Carotid Dissection: Systematic Review with ☸SAIMSARA.

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Abstract: Systematic review with multilayer AI research agent: keyword normalization, retrieval & structuring, and paper synthesis (see SAIMSARA About section for details). The review utilises 110 studies with 5808 total participants (naïve ΣN). For acute ischemic stroke patients with carotid dissection and tandem occlusion undergoing endovascular interventions, successful reperfusion (mTICI 2b–3) rates ranged from 62% to 100%, with a median of 81% across studies reporting this metric. This indicates high technical success in restoring blood flow in a complex patient population, though favorable functional outcomes are not always significantly improved with stenting. The generalizability of these findings is somewhat limited by the predominantly retrospective nature and heterogeneity of the existing studies. The most significant limitation affecting certainty is the lack of large-scale, prospective, randomized controlled trials comparing different treatment approaches and their long-term impact. Therefore, clinicians should prioritize early and accurate diagnosis using advanced imaging and consider endovascular options for acute stroke, while ongoing research is needed to refine optimal long-term management strategies.

Keywords: Cervical Artery Dissection; Spontaneous Dissection; Acute Ischemic Stroke; Tandem Occlusion; Endovascular Treatment; Carotid Artery Stenting; Horner Syndrome; Vascular Imaging

Review Stats

- Generated: 2026-02-12 00:02:19 CET
- Plan: Pro (expanded craft tokens; source: Semantic Scholar)
- Source: Semantic Scholar
- Scope: All fields
- Keyword Gate: Fuzzy (≥60% of required terms, minimum 2 terms matched in title/abstract)
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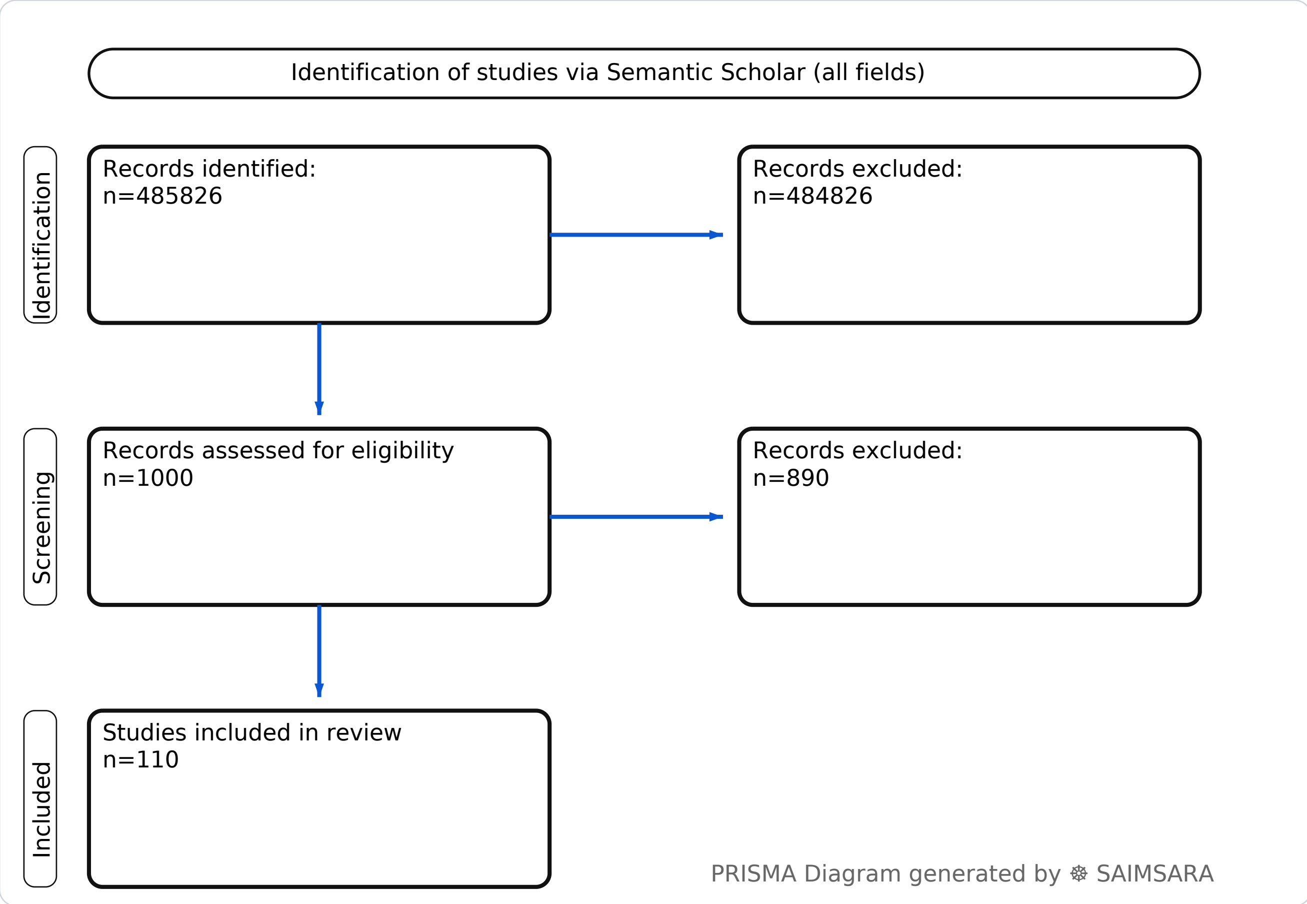
- Downloaded Abstracts/Papers: 1000
- Included original Abstracts/Papers: 110
- Total study participants (naïve ΣN): 5808


Identification of studies via Semantic Scholar (all fields)
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Records excluded:
n=484826
Screening
Records assessed for eligibility
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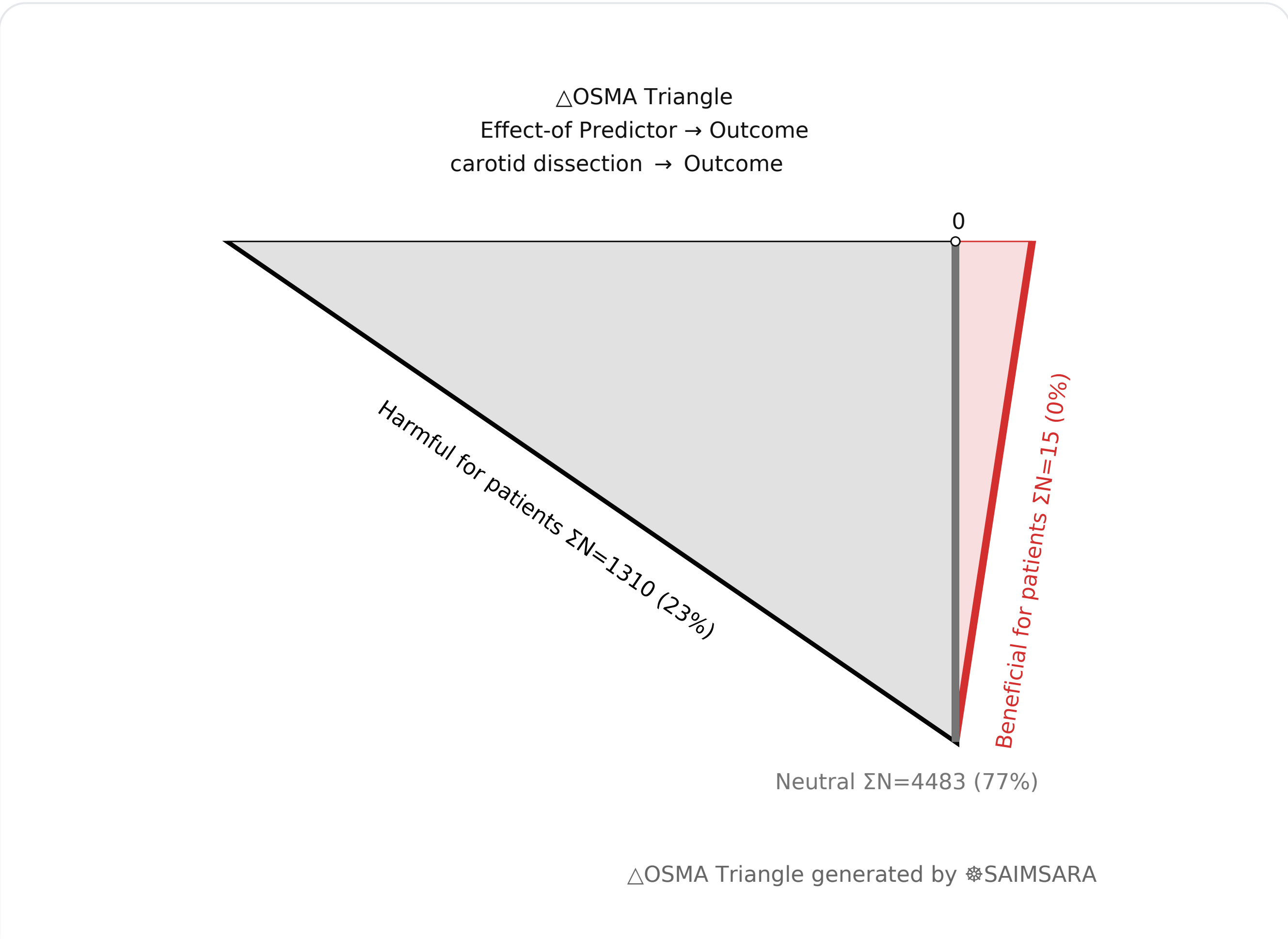
Records excluded:
n=890
Included
Studies included in review
n=110
PRISMA Diagram generated by ☸ SAIMSARA


△OSMA Triangle
Effect-of Predictor → Outcome
carotid dissection → Outcome
0
Harmful for patients ΣN=1310 (23%)
Beneficial for patients ΣN=15 (0%)
Neutral ΣN=4483 (77%)
△OSMA Triangle generated by ☸SAIMSARA

Outcome-Sentiment Meta-Analysis (OSMA): *(LLM-only)*

Frame: Effect-of Predictor → Outcome • *Source*: Semantic Scholar

Outcome: Outcome Typical timepoints: peri/post-op, 90-day. Reported metrics: %, CI, p.

Common endpoints: Common endpoints: complications, occlusion, functional.

Predictor: carotid dissection — exposure/predictor. Routes seen: intravenous. Typical comparator: patients without cas, controls, anticoagulation in patients, anticoagulation in carotid....

- **1) Beneficial for patients** — Outcome with carotid dissection — [98] — ΣN=15
- **2) Harmful for patients** — Outcome with carotid dissection — [26], [103], [108], [110] — ΣN=1310
- **3) No clear effect** — Outcome with carotid dissection — [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [27], [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58], [59], [60], [61], [62], [63], [64], [65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75], [76], [77], [78], [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89], [90], [91], [92], [93], [94], [95], [96], [97], [99], [100], [101], [102], [104], [105], [106], [107], [109] — ΣN=4483

1) Introduction

Carotid artery dissection (CAD) represents a critical cerebrovascular pathology, frequently manifesting as acute ischemic stroke or transient ischemic attacks (TIAs) [8, 20, 84]. This condition arises from a tear in the arterial wall, leading to the formation of a false lumen that can result in stenosis, occlusion, or the development of aneurysms [12, 90, 99]. CAD can be broadly categorized as spontaneous or traumatic in origin. Notably, the incidence of spontaneous cervical artery dissection (CeAD) has demonstrated a significant increase over recent decades, particularly among women, a trend potentially attributable to advancements in noninvasive diagnostic imaging techniques [4, 25, 110]. A comprehensive understanding of the etiology, diverse clinical presentations, diagnostic methodologies, and optimal management strategies for carotid dissection is paramount for enhancing patient outcomes. This paper synthesizes the current research landscape surrounding carotid dissection, encompassing its epidemiology, identified risk factors, diagnostic modalities, acute and long-term therapeutic approaches, and associated complications.

2) Aim

Systematic review with multilayer AI research agent: keyword normalization, retrieval & structuring, and paper synthesis (see SAIMSARA About section for details).

3) Methods

Systematic review with multilayer AI research agent: keyword normalization, retrieval & structuring, and paper synthesis (see SAIMSARA About section for details).

- **Bias:** Qualitatively inferred from study design fields. The included studies primarily consist of retrospective cohort and mixed designs, with a smaller number of case-control studies and a few randomized controlled trials (RCTs). This methodological landscape suggests a moderate to high risk of selection and reporting bias across much of the evidence base, with RCTs providing higher certainty for specific interventions.

4) Results

4.1 Study characteristics:

The compiled evidence base is composed of diverse study designs, including retrospective and prospective cohort studies, case-control analyses, mixed methodological approaches, and randomized controlled trials (RCTs). Investigated populations encompass patients experiencing acute stroke, individuals diagnosed with spontaneous cervical artery dissection (CeAD), those with traumatic carotid artery dissection, and specific demographic cohorts such as women of childbearing age or residents of defined geographical areas. Anatomical studies utilizing cadaveric dissections also contribute to the understanding of carotid morphology. Follow-up durations reported in these studies vary, ranging from acute assessments without specified follow-up to periods of 90 days, 3 months, 1 year, and extended observations spanning up to 19 years.

4.2 Main numerical result aligned to the query:

For acute ischemic stroke patients with carotid dissection and tandem occlusion undergoing endovascular interventions, successful reperfusion (mTICI 2b–3) rates ranged from 62% to 100% [3, 98], with a median of 81% across studies reporting this metric [1, 3, 97, 98]. Emergency carotid artery stenting (CAS) in this context showed a successful reperfusion rate of 77.9% (95% CI, 71.0%–85.0%) compared to 67.6% without CAS (adjusted Odds Ratio [aOR], 2.24 [95% CI, 1.33–3.77]) [1]. However, CAS did not demonstrate a significant difference in favorable outcome (90-day modified Rankin Scale [mRS] 0–2), which was 54.3% with CAS versus 61.4% without (aOR, 0.84 [95% CI, 0.58–1.22]) [1].

4.3 Topic synthesis:

- **Incidence and Epidemiology:** The incidence rate of spontaneous cervical artery dissection (CeAD) increased nearly 4-fold over a 19-year period (2002-2020), rising from 2.30 to 8.93 per 100,000 person-years, with a more substantial rise in women (from 0.81 to 10.17 per 100,000 person-years), attributed to increased noninvasive imaging [4]. Pregnancy, particularly the postpartum period, is associated with an increased risk of hospitalization for CeAD (Odds Ratio 2.5 [95% CI, 1.3-4.7]) [25, 110].
- **Risk Factors and Etiology:** Anatomical variations such as any carotid tortuosity (53% vs 34%, P=0.02), loops (22% vs 8%, P=0.03), and a retrojugular course (23% vs 9%, P=0.0009) of the internal carotid artery are significantly more frequent in patients with spontaneous carotid artery dissection [2]. The proximity or length of the styloid and hyoid bone is identified as a risk factor for cervical carotid artery dissection [19, 22, 91, 93]. Fibromuscular dysplasia (FMD) is a nonatherosclerotic disease linked to arterial dissection, and a genetic susceptibility locus, PHACTR1, is associated with CeAD [90, 94, 108].
- **Clinical Presentation:** Carotid dissection commonly presents with acute stroke or transient ischemic attack (TIA) [8, 20, 84]. Other symptoms include headache and neck pain, with frontal and parietal pain associated with internal carotid artery dissection (ICAD), while occipital and nuchal pain are linked to vertebral artery dissection (VAD) [39, 77, 83]. Horner syndrome is a clinically important manifestation, particularly in internal carotid and vertebral artery dissection, and can be an isolated symptom [9, 16]. Clinically silent circulating microemboli are observed in patients with carotid or vertebral artery dissection [31, 47, 53].
- **Diagnosis and Imaging:** Noninvasive imaging modalities are crucial, including color duplex ultrasound [10, 33, 55, 79], high-resolution magnetic resonance (MR) imaging for intramural hematoma and periarterial edema [7, 41, 45, 59, 81], and helical computed tomography (CT)/CT angiography (CTA) for differentiating pseudo-occlusion and visualizing dissection features [44, 92, 102]. Dynamic CT appears to be a reliable diagnostic tool in pediatric cases [84]. Flow artifacts, however, can mimic dissection or vascular occlusion in 14% of patients imaged with 64-section CT scanners [104].
- **Acute Stroke Management:** Endovascular treatment of internal carotid dissection-related tandem occlusion stroke, employing a distal-to-proximal recanalization strategy, appears feasible with successful recanalization (Thrombolysis in Cerebral Infarction [TICI] 2b/3) in 62% of cases and favorable clinical outcomes in 67.65% after 3 months [3]. Emergency carotid artery stenting (CAS) for carotid dissection in acute stroke with tandem occlusion leads to higher rates of successful reperfusion (77.9% vs 67.6% without CAS) but no significant difference in favorable outcome, symptomatic intracerebral hemorrhage (sICH), or mortality [1]. Direct carotid puncture (DCP) for mechanical thrombectomy in acute ischemic stroke with large-vessel occlusion (AIS-LVO) and prohibitive vascular access was successful in 84% of cases and associated with improved functional outcomes, though complications included non-flow-limiting common carotid artery (CCA) dissections [96, 97].

Endovascular thrombectomy overall can lead to vascular complications, including dissection in 10 patients [100].

- **Antithrombotic Therapy:** A randomized clinical trial found that antiplatelet therapy was not more effective than anticoagulation therapy in preventing stroke in cervical dissection, with a low risk of recurrent stroke (2.4% at 1 year) [18, 27, 29]. Anticoagulation, often with heparin, was received by 75% of patients in one retrospective analysis [32, 60, 65].
- **Pathophysiology and Arterial Wall Properties:** Patients with spontaneous cervical artery dissection exhibit increased stiffness of the carotid wall material and impaired spontaneous and endothelial-independent vasodilation [15, 54, 56]. Histopathological characterization of extracranial carotid artery aneurysms reveals dissection as a distinct category [99].
- **Outcomes and Prognosis:** Spontaneous dissection of internal carotid arteries can demonstrate spontaneous resolution, as documented by serial ocular pneumoplethysmography and angiography [63, 68]. Vascular healing in carotid and vertebral artery dissections can be visualized using magnetic resonance angiography [81]. The long-term outcome of occlusive cervical carotid dissection has been a subject of study [5]. Occlusion due to carotid artery dissection is considered a more severe disease than previously suggested [52].

5) Discussion

5.1 Principal finding:

For acute ischemic stroke patients with carotid dissection undergoing endovascular interventions, successful reperfusion rates (mTICI 2b–3) ranged from 62% to 100% [3, 98], with a median of 81% across studies reporting this metric [1, 3, 97, 98], indicating high technical success in restoring blood flow.

5.2 Clinical implications:

- **Early Imaging for Diagnosis:** Given the increasing incidence of spontaneous CeAD, particularly in women, and its strong association with acute stroke, prompt and comprehensive noninvasive vascular imaging (CTA, MRA, ultrasound) is crucial for timely diagnosis and intervention [4, 10, 41, 92].
- **Anatomical Risk Factor Screening:** Clinicians should maintain a heightened suspicion for dissection in patients presenting with headache, neck pain, or Horner syndrome, especially when anatomical predispositions such as carotid tortuosity, loops, retrojugular course, or elongated styloid processes are present [2, 19, 91].

- **Acute Stroke Intervention Options:** For acute ischemic stroke with tandem occlusions related to carotid dissection, endovascular thrombectomy, with or without emergency stenting, represents a viable and effective strategy, achieving high reperfusion rates [1, 3, 97, 98]. Direct carotid puncture offers a valuable alternative access route when conventional femoral access is challenging [96, 97].
- **Antithrombotic Strategy:** Antiplatelet therapy appears to be as effective as anticoagulation in preventing recurrent stroke in cervical dissection, suggesting that the choice of therapy can be individualized based on bleeding risk and other patient-specific factors [18].
- **Pregnancy-Associated Risk:** Healthcare providers should be cognizant of the increased risk of cervical artery dissection during pregnancy and the postpartum period, particularly when evaluating women presenting with cerebrovascular symptoms [25, 110].

5.3 Research implications / key gaps:

- **Optimal Stenting Strategy:** Further randomized studies are needed to compare the long-term efficacy and safety of emergency carotid artery stenting versus conservative management or other endovascular approaches for acute stroke due to carotid dissection, particularly regarding functional outcomes and late complications [1, 40].
- **Genetic and Pathophysiological Mechanisms:** Research into the specific genetic predispositions (e.g., PHACTR1 variants) and arterial wall properties (e.g., stiffness, impaired vasodilation) contributing to spontaneous dissection could lead to improved risk stratification and targeted therapies [15, 56, 108].
- **Diagnostic Biomarkers:** Development and validation of novel biomarkers for early detection of carotid dissection, potentially complementing imaging findings, could reduce diagnostic delays and improve outcomes [74].
- **Long-Term Functional Outcomes:** More comprehensive, prospective studies are needed to evaluate the long-term neurological and functional outcomes of patients with carotid dissection, considering different treatment modalities and patient subgroups [5, 68].
- **Pediatric Dissection Management:** Given that carotid dissection is a recognized cause of stroke in pediatric populations, specific guidelines and evidence for diagnosis and management tailored to children are urgently needed [84, 109].

5.4 Limitations:

- **Retrospective Study Design** — Many studies are retrospective, which introduces inherent biases such as selection bias and incomplete data collection, potentially affecting the generalizability of findings.
- **Heterogeneity in Interventions** — The variety of endovascular techniques (stenting, thrombectomy, direct puncture) and antithrombotic regimens across studies makes direct comparison and synthesis challenging.
- **Variable Follow-up Periods** — Differing follow-up durations limit the ability to draw consistent conclusions about long-term outcomes, recurrence rates, and sustained treatment effects.
- **Small Sample Sizes** — Several studies, particularly those on specific interventions or rare presentations, involve small patient cohorts, reducing statistical power and the robustness of their conclusions.
- **Diagnostic Modality Evolution** — The increasing use and sophistication of noninvasive imaging over time may inflate reported incidence rates and affect comparisons of diagnostic accuracy across different eras.

5.5 Future directions:

- **Prospective Registry Development** — Establish a large, international prospective registry to standardize data collection on carotid dissection, including risk factors, clinical presentation, treatment, and long-term outcomes.
- **Comparative Effectiveness Research** — Conduct multicenter randomized controlled trials comparing different acute interventions (e.g., stenting vs. no stenting in tandem occlusions) and long-term medical management strategies.
- **Advanced Imaging Biomarkers** — Investigate the utility of advanced imaging techniques, such as high-resolution vessel wall MRI, for predicting dissection healing, recurrence, and response to therapy.
- **Genetic Risk Factor Validation** — Validate identified genetic susceptibility loci (e.g., PHACTR1) in diverse populations and explore their interaction with environmental and anatomical risk factors.
- **Patient-Reported Outcomes** — Incorporate patient-reported outcome measures (PROMs) to better understand the impact of carotid dissection and its treatments on quality of life and functional independence.

6) Conclusion

For acute ischemic stroke patients with carotid dissection and tandem occlusion undergoing endovascular interventions, successful reperfusion (mTICI 2b–3) rates ranged from 62% to 100% [3, 98], with a median of 81% across studies reporting this metric [1, 3, 97, 98]. This indicates high technical success in restoring blood flow in a complex patient population, though favorable functional outcomes are not always significantly improved with stenting. The generalizability of these findings is somewhat limited by the predominantly retrospective nature and heterogeneity of the existing studies. The most significant limitation affecting certainty is the lack of large-scale, prospective, randomized controlled trials comparing different treatment approaches and their long-term impact. Therefore, clinicians should prioritize early and accurate diagnosis using advanced imaging and consider endovascular options for acute stroke, while ongoing research is needed to refine optimal long-term management strategies.

References

SAIMSARA Session Index — session.json

Figure 1. Publication-year distribution of included originals

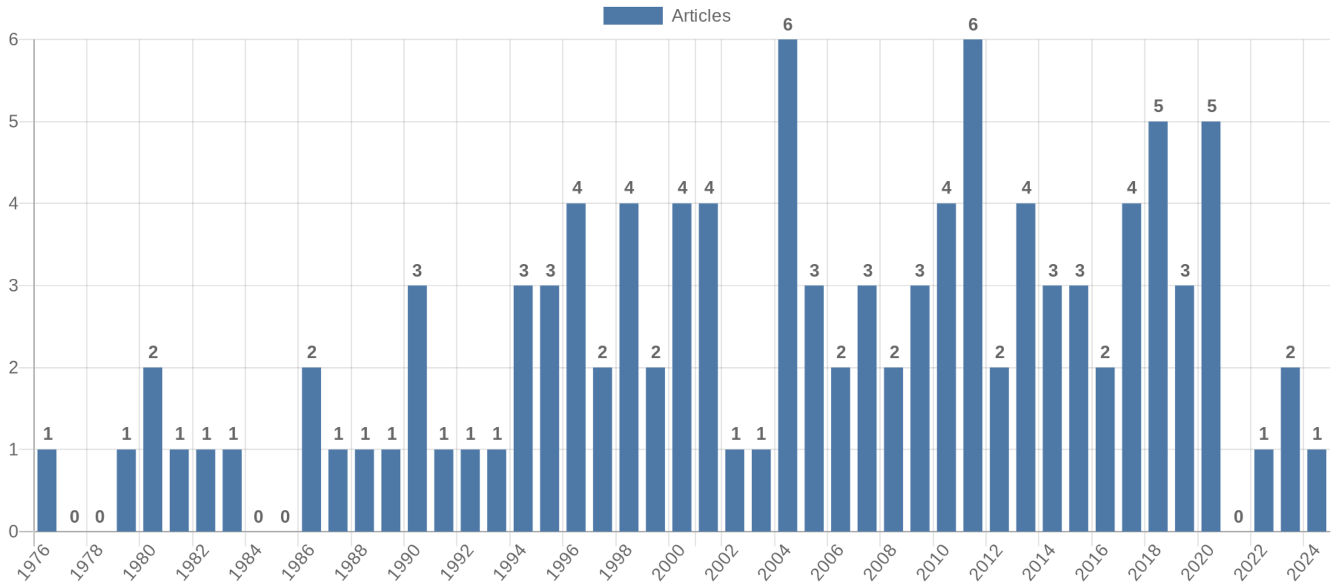


Figure 2. Study-design distribution of included originals

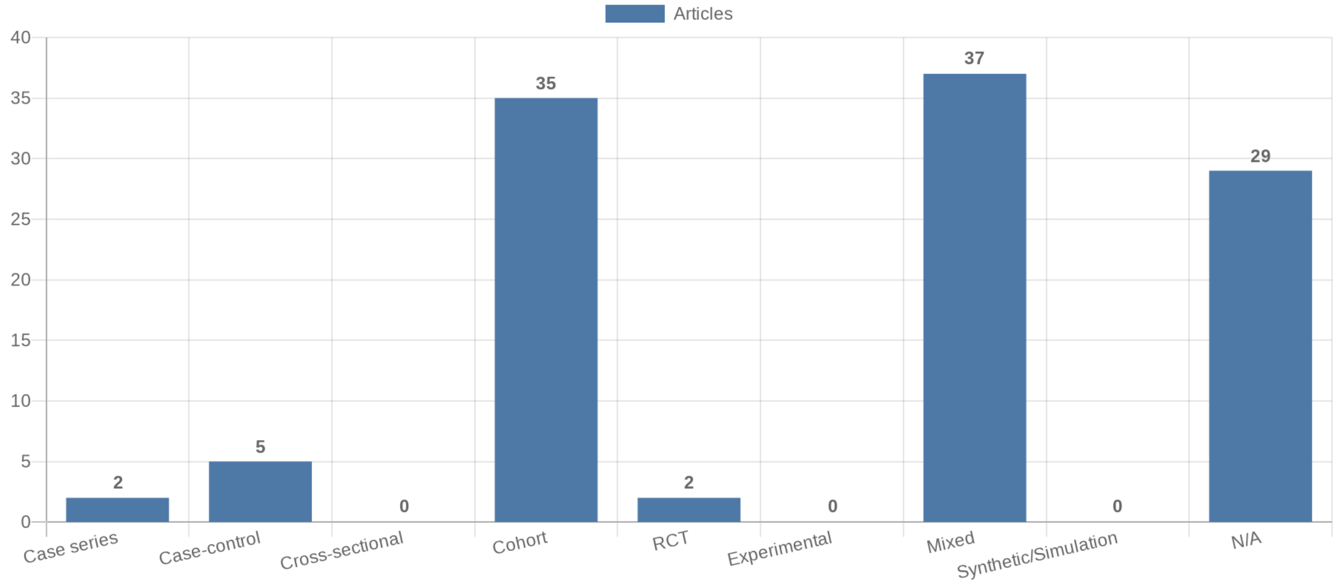


Figure 3. Study-type (directionality) distribution of included originals

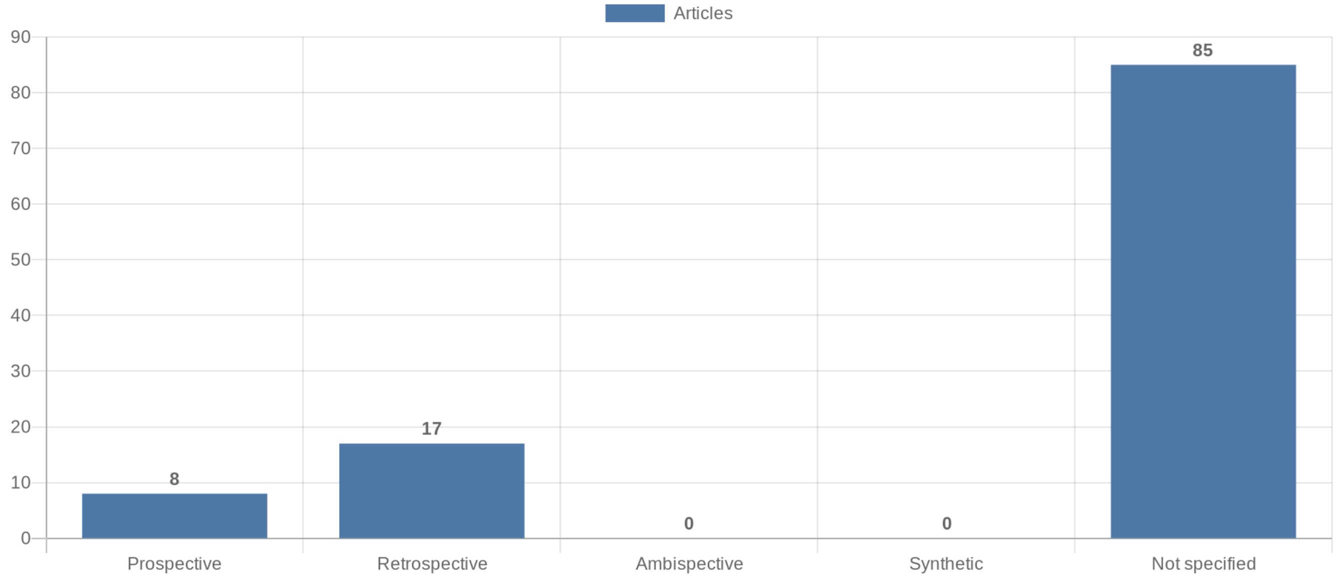


Figure 4. Main extracted research topics

- STUDY CHARACTERISTICS
- MAIN NUMERICAL RESULT ALIGNED TO THE QUERY
- INCIDENCE AND EPIDEMIOLOGY
- RISK FACTORS AND ETIOLOGY
- CLINICAL PRESENTATION
- DIAGNOSIS AND IMAGING
- ACUTE STROKE MANAGEMENT

Figure 5. Limitations of current studies (topics)

- RETROSPECTIVE STUDY DESIGN
- HETEROGENEITY IN INTERVENTIONS
- VARIABLE FOLLOW-UP PERIODS
- SMALL SAMPLE SIZES
- DIAGNOSTIC MODALITY EVOLUTION

Figure 6. Future research directions (topics)

- OPTIMAL STENTING STRATEGY
- GENETIC AND PATHOPHYSIOLOGICAL MECHANISMS
- DIAGNOSTIC BIOMARKERS
- LONG-TERM FUNCTIONAL OUTCOMES
- PEDIATRIC DISSECTION MANAGEMENT
- PROSPECTIVE REGISTRY DEVELOPMENT
- COMPARATIVE EFFECTIVENESS RESEARCH