PAD TASC Classification: Systematic Review with ☸SAIMSARA.

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Abstract: This paper aims to systematically review the current literature on the application and implications of the TASC classification in peripheral artery disease, synthesizing findings related to its role in predicting disease complexity, guiding interventions, and correlating with patient outcomes and associated biomarkers. The review utilises 156 studies with 58532 total participants (naïve ΣN). For femoropopliteal lesions classified as TASC C or D, endovascular interventions achieve a median 1-year primary patency rate of 78.0% (range: 57.33%–85.6%). The TASC classification remains a cornerstone for assessing peripheral artery disease severity, guiding treatment decisions, and predicting outcomes across various anatomical segments and patient populations. However, the reliance on retrospective study designs and the inherent heterogeneity in outcome reporting represent the most significant limitations to drawing definitive conclusions. A concrete next study should involve large-scale prospective comparative trials to definitively assess long-term outcomes of endovascular versus surgical approaches for complex TASC C/D lesions.

Keywords: Peripheral Artery Disease; TASC classification; TASC II classification; Endovascular treatment; PAD severity

Review Stats

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- Scope: All fields
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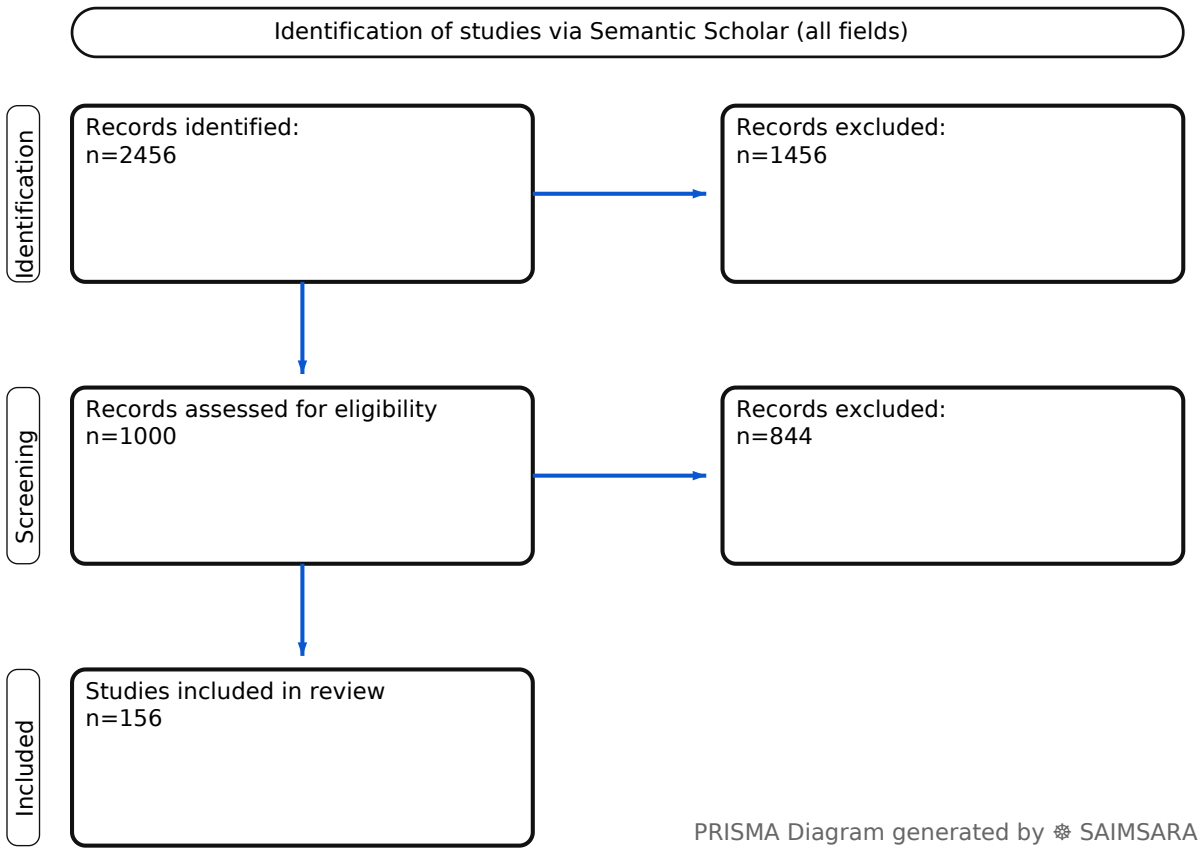
- Downloaded Abstracts/Papers: 1000
- Included original Abstracts/Papers: 156
- Total study participants (naïve ΣN): 58532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Records excluded:
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Screening
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Records excluded:
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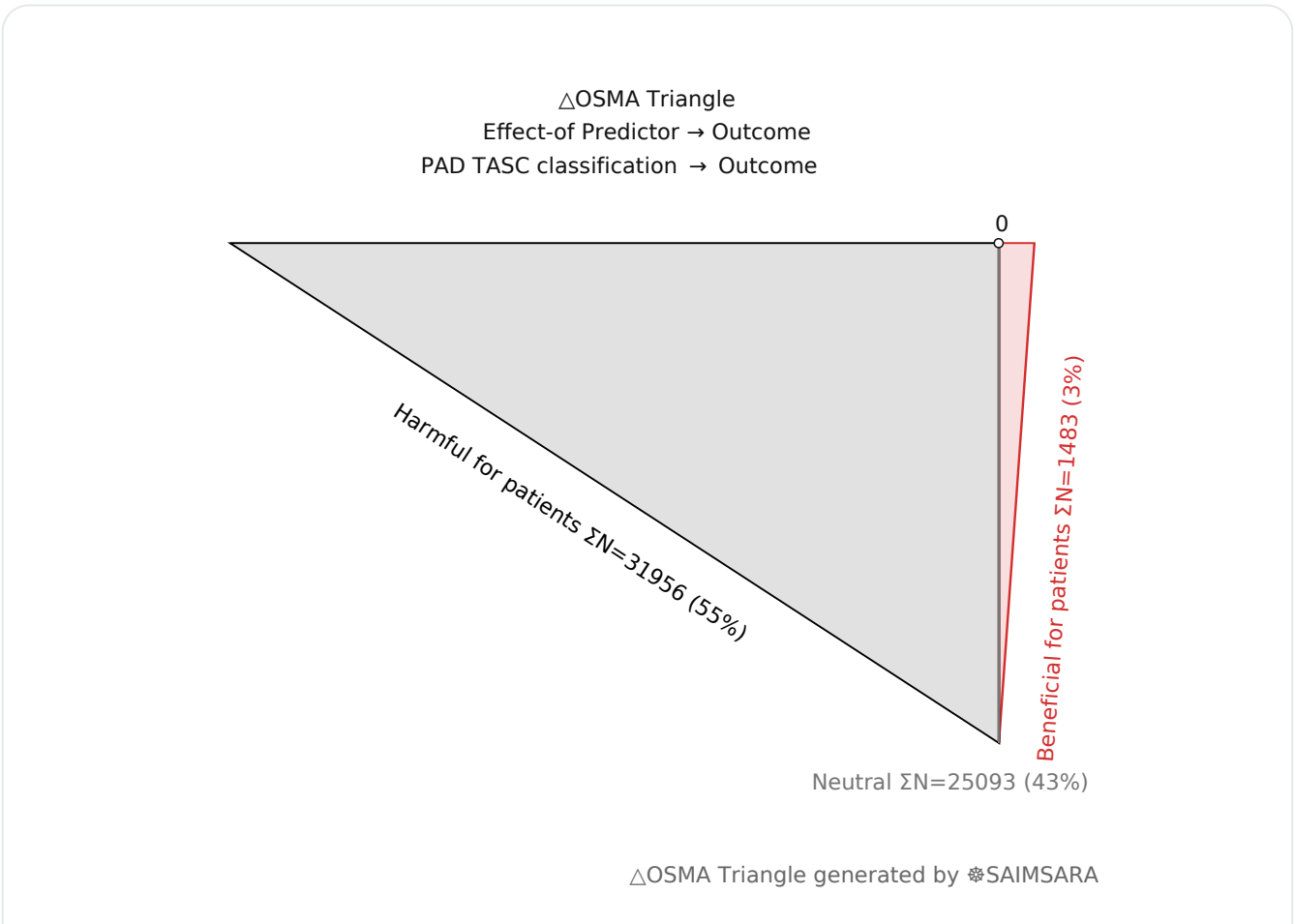
Included
Studies included in review
n=156
PRISMA Diagram generated by ☸ SAIMSARA


△OSMA Triangle
Effect-of Predictor → Outcome
PAD TASC classification → Outcome
0
Harmful for patients ΣN=31956 (55%)
Beneficial for patients ΣN=1483 (3%)
Neutral ΣN=25093 (43%)
△OSMA Triangle generated by ☸SAIMSARA

Outcome-Sentiment Meta-Analysis (OSMA): *(LLM-only)*
Frame: Effect-of Predictor → Outcome • *Source*: Semantic Scholar
Outcome: Outcome Typical timepoints: 2-y, 12-mo. Reported metrics: %, CI, p.
Common endpoints: Common endpoints: patency, complications, survival.
Predictor: PAD TASC classification — exposure/predictor. Routes seen: iv. Typical comparator: iliac stenting alone, direct surgical bypass, other antibody deficiencies, ba alone. the tasc ii….

- **1) Beneficial for patients** — Outcome with PAD TASC classification — [2], [3], [5], [13], [20], [22], [28], [45], [49], [50], [58], [59], [60], [66], [67], [151], [153] — ΣN=1483
- **2) Harmful for patients** — Outcome with PAD TASC classification — [4], [7], [11], [12], [14], [21], [23], [39], [46], [47], [48], [52], [73], [74], [75], [86], [100], [101], [102], [103], [105], [110], [111], [121], [122], [154], [156] — ΣN=31956
- **3) No clear effect** — Outcome with PAD TASC classification — [1], [6], [8], [9], [10], [15], [16], [17], [18], [19], [24], [25], [26], [27], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [40], [41], [42], [43], [44], [51], [53], [54], [55], [56], [57], [61], [62], [63], [64], [65], [68], [69], [70], [71], [72], [76], [77], [78], [79], [80], [81], [82], [83], [84], [85], [87], [88], [89], [90], [91], [92], [93], [94], [95], [96], [97], [98], [99], [104], [106], [107], [108], [109], [112], [113], [114], [115], [116], [117], [118], [119], [120], [123], [124], [125], [126], [127], [128], [129], [130], [131], [132], [133], [134], [135], [136], [137], [138], [139], [140], [141], [142], [143], [144], [145], [146], [147], [148], [149], [150], [152], [155] — ΣN=25093

1) Introduction

Peripheral artery disease (PAD) represents a significant global health burden, characterized by stenotic or occlusive lesions in the arteries supplying the limbs. Accurate classification of PAD severity and anatomical complexity is crucial for guiding treatment strategies and predicting outcomes. The Trans-Atlantic Inter-Society Consensus (TASC) classification, particularly TASC II, has emerged as a widely adopted system for categorizing peripheral arterial lesions, ranging from simple (TASC A/B) to complex (TASC C/D). This classification system informs decisions regarding endovascular versus surgical revascularization and is increasingly integrated with prognostic biomarkers and advanced diagnostic technologies. Understanding the multifaceted role of TASC classification in PAD, from risk stratification to therapeutic planning and outcome prediction, is essential for optimizing patient care.

2) Aim

This paper aims to systematically review the current literature on the application and implications of the TASC classification in peripheral artery disease, synthesizing findings related to its role in predicting disease complexity, guiding interventions, and correlating with patient outcomes and associated biomarkers.

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 majority of studies are retrospective cohort or mixed designs, introducing potential for selection bias and confounding. Cross-sectional designs preclude causal inference, while studies with unspecified designs or directionality further limit the ability to assess bias systematically. Several studies lack explicit follow-up periods, impacting the generalizability of long-term outcomes.

4) Results

4.1 Study characteristics

The included studies predominantly employed mixed, retrospective cohort, or cross-sectional designs, with a smaller number of prospective cohorts and randomized controlled trials (RCTs). Populations consistently focused on peripheral artery disease (PAD) patients, often stratified by TASC II classification, examining lesions in aorto-iliac, femoro-popliteal, and infrapopliteal regions. Follow-up periods varied widely, ranging from short-term (30 days) to mid-term (6 months, 1 year, 2 years), and long-term (3 years, 5 years, 10 years), with many studies not specifying a follow-up duration.

4.2 Main numerical result aligned to the query

For femoropopliteal lesions classified as TASC C or D, the 1-year primary patency rate following endovascular interventions showed a median of 78.0% (range: 57.33%–85.6%) [5, 45, 58, 110, 112]. Technical success rates for endovascular procedures were generally high across lesion types, with specific reports of 97.7% for TASC II A and B iliac artery occlusions [2], 98.67% for complex femoropopliteal diseases [5], and 87% for infra-popliteal TASC C and D lesions [22]. However, technical success could be lower for TASC D lesions compared to TASC A lesions (65.0% vs. 95.8%) [121], and TASC D lesions were associated with higher perioperative complication rates compared to TASC C lesions (10% vs. 0%, p=0.011) [20].

4.3 Topic synthesis

- **Predictors of PAD Complexity and Severity:** Non-O blood group [1], C-reactive protein (CRP) and Growth Differentiation Factor 15 (GDF-15) [4], LDL/HDL ratio [6], modified Glasgow Prognostic Score (mGPS) [7], SYNTAX score for coronary artery disease (CAD) [8, 133], Triglyceride-glucose (TyG) index [10], Lipoprotein(a) (Lp(a)) levels [11, 14], Neutrophil-to-lymphocyte (N/L) ratio [12], and constitutional parameters (weight, BMI, abdominal circumference, costoiliac distance, epigastric angle) [23] are independently associated with higher TASC II classification, indicating more complex PAD.
- **Endovascular Treatment Efficacy for TASC A/B Lesions:** Balloon angioplasty and stent placement are effective and safe for TASC II A and B iliac artery occlusions, demonstrating favorable short and mid-term outcomes with a 97.7% immediate technical success rate [2].
- **Endovascular Treatment Efficacy for TASC C/D Lesions:** Endovascular revascularization, including rotational atherothrombectomy [5], Supera stent implantation [58, 66], excimer laser-assisted balloon angioplasty [77], rotational atherectomy with drug-coated balloons (DCB) [78], and covered stents [141], is a safe and effective option for TASC II C and D lesions across aorto-iliac, femoropopliteal, and infra-popliteal segments, with 1-year primary patency rates ranging from 57.33% to 85.6% [5, 45, 58, 110, 112].
- **Comparison of Endovascular vs. Surgical Approaches for TASC C/D Lesions:** For TASC C and D femoropopliteal lesions, bypass surgery showed better 3-year primary and secondary patency rates compared to endovascular interventions [28]. However, for TASC II C and D aortoiliac occlusive disease, kissing stents were associated with significantly shorter hospital stay and operation time compared to direct surgical bypass, with comparable or superior patency rates [59]. Combined iliofemoral endarterectomy and stenting (IFE + S) improved mid-term primary stent patency compared to iliac stenting alone (ISA) in TASC C or D aortoiliac occlusive disease (AIOD) with concomitant common femoral artery disease [50].
- **TASC Classification in Systemic Conditions and Outcomes:** Higher TASC II classification is associated with increased severity of coronary artery disease (CAD) [8, 24, 61, 133]. TASC II C/D aorto-iliac lesions are independent risk factors for mortality in kidney transplant recipients [21, 74, 105] and are associated with an increased risk of contrast-induced acute kidney injury (CI-AKI) in PAD patients undergoing peripheral vascular interventions (PVI) [52]. TASC C/D lesions also adversely affect wound healing in diabetic foot ulcer (DFU) patients [101] and are linked to higher iliac calcium scores [104].
- **Biomarkers and TASC Severity:** Endothelial progenitor cells (EPCs) and pentraxin-3 levels were increased in TASC II type A/B lesions compared to C/D, decreasing in advanced phases of PAD [13]. The C-reactive protein to albumin ratio [89], TG/HDL-C ratio [82], and the HALP score [47, 48] are independent predictors of PAD complexity and severity as assessed by TASC II. Elastin degradation, measured by desmosines, was associated with PAD in Pseudoxanthoma elasticum (PXE) patients, independent of arterial calcification [95].

- **Imaging and AI in PAD and TASC Assessment:** Preoperative magnetic resonance angiography (MRA) can reliably determine infrapopliteal lesions using TASC II criteria, though interobserver variability affects the overall TASC II grade [19, 93]. Automated deep learning models for detecting arteries and classifying stenosis severity in PAD CTA scans achieved high accuracy (98.79%) [25]. Machine learning algorithms using Doppler arterial spectral waveforms [35], vision transformers [40], and AutoML models for GLASS grades [26] show promise in PAD diagnosis and anatomical pattern classification.

5) Discussion

5.1 Principal finding

The central finding reveals that for femoropopliteal lesions classified as TASC C or D, endovascular interventions achieve a median 1-year primary patency rate of 78.0% (range: 57.33%–85.6%) [5, 45, 58, 110, 112]. This highlights the variable but generally acceptable efficacy of endovascular approaches for complex lesions, despite TASC II D lesions being associated with lower technical success and higher complication rates in some contexts [20, 121].

5.2 Clinical implications

- **Risk Stratification:** The TASC II classification, combined with various biomarkers (e.g., non-O blood group, LDL/HDL ratio, mGPS, HALP score), provides a robust framework for identifying patients at higher risk of complex PAD and adverse outcomes [1, 6, 7, 47, 48].
- **Treatment Guidance:** While TASC II guidelines traditionally recommend surgical approaches for TASC C and D lesions, current evidence supports the safety and effectiveness of endovascular interventions for many complex lesions, particularly in femoropopliteal and aortoiliac segments, often with favorable patency and limb salvage rates [3, 22, 49, 58, 59, 66].
- **Prognostic Indicators:** TASC II C/D lesions are critical independent risk factors for mortality in kidney transplant recipients [21, 74, 105] and are associated with increased risk of contrast-induced acute kidney injury (CI-AKI) in PAD patients undergoing PVI [52], necessitating careful patient selection and monitoring.
- **Diagnostic Enhancement:** Advanced imaging techniques like MRA and CTA, increasingly augmented by AI-driven models, can reliably assess lesion severity according to TASC II criteria, potentially improving diagnostic accuracy and workflow efficiency [19, 25, 40].
- **Personalized Management:** Constitutional parameters [23] and specific biomarkers [89, 90] correlate with TASC II severity, suggesting avenues for more personalized risk assessment and treatment planning.

5.3 Research implications / key gaps

- **Long-term Comparative Outcomes:** Further prospective studies comparing long-term (e.g., >5 years) primary and secondary patency, limb salvage, and mortality rates between endovascular and open surgical revascularization for specific TASC C/D lesion subsets are needed [28, 120].
- **AI-Driven TASC Assessment Validation:** Large-scale, multicenter prospective studies are required to validate the accuracy, reproducibility, and clinical utility of AI models for automated TASC classification from CTA or MRA scans, particularly concerning interobserver variability [19, 25, 93].
- **Biomarker Integration into Clinical Pathways:** Research is needed to develop and validate integrated clinical algorithms that combine TASC classification with novel biomarkers (e.g., HALP score, TG/HDL-C ratio) to refine risk prediction and guide personalized treatment decisions [47, 82, 89].
- **Impact of TASC on Specific Comorbidities:** Dedicated studies are warranted to explore the precise impact of TASC II classification on outcomes in specific high-risk populations, such as diabetic patients with critical limb ischemia (CLI) and those with concomitant coronary artery disease (CAD) [61, 101, 134].
- **Standardization of Reporting:** Future studies should standardize the reporting of TASC classification, particularly for infrapopliteal lesions, to improve comparability and facilitate meta-analyses, addressing issues of interobserver agreement for overall TASC II grade [93].

5.4 Limitations

- **Retrospective Study Designs** — Many studies were retrospective, introducing potential for selection bias and limiting the ability to establish causality or control for all confounding factors.
- **Heterogeneity of Outcomes** — Variability in reported metrics (e.g., different patency definitions, diverse follow-up durations) for comparable TASC lesion types made direct quantitative synthesis challenging.
- **Lack of Randomized Controlled Trials** — The scarcity of RCTs limits the highest level of evidence for comparing different treatment modalities across TASC classifications, particularly for complex lesions.
- **Interobserver Variability in TASC Assessment** — Some studies highlighted poor interobserver agreement for the overall TASC II grade, especially for infrapopliteal lesions, which can affect the reliability of classification and generalizability of findings [19, 93].
- **Limited Generalizability to Diverse Populations** — While some studies included specific cohorts (e.g., Peruvian, Japanese, kidney transplant recipients), comprehensive data across

a wider range of global populations for all TASC classifications were not consistently available.

5.5 Future directions

- **Prospective Comparative Trials** — Conduct large-scale prospective randomized trials comparing endovascular and surgical strategies for TASC C/D lesions.
- **AI-Powered TASC Automation** — Develop and validate AI models for automated, real-time TASC classification from angiographic images to improve consistency.
- **Integrated Risk Prediction Models** — Create and validate comprehensive prognostic models combining TASC with clinical, biochemical, and imaging markers.
- **Standardized Outcome Reporting** — Establish universal guidelines for reporting PAD outcomes, including specific TASC categories and follow-up durations.
- **TASC in Underserved Cohorts** — Investigate the utility and impact of TASC classification in underrepresented populations and those with specific comorbidities.

6) Conclusion

For femoropopliteal lesions classified as TASC C or D, endovascular interventions achieve a median 1-year primary patency rate of 78.0% (range: 57.33%–85.6%) [5, 45, 58, 110, 112]. The TASC classification remains a cornerstone for assessing peripheral artery disease severity, guiding treatment decisions, and predicting outcomes across various anatomical segments and patient populations. However, the reliance on retrospective study designs and the inherent heterogeneity in outcome reporting represent the most significant limitations to drawing definitive conclusions. A concrete next study should involve large-scale prospective comparative trials to definitively assess long-term outcomes of endovascular versus surgical approaches for complex TASC C/D lesions.

References

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Figure 1. Publication-year distribution of included originals

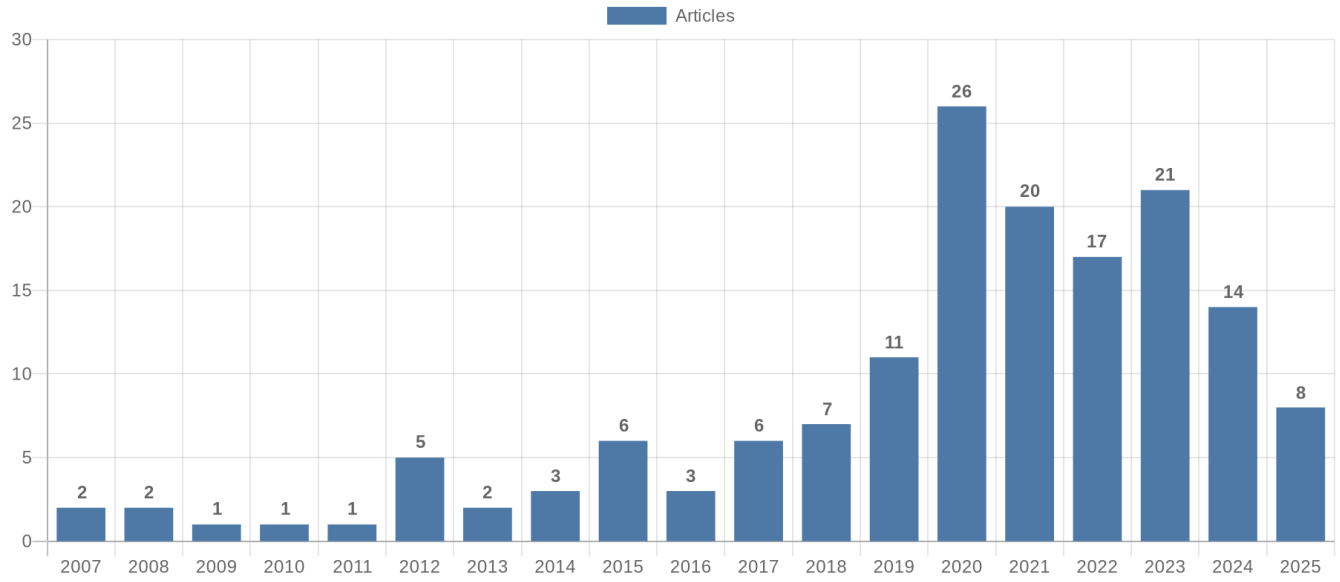

Figure 2. Study-design distribution of included originals

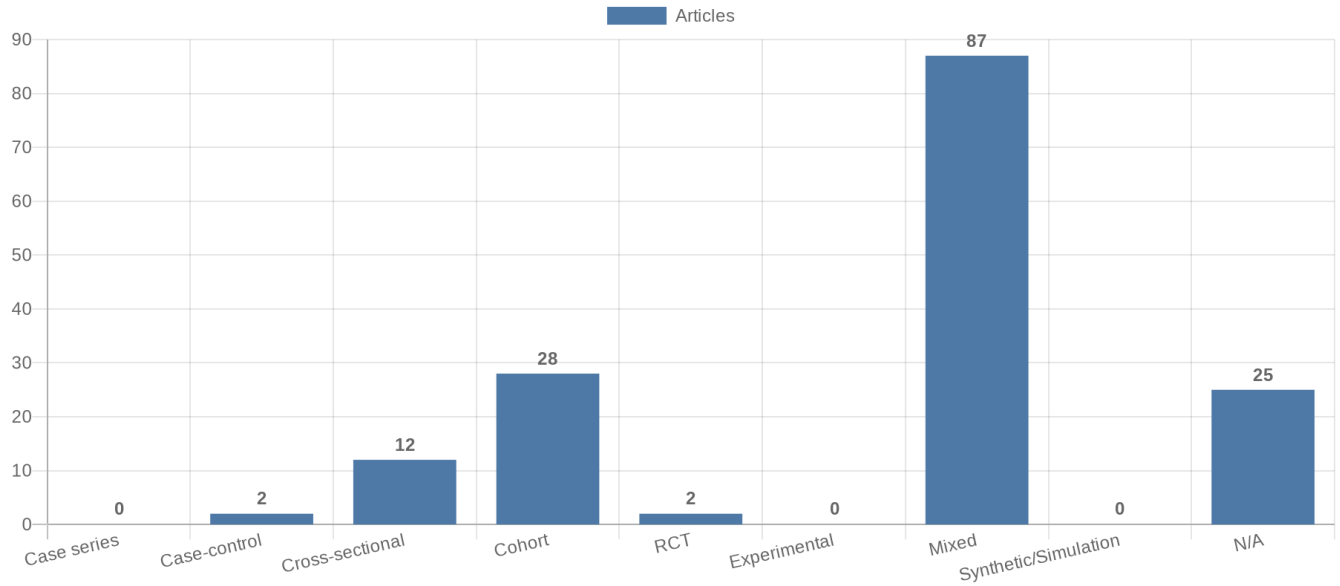

Figure 3. Study-type (directionality) distribution of included originals

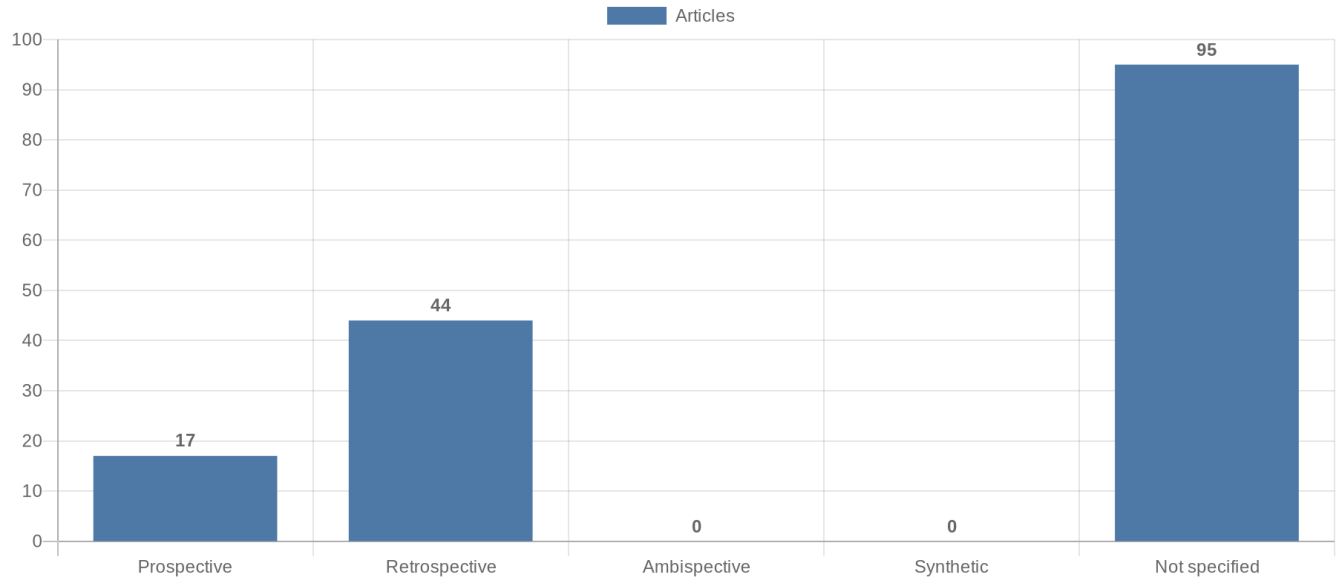

Figure 4. Main extracted research topics

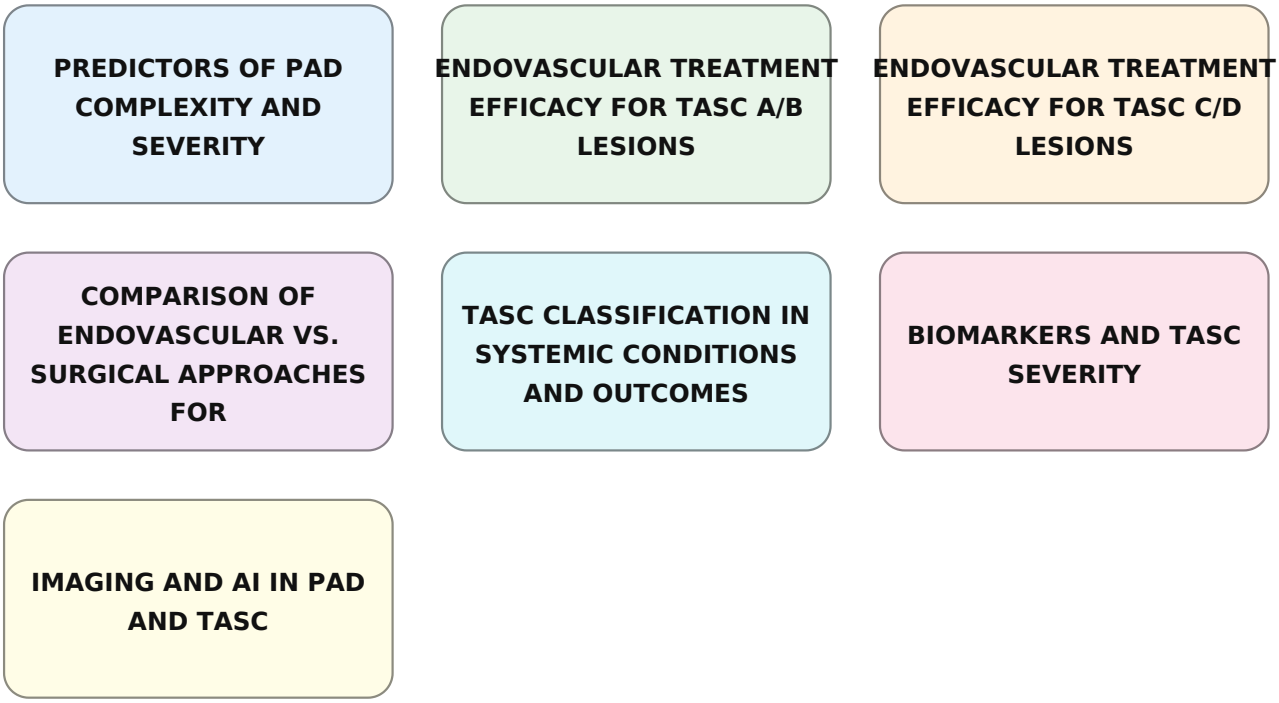

Figure 5. Limitations of current studies (topics)

Figure 6. Future research directions (topics)

LONG-TERM COMPARATIVE OUTCOMES

AI-DRIVEN TASC ASSESSMENT VALIDATION

BIOMARKER INTEGRATION INTO CLINICAL PATHWAYS

IMPACT OF TASC ON SPECIFIC COMORBIDITIES

STANDARDIZATION OF REPORTING

PROSPECTIVE COMPARATIVE TRIALS

AI-POWERED TASC AUTOMATION