP protocols could achieve outcomes equivalent or superior to CS. The SIESTA trial, randomizing 150 patients, found that GA was associated with greater early neurological improvement (8). The AnStroke trial showed no difference in functional outcomes between GA and CS when BP was rigorously maintained (7). GOLIATH similarly demonstrated better outcomes with GA despite lower intraprocedural MAP (19). Subsequent meta-analyses by Schönenberger et al. (6) and Zhang et al. (75) confirmed that GA was associated with higher recanalization rates and functional independence, despite greater hypotension.

These seemingly contradictory findings suggest that the presence of structured BP protocols and dedicated neuroanesthesia teams may be more important than anesthesia modality per se. The SIESTA protocol mandated SBP >140 mmHg (21), AnStroke targeted 140-180 mmHg (30), and GOLIATH maintained MAP >70 mmHg (19). When these targets were rigorously applied, the

hemodynamic disadvantages of GA were mitigated, and the benefits of improved procedural conditions (patient immobility, airway protection) became apparent. This interpretation is supported by the SELECT2 secondary analysis, which found no outcome difference between GA and non-GA in large core strokes despite higher SBP variability in GA (17).

BPV Measurement and Definition Challenges

A critical finding of this review is the substantial heterogeneity in BPV measurement and definition across studies, limiting cross-study comparisons and meta-analytic synthesis. Studies vary on multiple dimensions:

Measurement frequency: Some studies employ continuous invasive arterial monitoring capturing every cardiac cycle (27), while others rely on non-invasive cuff measurements at 5-15 minute intervals (20,22). Wiącek et al. demonstrated that this distinction matters clinically, finding SBP discrepancies ≥20 mmHg between invasive and non-invasive monitoring during 41% of procedure time (27). Transient but consequential pressure changes may be missed with intermittent measurement.

BP parameters: Studies variably report systolic BP, diastolic BP, MAP, or combinations thereof. While MAP may better reflect cerebral perfusion pressure, SBP is more commonly reported and may better predict hemorrhagic complications. The optimal parameter remains debated.

Variability metrics: Studies employ SD, CoV (SD normalized to mean), SV (accounting for temporal order), range, time below threshold, and various other metrics. These capture different aspects of variability: SD reflects overall dispersion, SV reflects successive changes, and time below threshold reflects hypotension burden. Prasad et al. identified distinct temporal BPV trajectories, with the highest trajectory group having aOR 2.2 for poor outcome (34), suggesting that pattern recognition may be more informative than summary statistics.

Threshold definitions: Studies define clinically significant BPV using variable thresholds. Zhang et al. identified SBP SV >12.5 mmHg as predictive of unfavorable outcome (65), while Nisar et al. reported odds ratios for 5 mmHg increments in SD (43). This lack of standardization precludes establishing evidence-based thresholds for clinical intervention.

The Individualized BP Management Paradox

Several trials have attempted to test whether individualized BP targets based on baseline values improve outcomes compared to standardized targets, with uniformly negative results. Espelund et al. randomized patients to standard versus individualized MAP targets but failed to achieve target separation between groups (14). Chen et al., in the INDIVIDUATE trial, found no difference in favorable outcomes between individualized and standardized SBP management (15). The DETERMINE trial protocol similarly aims to test individualized versus standard MAP targets but results are pending (44).

These failures may reflect methodological challenges rather than true equivalence. Achieving adequate separation between treatment arms in BP trials is notoriously difficult, as clinicians may be reluctant to allow patients to remain outside perceived safe ranges. Furthermore, the assumption that baseline BP represents an optimal target may be flawed; chronic hypertension shifts the cerebral autoregulatory curve rightward, such that previously "normal" pressures may be relatively hypotensive for chronically hypertensive patients. L'allinec et al. attempted personalized BP management under GA, reducing MAP drops below 30% baseline from 48.8% to 32.8%, but this difference did not reach statistical significance (20). Whether true individualization accounting for autoregulatory status (potentially measured by transcranial Doppler or near-infrared spectroscopy) would improve outcomes remains unknown.

Vasoactive Agent Selection

The choice of vasopressor for managing hypotension during MT represents an understudied area with potential clinical importance. Raychev et al., analyzing the GOLIATH trial, found that phenylephrine dose independently predicted infarct growth (18), raising concerns about selective alpha-agonists causing cerebral vasoconstriction in the collateral circulation. Experimental data suggest that agents with mixed alpha-beta activity (e.g., norepinephrine, ephedrine) may better preserve cerebral blood flow by maintaining cardiac output while avoiding unopposed vasoconstriction. However, no comparative effectiveness trials have examined different vasoactive agents during MT.

For hypertension management, Oliver et al. compared clevidipine versus nicardipine for post-thrombectomy BP control, finding that clevidipine achieved faster BP control (5 vs 17 minutes) (55). Whether more rapid control translates to improved outcomes remains unknown. The optimal agent, target, and timing of antihypertensive therapy after successful recanalization await definitive study.

Underrepresented Populations

This review identifies critical gaps in evidence for specific patient populations:

Posterior circulation strokes: Despite comprising approximately 20% of LVO strokes, only one small study (n=85) specifically examined basilar artery occlusion (16). Posterior circulation has distinct collateral patterns, brainstem involvement, and potentially different hemodynamic vulnerability. Extrapolation from anterior circulation data may be inappropriate.

Large ischemic cores: Patients with baseline infarct volume ≥50 mL, increasingly treated following DAWN and DEFUSE-3 trial extensions, remain understudied. The SELECT2 secondary analysis included 178 such patients but was underpowered for interaction testing (17). Whether these patients have different optimal BP targets due to established infarct and reduced penumbra is unknown.

Extended time windows: Contemporary practice treats patients up to 24 hours from onset, yet most evidence derives from patients treated within 6-8 hours (7,19). Patients with slow infarct progression or favorable collateral profiles may have different hemodynamic requirements.

Comorbid populations: Patients with chronic hypertension (the majority of stroke patients), renal impairment, heart failure, or diabetes may tolerate BP fluctuations differently, yet subgroup analyses are rarely reported.

Temporal Dynamics and Mechanistic Understanding

Current BPV metrics treat all fluctuations equivalently regardless of timing relative to procedural events. A patient experiencing brief hypotension during anesthetic induction followed by stable intra-procedural BP differs fundamentally from one with sustained oscillations throughout the procedure. Similarly, hypotension before recanalization (threatening penumbral perfusion) may have different implications than hypotension after recanalization (when reperfusion injury is the

primary concern). Kim et al. found that associations between BP and outcomes differed by hypoperfusion intensity ratio and recanalization timing (69), suggesting that context-specific BP management may be required.

Mechanistic understanding of how BPV affects neurological outcomes remains limited. Potential pathways include:

1. **Hypoperfusion injury:** Reduced cerebral blood flow extending infarct core
2. **Reperfusion injury:** Sudden pressure increases disrupting blood-brain barrier
3. **Endothelial dysfunction:** Oscillatory shear stress impairing microvascular function
4. **Edema formation:** Pressure-related fluid extravasation
5. **Hemorrhagic transformation:** Rupture of fragile reperfused vessels

Few studies have incorporated mechanistic biomarkers. Tao et al. conducted a prospective trial of transcranial Doppler-guided BP management (86), and Juhász et al. examined propofol-sufentanil effects on cerebral autoregulation in a small case series (60), but broader implementation of multimodal neuromonitoring is lacking.

Long-term and Patient-centered Outcomes

Nearly all included studies assess functional outcomes at 90 days using the modified Rankin Scale, a relatively crude measure of disability. Cognitive function, quality of life, depression, return to work, and caregiver burden are almost never reported. The IDENTIFY trial protocol mentions EQ-5D quality of life assessment (101), but results are pending. Whether intra-procedural BPV influences long-term cognitive trajectories, recurrent stroke risk, or survival beyond 90 days remains unknown.

Economic implications are similarly unexplored. While some studies report ICU length of stay or ventilation duration, formal cost-effectiveness analyses comparing different BP management strategies or anesthesia approaches are absent. Krawchuk et al. found that 53.6% of MT patients

required no ICU resources in the first 24 hours (90), suggesting potential for risk-stratified resource allocation if BPV could identify low-risk patients.

Predictive Factors and Risk Stratification

Identifying patients at high risk for clinically significant BPV could enable targeted interventions. Najafali et al. used supervised machine learning (random forest modeling) to predict BPV during thrombectomy, identifying time-to-puncture and mechanical ventilation status as important predictors (32). This proof-of-concept study suggests that preprocedural risk stratification may be feasible, potentially identifying patients who would benefit from early arterial line placement, specific anesthesia techniques, or prophylactic vasoactive medications.

Other reported predictors of BPV include baseline SBP (predicting need for hemodynamic intervention under CS) (22), choice of anesthetic agent (dexmedetomidine associated with 7-fold increased MAP drop risk compared to midazolam) (23), and transport BP (maximum SBP during transport associated with worse outcomes) (94). Integration of these factors into clinical prediction tools awaits validation in larger cohorts.

Clinical Implications

Despite evidence gaps, several clinical implications emerge from this synthesis:

1. **Avoid profound hypotension:** Evidence consistently supports avoiding MAP <70 mmHg or decreases >20-40% from baseline. Duration of hypotension matters, with longer exposures conferring greater risk.

2. **Implement structured BP protocols:** Whether using GA or CS, centers should establish explicit BP targets and protocols for achieving them. The success of GA in randomized trials likely reflects protocol-driven management rather than anesthesia technique per se.

3. **Monitor continuously:** Invasive arterial monitoring enables detection of transient but consequential BP changes missed by intermittent cuff measurements. When available, continuous monitoring should be standard.

4. **Individualize targets:** While formal individualization trials have failed, clinical judgment should consider patient factors including chronic hypertension status, collateral grade, occlusion location, and recanalization timing.

5. **Avoid intensive post-thrombectomy lowering:** Evidence strongly supports avoiding SBP targets <120 mmHg after successful recanalization. The optimal upper limit remains uncertain, but permissive hypertension to 180-220 mmHg appears safe in most patients.

6. **Consider agent-specific effects:** When vasopressors are required, agents with mixed alpha-beta activity may better preserve cerebral perfusion than pure alpha-agonists, though definitive evidence is lacking.

CONCLUSION AND RECOMMENDATIONS

This comprehensive systematic review synthesizes evidence from 104 sources examining blood pressure variability during mechanical thrombectomy under anesthesia, revealing both consistent patterns and critical knowledge gaps that limit definitive clinical guidance.

Summary of Key Findings

The accumulated evidence demonstrates that intra-procedural hemodynamic instability is consistently associated with worse functional outcomes following MT. Hypotension, particularly MAP decreases exceeding 20-40% from baseline or MAP below 70 mmHg for prolonged periods, predicts unfavorable modified Rankin Scale scores at 90 days. Intensive BP lowering to targets <120 mmHg after successful recanalization worsens outcomes compared to more permissive strategies. BPV metrics including standard deviation, coefficient of variation, and successive variation independently predict outcomes beyond mean BP, suggesting that hemodynamic stability per se may be neuroprotective.

The relationship between anesthesia technique and BPV is complex and context-dependent. While observational studies suggest GA is associated with greater hemodynamic instability, randomized trials implementing strict BP protocols have demonstrated equivalent or superior

outcomes with GA compared to CS. This paradox suggests that structured protocols and dedicated neuroanesthesia teams may be more important than anesthesia modality per se.

Critical evidence gaps include: absence of standardized BPV definitions and measurement methods; underrepresentation of posterior circulation strokes, large core infarcts, and extended time window patients; lack of comparative effectiveness data for vasoactive agents; inadequate characterization of temporal BPV dynamics; and absence of long-term patient-centered outcomes beyond 90-day mRS.

Recommendations for Clinical Practice

Based on current evidence, we recommend:

1. **Continuous invasive BP monitoring** during MT to detect clinically significant fluctuations missed by intermittent cuff measurements.

2. **Avoidance of profound hypotension** with particular attention to MAP <70 mmHg or decreases >20-40% from baseline, especially before recanalization.

3. **Implementation of structured BP protocols** specifying target ranges, monitoring frequency, and intervention thresholds regardless of anesthesia modality.

4. **Avoidance of intensive post-recanalization BP lowering** to targets <120 mmHg, with permissive hypertension to 180-220 mmHg appearing safe in most patients.

5. **Clinical individualization** considering patient factors including chronic hypertension status, collateral grade, occlusion location, and recanalization timing when setting BP targets.

6. **Consideration of vasopressor selection** when hemodynamic support is required, recognizing that pure alpha-agonists may theoretically impair collateral perfusion, though definitive evidence is lacking.

Recommendations for Future Research

To address identified evidence gaps, we recommend:

1. **Adequately powered multicenter randomized trials** with BPV as a prespecified primary outcome, employing standardized measurement methods (continuous invasive monitoring with data capture at minimum 1-minute intervals), harmonized variability metrics accounting for temporal patterns, and functional independence at 90 days as the primary efficacy endpoint. Sample sizes of 800-1200 patients would be required to detect clinically meaningful 10-15% absolute differences in favorable outcomes.

2. **Comparative effectiveness trials of vasoactive agents** (alpha-agonists versus mixed alpha-beta agents versus vasopressin) during MT, with primary outcomes of BP stability, cerebral perfusion measured by transcranial Doppler where feasible, and 90-day mRS. Pragmatic cluster-randomized designs may be appropriate given ethical constraints.

3. **Prospective registries with granular BP data** (minimum 5-minute intervals from ED arrival through 24 hours post-procedure) linked to detailed anesthesia records, mandating inclusion of underrepresented populations (posterior circulation, large cores >70 mL, significant comorbidities, extended time windows 12-24 hours). Data elements should include context (anesthesia phase, procedural events, recanalization timing) to enable analysis of clinically relevant patterns.

4. **Development and validation of real-time BPV monitoring tools** integrating machine learning algorithms to identify high-risk patterns during procedures, with prospective validation studies comparing algorithm-guided versus standard management. Validation studies should enroll 300-500 patients to establish accuracy metrics before proceeding to intervention trials.

5. **Mechanistic substudies embedded within larger trials** measuring cerebral blood flow (transcranial Doppler), cerebral oxygenation (near-infrared spectroscopy), and neuroinflammatory markers (S100B, GFAP) in subsets of 100-150 patients to clarify whether BPV effects operate through hypoperfusion, reperfusion injury, blood-brain barrier disruption, or alternative pathways.

6. **Standardization of BPV metrics** through consensus processes involving relevant stakeholders (neurointerventionalists, neuroanesthesiologists, clinical trialists, regulatory authorities) to establish minimum core outcome sets for future studies.

7. **Long-term follow-up studies** assessing cognitive function, quality of life, return to work, and economic outcomes beyond 90 days to understand the full impact of intra-procedural BPV on patient-centered outcomes.

Concluding Remarks

Blood pressure variability during mechanical thrombectomy under anesthesia represents a critical determinant of neurological outcomes, yet current evidence provides insufficient guidance for optimal clinical management. The field stands at a crossroads where further observational studies are unlikely to resolve persistent uncertainties. What is needed now is a coordinated research agenda encompassing adequately powered randomized trials with standardized BPV definitions, comparative effectiveness studies of specific interventions (anesthetic agents, vasoactive drugs, fluid strategies), and mechanistic investigations elucidating how hemodynamic fluctuations translate to neuronal injury or protection. Such efforts will require multicenter collaboration, substantial funding commitment, and engagement of patients, clinicians, and regulatory stakeholders. The potential reward—improved functional outcomes for the hundreds of thousands of patients undergoing MT annually worldwide—justifies the investment.

REFERENCES

1. K. Treurniet, O. Berkhemer, Vivian M C Ward-van der Stam, et al (2017) Abstract 34: A Decrease in Blood Pressure is Associated with Unfavorable Outcome in Patients Undergoing Thrombectomy Under General Anesthesia in the Mr Clean Study

2. K. Treurniet, O. Berkhemer, R. Immink, et al (2017) A decrease in blood pressure is associated with unfavorable outcome in patients undergoing thrombectomy under general

anesthesia. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/neurintsurg-2017-012988

3. B. Maïer, R. Fahed, N. Khoury, et al (2019) Association of Blood Pressure During Thrombectomy for Acute Ischemic Stroke With Functional Outcome. Stroke. https://doi.org/10.1161/STROKEAHA.119.024915

4. M. Rasmussen, S. Schönenberger, P. L. Hendén, et al (2020) Blood Pressure Thresholds and Neurologic Outcomes After Endovascular Therapy for Acute Ischemic Stroke: An Analysis of Individual Patient Data From 3 Randomized Clinical Trials. JAMA Neurology. https://doi.org/10.1001/jamaneurol.2019.4838

5. M. Jagani, W. Brinjikji, A. Rabinstein, et al (2015) Hemodynamics during anesthesia for intra-arterial therapy of acute ischemic stroke. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/neurintsurg-2015-011867

6. S. Schönenberger, P. L. Hendén, C. Simonsen, et al (2019) Association of General Anesthesia vs Procedural Sedation With Functional Outcome Among Patients With Acute Ischemic Stroke Undergoing Thrombectomy: A Systematic Review and Meta-analysis. Journal of the American Medical Association (JAMA). https://doi.org/10.1001/jama.2019.11455

7. P. Löwhagen Hendén, A. Rentzos, J. Karlsson, et al (2017) General Anesthesia Versus Conscious Sedation for Endovascular Treatment of Acute Ischemic Stroke: The AnStroke Trial (Anesthesia During Stroke). Stroke. https://doi.org/10.1161/STROKEAHA.117.016554

8. S. Schönenberger, L. Uhlmann, W. Hacke, et al (2016) Effect of Conscious Sedation vs General Anesthesia on Early Neurological Improvement Among Patients With Ischemic Stroke Undergoing Endovascular Thrombectomy: A Randomized Clinical Trial. Journal of the American Medical Association (JAMA). https://doi.org/10.1001/jama.2016.16623

9. Pengfei Yang, L. Song, Yongwei Zhang, et al (2022) Intensive blood pressure control after endovascular thrombectomy for acute ischaemic stroke (ENCHANTED2/MT): a multicentre, open-label, blinded-endpoint, randomised controlled trial. The Lancet. https://doi.org/10.1016/S0140-6736(22)01882-7

10. Yifeng Liu, Xuan Zhu, Donghuan Zhang, et al (2025) Systolic blood pressure within 24 hours after successful reperfusion correlates with outcomes in acute ischemic stroke: a secondary analysis of the EHCHANTED2/MT Trial. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/jnis-2025-023697

11. L. Palaiodimou, Raed A. Joundi, A. Katsanos, et al (2023) Association between blood pressure variability and outcomes after endovascular thrombectomy for acute ischemic stroke: An individual patient data meta-analysis. European Stroke Journal. https://doi.org/10.1177/23969873231211157

12. Gaurav Nepal, G. Shrestha, Y. K. Shing, et al (2021) Systolic blood pressure variability following endovascular thrombectomy and clinical outcome in acute ischemic stroke: A meta-analysis. Acta Neurologica Scandinavica. https://doi.org/10.1111/ane.13480

13. J. Bösel (2019) Optimal Blood Pressure for Stroke Thrombectomy. Stroke. https://doi.org/10.1161/STROKEAHA.119.026550

14. U. Espelund, J. Valentin, C. F. Eriksen, et al (2023) Standard Versus Individualized Blood Pressure Targets During Thrombectomy: A Randomized Controlled Pilot Trial. Stroke. https://doi.org/10.1161/SVIN.123.001027

15. Min Chen, Jan Meis, A. Potreck, et al (2023) Effect of Individualized Versus Standardized Blood Pressure Management During Endovascular Stroke Treatment on Clinical Outcome: A Randomized Clinical Trial. Stroke. https://doi.org/10.1161/STROKEAHA.123.044062

16. M. Amjad,.. Faizuddin, O. Alasmar, et al (2024) EFFECTS OF ANESTHETIC STRATEGY ON PATIENTS' OUTCOMES WITH ACUTE BASILAR ARTERY OCCLUSION UNDERGOING MECHANICAL THROMBECTOMY. Biological and Clinical Sciences Research Journal. https://doi.org/10.54112/bcsrj.v2024i1.1291

17. A. Sarraj, Spiros Blackburn, Michael G. Abraham, et al (2025) General vs Nongeneral Anesthesia for Endovascular Thrombectomy in Patients With Large Core Strokes: A Prespecified Secondary Analysis of SELECT2 Trial. Neurology. https://doi.org/10.1212/WNL.0000000000213819

18. R. Raychev, D. Liebeskind, A. Yoo, et al (2020) Physiologic predictors of collateral circulation and infarct growth during anesthesia – Detailed analyses of the GOLIATH trial. Journal of Cerebral Blood Flow and Metabolism. https://doi.org/10.1177/0271678X19865219

19. J. Graw, Harald Engelhardt, Kirsten Küsel, et al (2018) Journal Club. BIOspektrum. https://doi.org/10.1097/ANA.0000000000000502

20. V. L'allinec, Océane Palka, Madjid Bouizegarene, et al (2026) Effect of personalized blood pressure management during mechanical thrombectomy under general anesthesia: a single-center before-after study. Neuroradiology. https://doi.org/10.1007/s00234-025-03878-6

21. S. Schönenberger, L. Uhlmann, M. Ungerer, et al (2018) Association of Blood Pressure With Short- and Long-Term Functional Outcome After Stroke Thrombectomy: Post Hoc Analysis of the SIESTA Trial. Stroke. https://doi.org/10.1161/STROKEAHA.117.019709

22. G. Alcaraz, J. Chui, J. Schaafsma, et al (2019) Hemodynamic Management of Patients During Endovascular Treatment of Acute Ischemic Stroke Under Conscious Sedation: A Retrospective Cohort Study. Journal of Neurosurgical Anesthesiology. https://doi.org/10.1097/ANA.0000000000000514

23. M. Baldassari, N. Mouchtouris, L. Velagapudi, et al (2021) Comparison of Anesthetic Agents Dexmedetomidine and Midazolam During Mechanical Thrombectomy. Journal of Stroke & Cerebrovascular Diseases. https://doi.org/10.1016/j.jstrokecerebrovasdis.2021.106117

24. Min Chen, Lukas D. Sauer, A. Potreck, et al (2025) Association of hemodynamic variability during endovascular stroke treatment with functional outcome and parenchymal hemorrhage. Therapeutic Advances in Neurological Disorders. https://doi.org/10.1177/17562864251391837

25. A. Toma, A. Vijayashankar, Neil Haranhalli, et al (2020) E-080 Risk factors of post thrombectomy mortality in acute anterior circulation ischemic stroke: single comprehensive stroke center experience. https://doi.org/10.1136/neurintsurg-2020-snis.114

26. Chunguang Ren, Guangjun Xu, Yanchao Liu, et al (2020) Effect of Conscious Sedation vs. General Anesthesia on Outcomes in Patients Undergoing Mechanical Thrombectomy for Acute Ischemic Stroke: A Prospective Randomized Clinical Trial. Frontiers in Neurology. https://doi.org/10.3389/fneur.2020.00170

27. M. Wiącek, Katarzyna Koszarska, Aleksandra Kotlińska, et al (2025) Non-invasive versus continuous invasive blood pressure monitoring during endovascular treatment of acute ischemic stroke under general anesthesia - a pilot study. Neurologia i Neurochirurgia Polska. https://doi.org/10.5603/pjnns.107681

28. S. John, Umera Thebo, J. Gomes, et al (2014) Intra-Arterial Therapy for Acute Ischemic Stroke Under General Anesthesia versus Monitored Anesthesia Care. Cerebrovascular Diseases. https://doi.org/10.1159/000368216

29. A. Rai, S. Boo, J. Domico, et al (2014) E-026 Time and Pressure - Possible Reasons Behind Worse Outcomes For GETA Patients Undergoing Stroke Interventions. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/neurintsurg-2014-011343.93

30. B. Zussman, G. Weiner, A. Ducruet (2018) A Second Randomized Trial Comparing General Anesthesia to Conscious Sedation in Acute Ischemic Stroke Patients Undergoing Endovascular Treatment. Neurosurgery. https://doi.org/10.1093/neuros/nyx589

31. S. John, Umera Thebo, M. Saqqur, et al (2014) Abstract W P12: Intra-procedural Hemodynamics in General Anesthesia versus Monitored Anesthesia Care During Endovascular Therapy for Acute Anterior Circulation Ischemic Stroke

32. Daniel Najafali, T. Johnstone, Melissa B. Pergakis, et al (2023) Prediction of blood pressure variability during thrombectomy using supervised machine learning and outcomes of patients with ischemic stroke from large vessel occlusion. Journal of Thrombosis and Thrombolysis. https://doi.org/10.1007/s11239-023-02796-9

33. María Zuluaga, Juan David Tascón-Romero, Jaime A. Ortiz-Villegas, et al (2025) Periprocedural Hypotension and Functional Outcomes in Ischemic Stroke Patients Undergoing Mechanical Thrombectomy. Stroke. https://doi.org/10.1161/SVIN.125.001789

34. Ayush Prasad, Jessica Kobsa, Sreeja Kodali, et al (2022) Temporal profiles of systolic blood pressure variability and neurologic outcomes after endovascular thrombectomy. European Stroke Journal. https://doi.org/10.1177/23969873221106907

35. T. Devlin, F. Fesmire, Wade S. Smith, et al (2012) Abstract 2561: Blood Pressure Variation Associated with Emergent Intubation and During Endovascular Treatment in Acute Stroke Patients. Stroke. https://doi.org/10.1161/str.43.suppl_1.a2561

36. Carolyn Deng, D. Campbell, William K. Diprose, et al (2019) A pilot randomised controlled trial of the management of systolic blood pressure during endovascular thrombectomy for acute ischaemic stroke. Anaesthesia. https://doi.org/10.1111/anae.14940

37. Sameer Lakha, L. Qian, S. Lipson, D. Katz (2020) Severe Intraoperative Hypertension Associated With AngioJet Rheolytic Thrombectomy for Lower Extremity Deep Venous

Thrombosis. Journal of Cardiothoracic and Vascular Anesthesia. https://doi.org/10.1053/j.jvca.2020.08.026

38. Min Chen, D. Kronsteiner, M. Möhlenbruch, et al (2021) Individualized blood pressure management during endovascular treatment of acute ischemic stroke under procedural sedation (INDIVIDUATE) – An explorative randomized controlled trial. European Stroke Journal. https://doi.org/10.1177/23969873211000879

39. G. Ackland, Tim Martin, Mareena Joseph, et al (2023) Transauricular nerve stimulation in acute ischaemic stroke requiring mechanical thrombectomy: Protocol for a phase 2A, proof-of-concept, sham-controlled randomised trial. PLoS ONE. https://doi.org/10.1371/journal.pone.0289719

40. C. G. Fugelli, H. Ersdal, S. Ajmi, et al (2025) Engaging anaesthesia professionals as co-faculty in stroke thrombectomy simulation training: associations with clinical care and patient outcomes. Advances in Simulation. https://doi.org/10.1186/s41077-025-00383-x

41. G. Ackland, David Crane, Sanjali Ahuja, et al (2025) Transauricular Vagus Nerve Stimulation in Acute Ischaemic Stroke Requiring Mechanical Thrombectomy: Sham-Controlled, Randomised Device Trial. Translational Stroke Research. https://doi.org/10.1007/s12975-025-01404-7

42. Lijuan Fu, Rui Zhou, Wencai Jiang, et al (2024) The Effects of Remimazolam versus Propofol on Endovascular Thrombectomy for Acute Ischemic Stroke: Study Protocol for a Randomized Controlled Trial. Vascular Health and Risk Management. https://doi.org/10.2147/VHRM.S486834

43. T. Nisar, T. Tofade, Ava L. Liberman, P. Khandelwal (2020) Abstract TP42: Association of 24-Hour Blood Pressure Parameters Post-Thrombectomy With Functional Outcomes at Discharge. Stroke. https://doi.org/10.1161/STR.51.SUPPL_1.TP42

44. B. Maïer, B. Gory, R. Chabanne, et al (2022) Effect of an individualized versus standard blood pressure management during mechanical thrombectomy for anterior ischemic stroke: the DETERMINE randomized controlled trial. Trials. https://doi.org/10.1186/s13063-022-06538-9

45. R. Tosello, R. Riera, G. Tosello, et al (2020) Type of anaesthesia for acute ischaemic stroke endovascular treatment. Cochrane Database of Systematic Reviews. https://doi.org/10.1002/14651858.cd013690

46. D. Crimmins, Elizabeth Ryan, D. Shah, et al (2022) The Effect of Anesthetic Agent and Mean Arterial Pressure on Functional Outcome After General Anesthesia for Endovascular Thrombectomy. Journal of Neurosurgical Anesthesiology. https://doi.org/10.1097/ANA.0000000000000897

47. T. Nisar, Osama Abu-hadid, Konrad Lebioda, et al (2022) Abstract TP149: Association Of 24-hour Blood Pressure Parameters Post-thrombectomy With Functional Outcomes According To Collateral Status. Stroke. https://doi.org/10.1161/str.53.suppl_1.tp149

48. Eva A. Mistry, K. Hart, Larry T Davis, et al (2023) Blood Pressure Management After Endovascular Therapy for Acute Ischemic Stroke: The BEST-II Randomized Clinical Trial. Journal of the American Medical Association (JAMA). https://doi.org/10.1001/jama.2023.14330

49. A. White, Mohammed Alabdulkareem, N. Jouett, et al (2023) Abstract TP148: Anesthesia Protocol For Acute Ischemic Stroke Facilitates General Anesthesia In EVT And Optimizes Key Performance Measures. Stroke. https://doi.org/10.1161/str.54.suppl_1.tp148

50. Arianna Gaspari, G. Vaccari, Federica Arturi, et al (2024) Anesthesia for Endovascular Therapy for Stroke. Neurology International. https://doi.org/10.3390/neurolint16030050

51. Pandhi, N. Goyal, G. Tsigoulis, et al (2017) O-034 Blood pressure control post thrombectomy. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/neurintsurg-2017-SNIS.34

52. V. Padmanaban, Chloe Grzyb, César Velasco, et al (2023) Conscious sedation by sedation-trained interventionalists versus anesthesia providers in patients with acute ischemic stroke undergoing endovascular thrombectomy: A propensity score-matched analysis. Interventional Neuroradiology. https://doi.org/10.1177/15910199231207409

53. Jae Wook Jung, Hyungwoo Lee, Joonnyung Heo, et al (2025) Blood pressure threshold and outcomes after successful endovascular thrombectomy. International Journal of Stroke. https://doi.org/10.1177/17474930251366063

54. J. Stolp, J. Coutinho, R. Immink, B. Preckel (2022) Anesthetic considerations for endovascular treatment in stroke therapy. Current Opinion in Anaesthesiology. https://doi.org/10.1097/ACO.0000000000001150

55. M. Oliver, J. Shawver, H. Salahuddin, et al (2021) E-084 Nicardipine versus clevidipine for post mechanical thrombectomy blood pressure management in patients with ischemic stroke due to isolated middle cerebral artery occlusion. Electronic poster abstracts. https://doi.org/10.1136/neurintsurg-2021-snis.179

56. Izabela Duda, Mariusz Hofman, M. Dymek, et al (2024) Hypotension after Induction of Anesthesia as a Predictor of Hypotension after Opening the Dura Mater during Emergency Craniotomy. Journal of Clinical Medicine. https://doi.org/10.3390/jcm13196021

57. Danielle Crimmins, Allison Kearney, Syeda Zahir, et al (2026) Feasibility of a Randomized Controlled Trial Comparing Propofol and Sevoflurane General Anesthesia in Endovascular Thrombectomy for Stroke: A Pilot Study. Journal of Neurosurgical Anesthesiology. https://doi.org/10.1097/ANA.0000000000001091

58. Chih-Jun Lai, Ya-Jung Cheng, Yin-Yi Han, et al (2024) Hypotension prediction index for prevention of intraoperative hypotension in patients undergoing general anesthesia: a randomized controlled trial. Perioperative Medicine. https://doi.org/10.1186/s13741-024-00414-7

59. S. John, Jaspreet Somal, E. Farag, et al (2013) Abstract WP15: Dexmedetomidine versus Propofol for Monitored Anesthesia Care (MAC) during Endovascular Therapy for Acute Ischemic Stroke. Stroke. https://doi.org/10.1161/str.44.suppl_1.awp15

60. M. Juhász, D. Páll, B. Fülesdi, et al (2021) The effect of propofol-sufentanil intravenous anesthesia on systemic and cerebral circulation, cerebral autoregulation and CO2 reactivity: a case series. Brazilian Journal of Anesthesiology. https://doi.org/10.1016/j.bjane.2021.04.002

61. A. Abou-Chebl, M. Hill, B. Yan, et al (2014) Abstract 187: Impact of General Anesthesia on Safety and Outcomes in the Endovascular Arm of IMS III

62. Binben Li, Ting Niu, Yuanqiang Dai, et al (2024) Intraoperative intensive blood pressure management strategy and the outcome of patients who had an acute ischaemic stroke undergoing endovascular treatment under general anaesthesia: study protocol for a prospective randomised controlled trial. BMJ Open. https://doi.org/10.1136/bmjopen-2023-079197

63. B. Menon, M. Davis, C. Herrera, et al (2010) P-005 Anesthetic considerations and the role of blood pressure management in the endovascular treatment of acute ischemic stroke. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/jnis.2010.003236.5

64. D. Campbell, Carolyn Deng, Fiona Dianne McBryde, et al (2021) Protocol for the MAnagement of Systolic blood pressure during Thrombectomy by Endovascular Route for acute ischemic STROKE randomized clinical trial: The MASTERSTROKE trial. International Journal of Stroke. https://doi.org/10.1177/17474930211059029

65. Tianli Zhang, Xiaolong Wang, Chao Wen, et al (2019) Effect of short-term blood pressure variability on functional outcome after intra-arterial treatment in acute stroke patients with large-vessel occlusion. BMC Neurology. https://doi.org/10.1186/s12883-019-1457-5

66. Vinay Byrappa, M. Lamperti, Aliaksandr Ruzhyla, et al (2021) Acute ischemic stroke & emergency mechanical thrombectomy: The effect of type of anesthesia on early outcome. Clinical

neurology and neurosurgery (Dutch-Flemish ed Print). https://doi.org/10.1016/j.clineuro.2021.106494

67. Daniel Campos, M. Requena, M. Carvalho, et al (2020) Abstract TMP88: Blood Pressure Variability Within 24 Hours After Recanalization Worsens Functional Outcome Among Patients Who Underwent Endovascular Treatment. Stroke. https://doi.org/10.1161/STR.51.SUPPL_1.TMP88

68. X. Bai, Xiao Zhang, Tao Wang, et al (2021) General anesthesia versus conscious sedation for endovascular therapy in acute ischemic stroke: A systematic review and meta-analysis. Journal of clinical neuroscience. https://doi.org/10.1016/j.jocn.2021.01.012

69. B. Kim, Nishita Singh, B. Menon, et al (2022) Abstract WP8: Blood Pressure And EVT Outcomes By The Baseline Perfusion And Recanalization Timing. Stroke. https://doi.org/10.1161/str.53.suppl_1.wp8

70. J. Chang, J. Park, Jeong Yun Song, et al (2025) Mediation of Time-Related Blood Pressure Variability on Intensive Blood Pressure Lowering and Functional Outcomes Post Endovascular Therapy: A Post Hoc Analysis of the OPTIMAL-BP Trial. Journal of the American Heart Association : Cardiovascular and Cerebrovascular Disease. https://doi.org/10.1161/JAHA.124.039723

71. A. Onalan, E. Gurkaş, Ç. K. Akpınar, et al (2024) A comparison of conscious sedation and local anesthesia for thrombectomy in acute ischemic stroke: a multicenter study. Frontiers in Neurology. https://doi.org/10.3389/fneur.2024.1416146

72. M. Anadani, B. Maier, S. Escalard, et al (2022) Abstract 38: Magnitude Of Blood Pressure Change After Endovascular Therapy And Outcomes: Insight From Bp Target Trial. Stroke. https://doi.org/10.1161/str.53.suppl_1.38

73. B. Hindman (2019) Anesthetic Management of Emergency Endovascular Thrombectomy for Acute Ischemic Stroke, Part 1: Patient Characteristics, Determinants of Effectiveness, and Effect of Blood Pressure on Outcome. Anesthesia and Analgesia. https://doi.org/10.1213/ANE.0000000000004044

74. B. Hindman, F. Dexter (2019) Anesthetic Management of Emergency Endovascular Thrombectomy for Acute Ischemic Stroke, Part 2: Integrating and Applying Observational Reports and Randomized Clinical Trials. Anesthesia and Analgesia. https://doi.org/10.1213/ANE.0000000000004045

75. Yu Zhang, L. Jia, Fang Fang, et al (2019) General Anesthesia Versus Conscious Sedation for Intracranial Mechanical Thrombectomy: A Systematic Review and Meta-analysis of Randomized Clinical Trials. Journal of the American Heart Association : Cardiovascular and Cerebrovascular Disease. https://doi.org/10.1161/JAHA.118.011754

76. M. Mazighi, S. Richard, B. Lapergue, et al (2021) Safety and efficacy of intensive blood pressure lowering after successful endovascular therapy in acute ischaemic stroke (BP-TARGET): a multicentre, open-label, randomised controlled trial. Lancet Neurology. https://doi.org/10.1016/S1474-4422(20)30483-X

77. L. K. Rasmussen, C. Simonsen, M. Rasmussen (2019) Anesthesia practice for endovascular therapy of acute ischemic stroke in Europe. Current Opinion in Anaesthesiology. https://doi.org/10.1097/ACO.0000000000000746

78. M. Anadani, B. Maïer, S. Escalard, et al (2022) Magnitude of Blood Pressure Change After Endovascular Therapy and Outcomes: Insight From the BP-TARGET Trial. Stroke. https://doi.org/10.1161/STROKEAHA.121.036701

79. M. Cappellari, D. Toni (2020) Response by Cappellari and Toni to Letter Regarding Article, "General Anesthesia Versus Conscious Sedation and Local Anesthesia During Thrombectomy for Acute Ischemic Stroke". Stroke. https://doi.org/10.1161/STROKEAHA.120.032094

80. M. Hill (2024) After EVT for ischemic stroke, intensive vs. conventional BP management reduced functional independence at 3 mo. Annals of Internal Medicine. https://doi.org/10.7326/J23-0106

81. E. Heyer, Z. H. Anastasian, P. Meyers (2012) What matters during endovascular therapy for acute stroke: anesthesia technique or blood pressure management? Anesthesiology. https://doi.org/10.1097/ALN.0b013e318242b1e3

82. E. Farag, M. Argalious, G. Toth (2022) Stroke thrombectomy perioperative anesthetic and hemodynamic management. Journal of NeuroInterventional Surgery. https://doi.org/10.1136/neurintsurg-2021-018300

83. B. Maïer, B. Gory, B. Lapergue, et al (2021) Effect of blood pressure variability in the randomized controlled BP TARGET trial. European Journal of Neurology. https://doi.org/10.1111/ene.15194

84. C. Simonsen, J. Bösel, M. Rasmussen (2021) Periprocedural Management During Stroke Thrombectomy. Neurology. https://doi.org/10.1212/WNL.0000000000012798

85. M. M. Al-Salihi, Ram Saha, Ali Ayyad, et al (2023) General anesthesia versus conscious sedation for acute ischemic stroke endovascular therapy: A Meta Analysis of Randomized Controlled Trials. World Neurosurgery. https://doi.org/10.1016/j.wneu.2023.10.143

86. Chunrong Tao, Pengfei Xu, Yang Yao, et al (2021) A Prospective Study to Investigate Controlling Blood Pressure Under Transcranial Doppler After Endovascular Treatment in Patients With Occlusion of Anterior Circulation. Frontiers in Neurology. https://doi.org/10.3389/fneur.2021.735758

87. Hyungjong Park, Jae Wook Jung, Kwang Hyun Kim, et al (2026) Abstract DP028: Venous Outflow and Outcomes After Endovascular Thrombectomy: Interaction With Blood Pressure

Variability in a Post Hoc Analysis of the OPTIMAL-BP Trial. Stroke. https://doi.org/10.1161/str.57.suppl_1.dp028

88. Federica Arturi, G. Melegari, F. Gazzotti, et al (2025) Endovascular Treatment of Stroke and Anesthesia Technique: What Is the Best Approach, According to the Literature? Neurology International. https://doi.org/10.3390/neurolint17080115

89. C. Takahashi, Elizabeth Macri, H. Hinson, et al (2013) Abstract WP11: Decreased Intraprocedural End Tidal Carbon Dioxide Is Associated With Unfavorable Functional Outcome After Endovascular Intervention For Acute Ischemic Stroke. Stroke. https://doi.org/10.1161/str.44.suppl_1.awp11

90. Lindsey J Krawchuk, Amanda Crooks, Rachel K Do, et al (2025) Resource Utilization After Mechanical Thrombectomy: Is ICU Care Required for All Patients? Neurocritical Care. https://doi.org/10.1007/s12028-025-02384-0

91. Jerrad R. Businger, A. Fort, Phillip E. Vlisides, et al (2020) Management of Acute Ischemic Stroke-Specific Focus on Anesthetic Management for Mechanical Thrombectomy. Anesthesia and Analgesia. https://doi.org/10.1213/ANE.0000000000004959

92. Jingcui Qin, Zhijun Zhang (2020) Prognostic significance of early systolic blood pressure variability after endovascular thrombectomy and intravenous thrombolysis in acute ischemic stroke: A systematic review and meta-analysis. Brain and Behavior. https://doi.org/10.1002/brb3.1898

93. C. Takahashi, A. Brambrink, M. Aziz, et al (2014) Association of Intraprocedural Blood Pressure and End Tidal Carbon Dioxide with Outcome After Acute Stroke Intervention. Neurocritical Care. https://doi.org/10.1007/s12028-013-9921-3

94. J. Shriki, L. Johnson, Priya Patel, et al (2020) Transport Blood Pressures and Outcomes in Stroke Patients Requiring Thrombectomy. Air Medical Journal. https://doi.org/10.1016/j.amj.2020.03.002

95. B. Maïer, F. Delvoye, J. Labreuche, et al (2020) Impact of Blood Pressure After Successful Endovascular Therapy for Anterior Acute Ischemic Stroke: A Systematic Review. Frontiers in Neurology. https://doi.org/10.3389/fneur.2020.573382

96. O. Akça, Conner J. Elliott, Ruolan Liu, et al (2019) Abstract TP4: Do Lower Blood Pressure Levels in the First 24 Hours After Mechanical Thrombectomy Have an Impact on the Short-Term Outcomes? Stroke. https://doi.org/10.1161/STR.50.SUPPL_1.TP4

97. Robert J. McCusker, V. Chinchilli, Chanju Fritch, et al (2023) Demonstrating the Value of Routine Anesthesiologist Involvement in Acute Stroke Care: A Retrospective Chart Review. Journal of Neurosurgical Anesthesiology. https://doi.org/10.1097/ANA.0000000000000927

98. B. Vinay, Nitin Manohara, Amit Jain (2025) Anesthesia Considerations in Older Adults Undergoing Emergency Mechanical Thrombectomy for Acute Ischaemic Stroke. Drugs & Aging. https://doi.org/10.1007/s40266-025-01246-w

99. Arthur Wang, A. Abramowicz (2018) Endovascular thrombectomy in acute ischemic stroke: new treatment guide. Current Opinion in Anaesthesiology. https://doi.org/10.1097/ACO.0000000000000621

100. Thomas Slaughter (2019) Faculty Opinions recommendation of Association of General Anesthesia vs Procedural Sedation With Functional Outcome Among Patients With Acute Ischemic Stroke Undergoing Thrombectomy: A Systematic Review and Meta-analysis. Faculty Opinions – Post-Publication Peer Review of the Biomedical Literature. https://doi.org/10.3410/f.736694085.793566034

101. Xuening Zhang, Fayun Hu, Z. Hao, et al (2022) Efficacy of Early Intensive Blood Pressure Management After Thrombectomy: Protocol for a Randomized Controlled Clinical Trial (IDENTIFY). Neurocritical Care. https://doi.org/10.1007/s12028-022-01618-9

102. M. Taboada, A. Estany-Gestal, Jorge Fernández, et al (2024) Effect of early vs. delayed extubation on functional outcome among patients with acute ischemic stroke treated with endovascular thrombectomy under general anesthesia: the prospective, randomized controlled EDESTROKE trial study protocol. Trials. https://doi.org/10.1186/s13063-024-08181-y

103. D. Rusy, Ádám Hofer, M. Rasmussen, et al (2019) Assessment of Anesthesia Practice Patterns for Endovascular Therapy for Acute Ischemic Stroke: A Society for Neuroscience in Anesthesiology and Critical Care (SNACC) Member Survey. Journal of Neurosurgical Anesthesiology. https://doi.org/10.1097/ANA.0000000000000661

104. Jingcui Qin, Qing He, Zhijun Zhang (2022) Detrimental effect of increased blood pressure variability on clinical outcome in acute ischemic stroke treated with reperfusion therapy: a case control study. BMC Neurology. https://doi.org/10.1186/s12883-022-02605-5