Journal of the Neurological Sciences 490 (2026) 126160

Contents lists available at ScienceDirect

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns

Review Article

Endovascular therapy for mild-to-moderate stroke due to basilar artery occlusion: A systematic review and meta-analysis

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ARTICLE INFO

Keywords:
Acute ischemic stroke
Endovascular therapy
Basilar artery occlusion
Mild-to-moderate stroke
Meta-analysis

ABSTRACT

Background: Endovascular therapy (EVT) is an established treatment for basilar artery occlusion (BAO) with severe deficits, but its benefit in patients with mild-to-moderate symptoms (National Institutes of Health Stroke Scale [NIHSS] <10) remains unclear due to limited randomized controlled trial (RCT) evidence. We performed a systematic review and meta-analysis to evaluate EVT efficacy and safety in this subgroup.

Methods: We searched PubMed, Embase, and the Cochrane Library for RCTs and observational studies published between January 1, 2014, and July 1, 2026, comparing EVT plus best medical treatment (BMT) versus BMT in BAO with NIHSS <10. The primary outcome was 90-day good functional status (modified Rankin Scale [mRS] 0–2). Secondary outcomes were favorable (mRS 0–3) and excellent (mRS 0–1) functional status. Safety outcomes included 90-day mortality, any intracerebral hemorrhage (ICH) and symptomatic ICH.

Results: Fifteen studies comprising 3981 patients (1812 EVT; 2169 BMT) were included. No significant differences were observed in good (OR = 1.51; 95% CI 0.89–2.54; $p = 0.12$) or favorable functional status (OR = 0.99; 95% CI 0.75–1.30; $p = 0.92$), while EVT increased the odds of excellent status (OR = 2.01; 95% CI 1.33–3.05; $p < 0.001$). Mortality (OR = 0.94; 95% CI 0.55–1.59), any ICH (OR = 1.23; 95% CI 0.69–2.19) and symptomatic ICH (OR = 0.98; 95% CI 0.61–1.57) were comparable.

Conclusion: Although no difference emerged for the primary outcome, EVT increased the likelihood of excellent recovery without compromising safety. These findings highlight the need for RCTs targeting this population.

1. Introduction

Basilar artery occlusion (BAO) accounts for approximately 1% of all acute ischemic strokes (AIS) and up to 10% of proximal intracranial occlusions [1,2]. Despite significant advances in acute stroke management, BAO remains associated with substantial morbidity and mortality, particularly when timely and complete reperfusion is not achieved [3,4].

In recent years, several randomized controlled trials (RCTs) have evaluated the efficacy of endovascular therapy (EVT) in this setting. Early trials, including BEST and BASICS [5,6], failed to demonstrate a clear superiority of EVT over best medical treatment (BMT) alone. In contrast, more recent studies, such as ATTENTION and BAOCHE [7,8], provided stronger evidence supporting the benefit of EVT in selected patients. These findings were further corroborated by a recent meta-analysis pooling data from available RCTs, which reinforced the substantial therapeutic effect of EVT in BAO [9].

Abbreviations: AIS, acute ischemic stroke; BAO, basilar artery occlusion; BMT, best medical treatment; CI, confidence interval; EVT, endovascular therapy; GRADE, Grading of Recommendations Assessment, Development and Evaluation; ICH, intracerebral hemorrhage; pc-ASPECTS, posterior circulation Alberta Stroke Program Early CT Score; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PROSPERO, International Prospective Register of Systematic Reviews; RCTs, randomized controlled trials; RoB2, version 2 of the Cochrane Risk of Bias; ROBINS-I, Risk of Bias in Non-randomized Studies – of interventions tool; TSA, trial sequential analysis; HARIS, Heterogeneity-Adjusted Required Information Size.

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https://doi.org/10.1016/j.jns.2026.126160
Received 1 March 2026; Received in revised form 4 August 2026; Accepted 31 August 2026
Available online 1 September 2026

Notably, the majority of patients enrolled in these trials presented with severe neurological deficits at baseline. Patients with mild-to-moderate symptoms, defined by a National Institutes of Health Stroke Scale (NIHSS) score < 10, were either excluded or markedly underrepresented, with only 97 individuals included across RCTs [5,6,8]. Consequently, subgroup analyses lacked sufficient statistical power to draw definitive conclusions regarding the efficacy of EVT in this subgroup [9], thereby limiting the reliability and generalizability of current evidence.

As a result, the optimal management strategy for patients with BAO and lower NIHSS scores remains uncertain, and no RCT has been specifically designed to address this population. Given the potentially different risk–benefit profile of EVT in patients with milder neurological deficits, further evidence is needed to guide clinical decision-making.

Accordingly, we conducted a systematic review and meta-analysis to compare EVT plus BMT with BMT alone in this subgroup, aiming to assess whether EVT improves functional outcomes without increasing adverse events.

2. Methods

2.1. Study design

This systematic review and meta-analysis was performed and reported in accordance with the Cochrane Collaboration Handbook for Systematic Review of Interventions and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [10,11]. The study protocol was preregistered in the International Prospective Register of Systematic Reviews PROSPERO (registration ID: CRD420250651039). Institutional Review Board approval was waived as this study is a systematic review of previously published, de-identified data.

2.2. Eligibility criteria

We included all peer-reviewed, English-language, RCTs and observational comparative studies (cohort, case-control, or registry-based) published as full articles. The study population included adult patients (aged ≥16 years) with mild-to-moderate AIS (NIHSS <10) due to BAO confirmed by neuroimaging (computed tomography angiography, magnetic resonance angiography, or digital subtraction angiography), and with a minimum follow-up period of 90 days; in addition, studies were included only if they reported at least one of the clinical outcomes of interest. We excluded case reports or series, studies with no control group or overlapping populations, studies that included pediatric populations (<16 years) or exclusively enrolled patients with severe stroke (NIHSS ≥10) or concomitant anterior large-vessel occlusion, and non-peer-reviewed literature.

The intervention of interest was EVT plus BMT (including intravenous thrombolysis [IVT]), compared to BMT alone.

2.3. Outcome measures

The primary outcome of interest was a good functional status, defined as a score of 0 to 2 on modified Rankin Scale (mRS) at 90 days. Secondary outcomes included (1) favorable functional status, defined as mRS 0–3 at 90 days and (2) excellent functional status, defined as mRS 0–1 at 90 days. Safety outcomes were (1) all-cause mortality, (2) any intracerebral hemorrhage (ICH) and (3) symptomatic ICH at 90 days.

2.4. Data sources

We systematically searched the electronic databases PubMed, EMBASE, and Cochrane Library including studies published in the period from January 1, 2014 to July 1, 2026, with the following search terms: “ischemic stroke”, “brain ischemia”, “basilar artery”, “BAO”, “endovascular treatment” and “mechanical thrombectomy”. A detailed description of the search strategies is provided in the Supplemental Material.

2.5. Data collection and analysis

All records retrieved through database searching were imported into Rayyan (https://www.rayyan.ai) for deduplication and blinded screening [12]. Two reviewers (M.A. and P.M.) independently screened titles and abstracts, classifying each study as “included”, “excluded”, or “uncertain”. Articles deemed relevant or uncertain were subsequently evaluated in full text to assess eligibility based on the predefined inclusion and exclusion criteria. Disagreements at any stage were resolved by discussion or, if needed, by consulting a third reviewer (E.N.). Data extraction was performed independently by the same two reviewers using a standardized data collection form. The following study-level characteristics were also extracted, when available: diagnostic imaging modality, baseline posterior circulation Alberta Stroke Program Early CT Score (pc-ASPECTS), and the anatomical location of the BAO, according to the definitions used in the original studies.

2.6. Risk of bias assessment and certainty of evidence

We evaluated the risk of bias in randomized studies using version 2 of the Cochrane Risk of Bias (RoB2) assessment tool [13]. Non-randomized studies were assessed with the Risk of Bias in Non-randomized Studies – of interventions tool (ROBINS-I) [14]. Two independent authors (M.A. and A.C.) completed the risk of bias assessment. Disagreements were resolved through a consensus after discussing reasons for discrepancy. Publication bias was assessed visually through funnel plot inspection and formally tested using Egger's regression intercept test. A p-value <0.10 was considered indicative of small-study effects. The overall certainty of evidence was assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) framework [15].

2.7. Statistical analysis

In the pairwise meta-analysis, pooled odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to compare dichotomous outcomes between patients treated with EVT plus BMT and those receiving BMT alone. For outcomes based on raw event counts, effect estimates were pooled using the Mantel–Haenszel method. For contrast-level outcomes derived from study-reported summary statistics, effect sizes were synthesized using the inverse variance method, assuming normally distributed log-odds and applying a Wald-type approximation for interval estimation.

Given the anticipated clinical and methodological heterogeneity among studies, pooled effect estimates were calculated using a random-effects model according to the DerSimonian and Laird method. Between-study variance (τ^2) was estimated accordingly.

Heterogeneity across studies was assessed using Cochran's Q test and quantified using the I^2 statistic. For interpretation, I^2 values below 25% were considered indicative of low heterogeneity, 25–75% moderate heterogeneity, and values above 75% high heterogeneity. A p-value <0.10 in Cochran's Q test was considered suggestive of statistically significant heterogeneity.

Statistical significance was defined as a two-sided p-value <0.05 for all comparisons. All analyses were performed using Review Manager (RevMan) version 5.4 (Cochrane Centre, The Cochrane Collaboration, Denmark) [16].

2.8. Sensitivity analyses

Trial sequential analysis (TSA) was used to assess whether the accumulated evidence from the included studies was sufficient to draw

reliable definite conclusions or whether additional trials are needed, estimating the required information size [17]. For each study, we used the raw data and log OR with standard error. A random-effects model was applied. We set the risk of type I error (α) at 10% and type II error (β) at 20% (power 80%). We defined the minimal clinically important effect as an OR of 1.5, meaning that a 50% relative increase in the odds of a favorable status with EVT plus BMT versus BMT alone was considered clinically meaningful. Two-sided monitoring boundaries were constructed.

Additional sensitivity analyses were conducted for symptomatic ICH by stratifying studies according to the definition adopted: the European Cooperative Acute Stroke Study II (ECASS II) criteria, the Safe Implementation of Thrombolysis in Stroke–Monitoring Study (SITS-MOST) criteria, and the Heidelberg Bleeding Classification (HBC).

3. Results

The initial search yielded 6744 results. After removal of duplicate records and ineligible studies, 109 full-text articles were assessed for eligibility. Following exclusion of studies for reasons such as inappropriate design, lack of subgroup analyses for BAO and mild-to-moderate deficits (NIHSS <10), or non-English language publication, a total of fifteen studies were included in qualitative and quantitative synthesis (Fig. 1), comprising a total of 1812 patients treated with EVT plus BMT versus 2169 with BMT alone. Design and characteristics of the included studies are summarized in Table 1: of fifteen included studies, two were RCTs [6,8], while the remaining were non-randomized comparative studies [18–30]. Baseline pc-ASPECTS data were available in seven of the fifteen included studies, with median values ranging from 8 to 9 in the EVT group and from 7 to 9 in the BMT group, and generally comparable distributions between treatment arms. Six studies also reported the distribution of proximal, middle, and distal BAO, which varied considerably across study populations and treatment groups.

3.1. Quality control

The risk of bias among the included observational studies [18–30] was judged to be at moderate to serious, particularly for confounding, selection of participants and measurement of outcomes (Supplemental Fig. 1 A), while among RCTs [6,8] the risk of bias was low, with BAOCHE presenting minor concerns related to outcome reporting (Supplemental Fig. 1B). Visual inspection of the funnel plot for the primary outcome revealed a relatively symmetric distribution of studies, suggesting the absence of substantial publication bias (Supplemental Fig. 2). This impression was confirmed by Egger's regression intercept test, which did not indicate small-study effects (intercept, −0.416; 95% CI, −1.916 to 1.084; $p = 0.54$). These findings reduce the likelihood that selective reporting or small-study effects substantially influenced the observed effect estimate for the primary outcome.

The certainty of evidence was assessed using the GRADE framework for each outcome [15] (Supplemental Fig. 3). The certainty of evidence for the primary outcome was rated as very low, as the available data were derived mainly from non-randomized studies and were downgraded by one level for risk of bias. For excellent functional status, defined as mRS 0–1, the certainty of evidence was rated as low: although downgraded for risk of bias, it was upgraded by one level due to the large magnitude of the observed effect. The certainty of evidence for all-cause mortality was judged to be very low because of risk of bias and inconsistency, whereas the certainty of evidence for any ICH and symptomatic ICH was also rated as very low due to risk of bias.

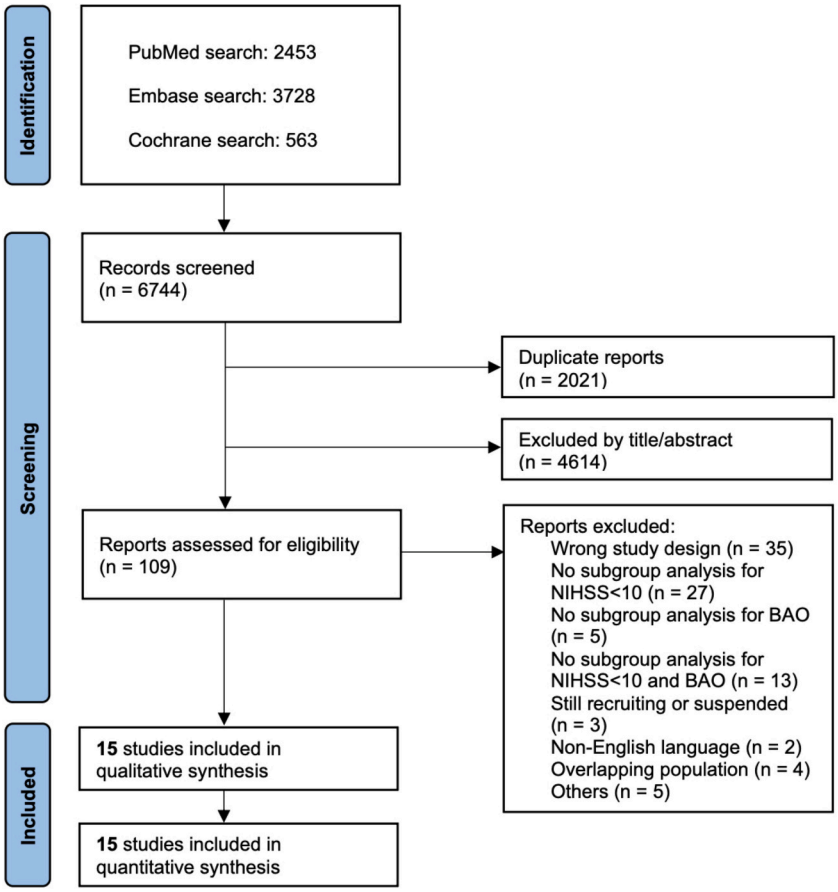

Fig. 1. PRISMA flow diagram of study screening and selection.

Table 1
Design and characteristics of included studies.

Study	Year	Design	Country	Patients, n EVT/BMT	Diagnostic imaging methods	pc-ASPECTS‡ EVT/BMT	Comparison group	Occlusion site, % (proximal-middle-distal) EVT/BMT	Primary outcome	Definition of sICH
BAOCHE	2022	RCT	INT	6/11	MRA or CTA	NA	± IVT	NA	mRS 0–3	SITS-MOST
BASICS	2021	RCT	INT	31/30	MRA or CTA	NA	± IVT	NA	mRS 0–3	HBC
Chhabra	2025	Non-RCT	USA	25/58	MRA or CTA	NA	IVT	NA	mRS 0–3	NA
Dargazanli	2024	Non-RCT	INT	64/63	MRA or CTA	8 (7–9)/8 (7–9)	± IVT	NA	mRS 0–2	ECASS II
Gruber	2021	Non-RCT	Germany	37/45	MRA, CTA or DSA	NA	± IVT	NA	mRS 0–3	NA
Guo	2025	Non-RCT	China	75/125	MRA, CTA or DSA	9 (8–9)/8 (7–9)	IVT	NA	mRS 0–1	SITS-MOST
Lieschke	2025	Non-RCT	INT	176/98	NA	NA	IVT	17–19-64/16–13-60	mRS 0–2	ECASS II
Nicolini	2024	Non-RCT	INT	710/707	MRA or CTA	NA	IVT	23–18-50/22–16-49	mRS 0–2	SITS-MOST
Räty	2025	Non-RCT	INT	118/63	NA	NA	IVT	NA	mRS 0–3	ECASS II
Seners	2021	Non-RCT	France	28/29	NA	9 (8–10)/9 (8–10)	IVT	43–0-57/41–0-59	mRS 0–1	ECASS II
Sun	2025	Non-RCT	China	338/783	MRA, CTA or DSA	9 (8–10)/9 (8–10)	± IVT	27–23-26/35–23-23	mRS 0–3	HBC
Tan	2026	Non-RCT	China	78/28	MRA, CTA or DSA	8 (7–9)/7 (6–9)	± IVT	14–35-31/11–64-21	scores	HBC
Tao	2022	Non-RCT	INT	NA	MRA, CTA or DSA	NA	± IVT	NA	mRS 0–3	ECASS II
Xiao	2025	Non-RCT	China	108/108	MRA, CTA or DSA	9 (8–10)/9 (8–10)	± IVT	34–36-42/41–28-40	mRS 0–2	HBC
Yoshimoto	2020	Non-RCT	Japan	18/21	MRA, CTA or DSA	8 (7–9)/9 (7–9)	IVT	NA	mRS 0–3	ECASS II

Abbreviations: RCT = randomized controlled trial; INT = international; EVT = endovascular therapy; BMT = best medical treatment; MRA = magnetic resonance angiography; CTA = computed tomography angiography; DSA = digital subtraction angiography; IVT = intravenous thrombolysis; mRS = modified Rankin Scale; sICH = symptomatic intracerebral hemorrhage; SITS-MOST = safe implementation of thrombolysis in stroke-monitoring study; HBC = Heidelberg Bleeding Classification; ECASS = European Cooperative Acute Stroke Study.

‡ Data are medians, with interquartile ranges in parentheses.

3.2. Quantitative analyses

Ten studies [8,19,21–25,27,29,30] contributed data to the primary outcome analysis, defined as a 90-day mRS score of 0–2, with 1381 patients allocated to the intervention and 1253 to the control arm. The pooled analysis revealed no statistically significant difference between EVT plus BMT and BMT alone (OR 1.51; 95% CI 0.89–2.54; $p = 0.12$; $I^2 = 79\%$; Fig. 2), with high between-study heterogeneity.

When evaluating 90-day favorable functional status, data from fourteen studies [6,8,18–24,26–30] yielded a pooled OR of 0.99 (95% CI 0.75–1.30; $p = 0.92$; $I^2 = 62\%$; Fig. 3A). The analysis of excellent functional status, based on nine studies [8,19,21–23,25,27,29,30], showed a significant treatment benefit for the intervention group (OR 2.01; 95% CI 1.33–3.05; $p < 0.001$; $I^2 = 65\%$; Fig. 3B), with moderate heterogeneity.

Concerning safety outcomes, available data on 90-day all-cause mortality and any ICH were analyzed from the same eight studies [19,21–24,27,29,30], whereas nine studies contributed data on symptomatic ICH [19,21–25,27,29,30]. Pooled analysis showed no significant difference between EVT plus BMT and BMT alone in 90-day mortality (OR 0.94; 95% CI 0.55–1.59; $p = 0.81$; $I^2 = 65\%$; Fig. 4A), any ICH (OR 1.23; 95% CI 0.69–2.19; $p = 0.48$; $I^2 = 20\%$; Fig. 4B) or symptomatic ICH (OR 0.98; 95% CI 0.61–1.57; $p = 0.93$; $I^2 = 0\%$; Fig. 4C).

In the sensitivity analyses, stratification by the definition of symptomatic ICH yielded consistent results across classification systems, with no evidence of a difference between the two groups. The pooled estimates were OR 1.07 (95% CI 0.45–2.53; $p = 0.88$; $I^2 = 3\%$) for ECASS II (Supplemental Fig. 4A), OR 0.79 (95% CI 0.32–1.93; $p = 0.61$; $I^2 = 36\%$) for SITS-MOST (Supplemental Fig. 4B), and OR 1.92 (95% CI 0.61–6.07, $p = 0.27$; $I^2 = 0\%$) for HBC (Supplemental Fig. 4C).

TSA showed that, for good functional status at 90 days, the cumulative *Z*-curve crossed neither the conventional significance boundary nor the trial-sequential monitoring boundaries for benefit or harm. The accrued information size was 2576 participants, corresponding to approximately 4% of the heterogeneity-adjusted required information size (HARIS) of 69,272 participants (Supplemental Fig. 5 A).

For favorable functional status, the pooled effect estimate was close to the null, and the cumulative *Z*-curve remained within both the conventional and trial-sequential monitoring boundaries. The accrued information size was 2786 participants, representing approximately 43% of the HARIS of 6435 participants (Supplemental Fig. 5B).

Conversely, for excellent functional status, the cumulative Z-curve crossed the conventional significance boundary but did not cross the more stringent trial-sequential monitoring boundary for benefit. The accrued information size was 2395 participants, corresponding to approximately 29% of the HARIS of 8335 participants (Supplemental Fig. 5C).

4. Discussion

We performed a systematic review and meta-analysis of fifteen studies investigating patients with AIS due to BAO and mild-to-moderate neurological deficits (NIHSS <10), comparing EVT plus BMT versus BMT alone.

For the primary outcome of good functional status at 90 days (mRS 0–2), pooled analysis showed no statistically significant difference between EVT plus BMT and BMT alone, although the direction of effect favored EVT. The considerable heterogeneity observed may be explained, at least in part, by differences in IVT use across treatment

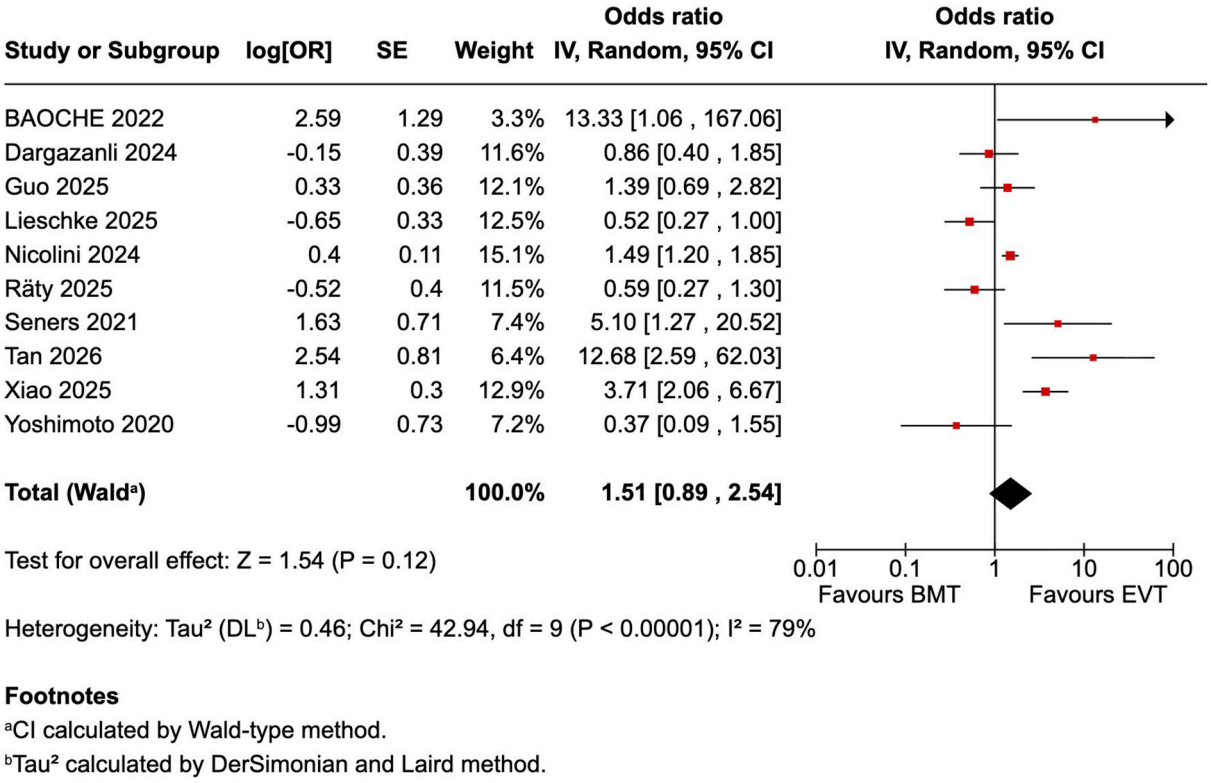

Fig. 2. Forest plot for good functional status at 90 days.
Abbreviations: EVT = endovascular therapy; BMT = best medical treatment.

arms and methodological differences across studies. Several factors, such as baseline NIHSS score, type of devices used, and underlying stroke etiology [31,32], may also influence the therapeutic efficacy of EVT in patients with BAO and likely contribute to the observed heterogeneity across the included studies. Consequently, the underrepresentation of patients with mild-to-moderate AIS in both randomized and observational studies limits a comprehensive assessment of these variables and makes it difficult to determine their individual impact on treatment outcomes.

Regarding secondary outcomes, our findings delineate the potential benefits of EVT in this specific patient population. Although the analysis of favorable functional status (mRS 0–3) at 90 days did not reach statistical significance, excellent functional recovery (mRS 0–1) demonstrated a statistically significant benefit of EVT. This suggests that, among patients with mild-to-moderate BAO stroke, EVT may meaningfully increase the probability of achieving near-complete neurological recovery. This finding implies the possibility of returning to baseline function in a subset of patients who may otherwise be considered borderline candidates for intervention.

Importantly, excellent functional status may be more informative in detecting treatment effects in patients with low-to-moderate severity of stroke at hospital entry, which were underrepresented in RCTs [5–8]. Dichotomizing the mRS at 0–3 or 0–2 may group together patients with very different levels of disability. For instance, patients with mRS 2 or 3 may still experience limitations in independence, despite being categorized as having a “favorable” or “good” status. In contrast, achieving mRS 0–1 reflects near-complete functional independence, which may be more sensitive in detecting subtle yet meaningful treatment effects in a population with low baseline severity. Notably, a shift analysis of the full mRS distribution might have provided a more comprehensive assessment of the treatment effect across the spectrum of functional outcomes. Such an approach could better capture gradations in recovery and mitigate information loss inherent in dichotomized endpoints. Unfortunately, these data were not available in most included studies, precluding such an analysis. Occlusion location may also be clinically relevant, as proximal, middle, and distal BAO have been associated with different prognoses [33,34]. However, occlusion location was reported in only six studies, none of which assessed whether the association between treatment strategy and excellent functional status differed according to occlusion site in this patient population. Consequently, it was not possible to reliably evaluate occlusion location as a potential treatment-effect modifier. However, these results should still be interpreted with caution. Although a total of 2455 patients were available for analysis (1263 in the intervention group and 1192 in the control group), only a limited number of studies contributed data to the mRS 0–1 outcome, reducing the overall precision of the estimate and potentially limiting its generalizability [8,19,21–23,25,27,29,30].

Concerning safety outcomes, our analysis found no statistically significant increase in 90-day all-cause mortality, any ICH or symptomatic ICH among patients treated with EVT compared to those receiving BMT alone. This finding was further supported by the sensitivity analyses stratified according to the definition of symptomatic ICH, which yielded consistent results across the ECASS II, SITS-MOST, and HBC classification systems. Although the point estimates varied across definitions, none indicated a statistically significant difference between treatment groups, supporting the robustness of the overall safety finding.

The results of our meta-analysis may provide important insights into the management of BAO in patients with NIHSS <10. Most RCTs to date have predominantly enrolled patients with high NIHSS, thereby excluding or underrepresenting individuals with lower scores [5–8]. However, a low NIHSS does not necessarily indicate a benign condition in BAO, as this score was originally designed to assess anterior circulation deficits and may underestimate the severity of posterior circulation involvement. This limitation was clearly demonstrated in a comparative analysis by Kim et al., which found that among patients with NIHSS ≤5, those with posterior circulation infarcts had significantly worse 90-day outcomes compared to anterior circulation strokes. Specifically, disability, defined as a mRS >1, was observed in 26% of posterior versus

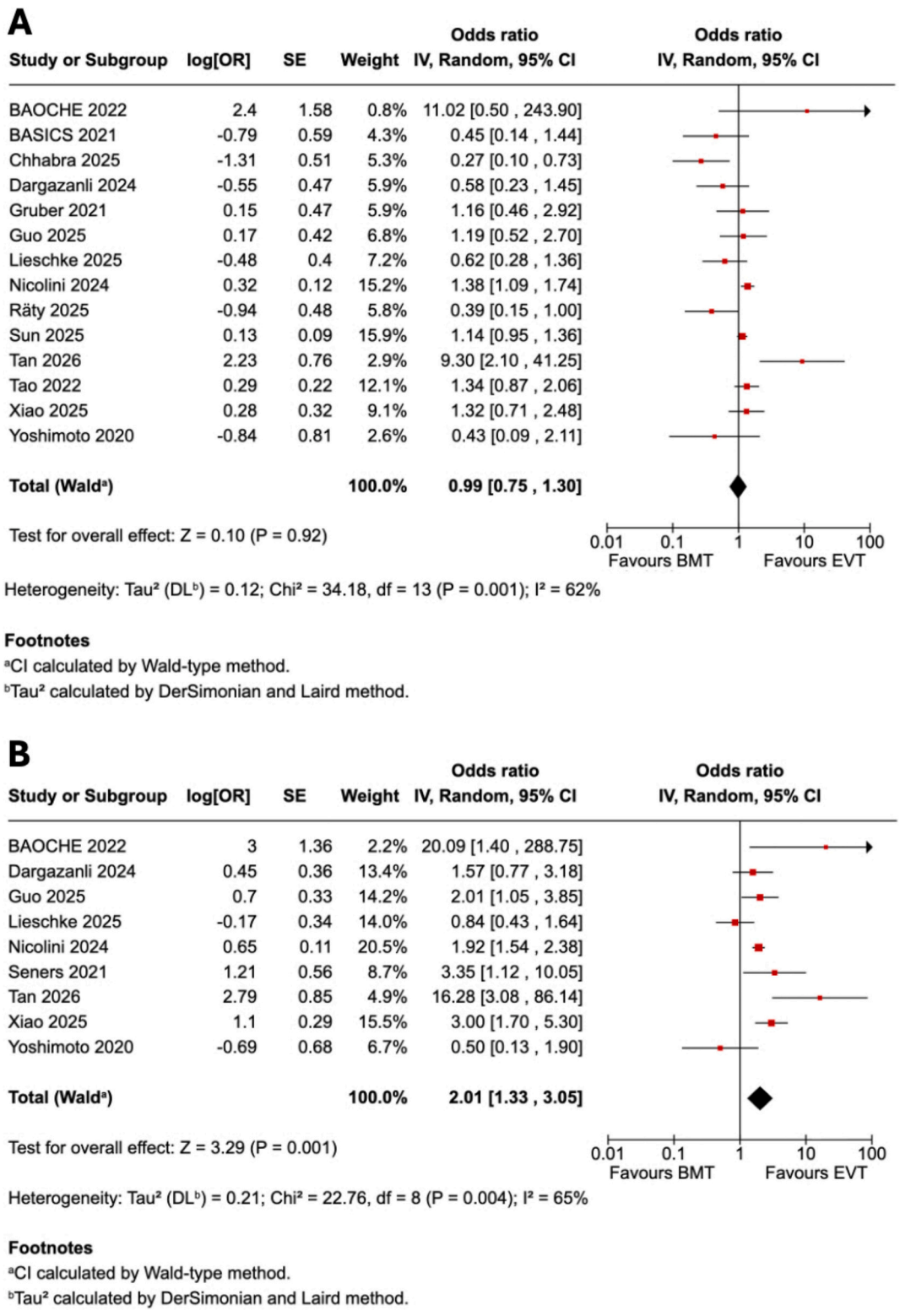

Fig. 3. Forest plots for favorable (A) and excellent (B) functional status at 90 days. Abbreviations: EVT = endovascular therapy; BMT = best medical treatment.

16% of anterior cases ($p = 0.03$), while dependency, characterized by mRS >2, occurred in 19% versus 11% respectively ($p = 0.04$) [35]. These findings underscore the tendency of NIHSS to underestimate the functional severity of posterior strokes, leading to suboptimal assessment of disease severity and undertreatment. In this context, the use of a posterior-specific version of the score, such as posterior NIHSS, has been proposed to improve the prognostic assessment of patients with posterior circulation stroke and mild-to-moderate symptoms [36]. This score incorporates the evaluation of clinical signs frequently underdetected by standard NIHSS, such as truncal ataxia, gait disturbance, and bulbar signs like dysphagia and impaired cough, offering a more tailored assessment of functional impairment in this population.

These findings should be interpreted cautiously and considered primarily hypothesis-generating. The pooled estimates were

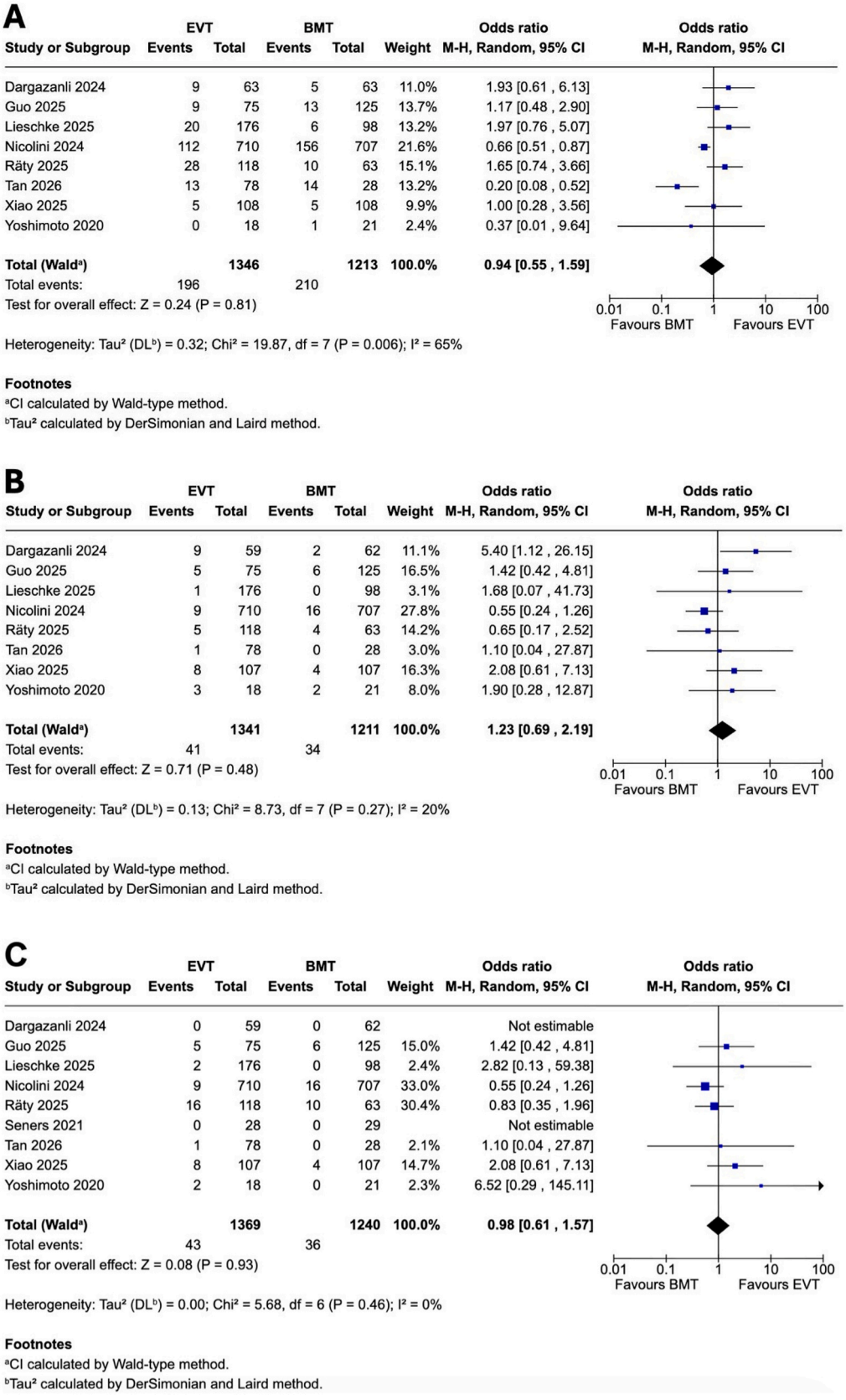

Fig. 4. Forest plots for 90-day mortality (A), any intracerebral hemorrhage (B) and symptomatic intracerebral hemorrhage (C). Abbreviations: EVT = endovascular therapy; BMT = best medical treatment. M-H = Mantel–Haenszel statistic.

predominantly informed by observational studies and are therefore vulnerable to selection or treatment-allocation bias and residual confounding. Collectively, these limitations resulted in a moderate-to-serious risk of bias and low certainty of evidence, thereby limiting both the robustness and the generalizability of the conclusions.

Dedicated RCTs or large-scale prospective cohort studies specifically targeting patients with mild-to-moderate BAO are warranted to better establish the functional benefits of EVT, particularly in relation to stringent functional outcome measures, including complete or near-complete recovery defined as 90-day mRS 0–1.

Importantly, the TSA findings underscore the uncertainty of the available evidence. For the primary outcome of good functional status at 90 days (mRS 0–2), the cumulative *Z*-curve crossed neither the conventional nor the trial-sequential monitoring boundaries, and the accrued information size represented only a small fraction of the estimated HARIS. Therefore, the absence of a statistically significant effect should not be interpreted as evidence of equivalence between EVT and BMT, but rather as reflecting substantial imprecision and insufficient information.

Similarly, for favorable functional status (mRS 0–3), the cumulative evidence remained close to the line of no effect and did not cross the monitoring boundaries for benefit or harm. Although a larger proportion of the required information size was accrued for this outcome, the available evidence remained insufficient to draw a definitive conclusion.

In contrast, for excellent functional status (mRS 0–1), the cumulative *Z*-curve crossed the conventional significance boundary but not the trial-sequential boundary for benefit, while the TSA-adjusted confidence interval included the null. This finding indicates a potentially relevant treatment effect that remains vulnerable to random error and requires confirmation in adequately powered prospective studies. Collectively, these results support the hypothesis that more stringent functional outcomes may be more sensitive to a possible benefit of EVT in patients with mild-to-moderate BAO, although the current evidence is not sufficiently robust to establish a firm treatment effect.

Moreover, the use of more refined baseline assessment scores, such as posterior NIHSS or imaging data [37], might enhance patient selection by capturing true clinical severity of posterior circulation strokes.

5. Conclusion

In this systematic review and meta-analysis of patients with AIS due to BAO and NIHSS <10, EVT plus BMT was not associated with significantly higher rates of good or favorable functional status at 90 days, compared with BMT alone. However, EVT may be associated with higher odds of excellent functional status with no safety concerns. These findings suggest that EVT may provide meaningful clinical benefit even in patients with mild-to-moderate BAO, emphasizing the need for dedicated RCTs specifically designed for this patient population.

CRediT authorship contribution statement

Marco Andrighetti: Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Antonio Ciacciarelli:** Visualization, Investigation, Data curation. **Pierludovico Moro:** Visualization, Software, Methodology, Investigation, Data curation. **Michele Romoli:** Visualization, Methodology, Formal analysis. **Carlo W. Cereda:** Visualization, Validation, Supervision, Conceptualization. **Danilo Toni:** Writing – original draft. **Ettore Nicolini:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Patient consent for publication

Not applicable.

Ethics approval

Not applicable.

Funding

The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Declaration of competing interest

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jns.2026.126160.

Data availability

Study data are available from the corresponding author upon reasonable request.

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