TJVS Turkish Journal of Vascular Surgery

Turk J Vasc Surg 2026;35(3):302-5
DOI: 10.9739/tjvs.2026.02.07

Available online at www.turkishjournalofvascularsurgery.org

Editorial

Artificial intelligence in vascular surgery: From decision support to decision control?

Nevzat Erdil[1], Burcu Tosun[2], Ufuk Demirkilic[3]

[1]Antalya City Hospital, Department of Cardiovascular Surgery, Antalya, Türkiye
[2]Atılım University, Faculty of Business, Department of Business Administration, Ankara, Türkiye
[3]Acıbadem Ankara Hospital, Department of Cardiovascular Surgery, Ankara, Türkiye

Received: October 18, 2026 Accepted: November 14, 2026 Published online: November 17, 2026

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Clinical Judgment in the Age of Artificial Intelligence

Consider the following hypothetical clinical scenario: A patient with chronic limb-threatening ischemia, tissue loss, severe infrapopliteal disease, and an adequate great saphenous vein is evaluated for revascularization. An artificial intelligence (AI) system recommends an endovascular-first strategy based on imaging findings and predicted procedural risk. The vascular surgeon favors bypass, considering conduit quality, anticipated durability, wound severity, life expectancy, and the consequences of treatment failure. How should this disagreement be resolved?

The BEST-CLI trial demonstrated superior outcomes with surgical bypass in cohort 1, which included patients with an adequate single-segment great saphenous vein who were suitable candidates for both surgical and endovascular revascularization, using a composite endpoint of major adverse limb events or death [1]. In contrast, BASIL-2 favored an endovascular-first strategy in patients requiring infrapopliteal revascularization, with the difference in amputation-free survival largely attributable to mortality [2]. These findings underscore the importance of patient selection, anatomical characteristics, conduit availability, and outcome definitions. The Global Vascular Guidelines similarly emphasize patient risk, limb severity, and anatomical complexity in revascularization decisions [3]. The 2024 ACC/AHA multisociety guideline on lower-extremity peripheral artery disease further emphasizes individualized revascularization strategies based on clinical presentation, anatomical considerations, and shared decision-making [4].

An AI system optimized to predict short-term procedural complications may recommend a different treatment from a clinician prioritizing long-term limb preservation. Moreover, predicting outcomes after a particular intervention does not necessarily establish its benefit relative to alternative treatments. The central question, therefore, is when AI enhances clinical judgment and when its recommendations begin to determine decisions that should remain individualized, evidence-based, and aligned with patient preferences.

Beyond Algorithmic Accuracy: Evaluating Clinical Benefit

Vascular surgery offers considerable opportunities for AI integration. Computed tomography, duplex ultrasound, angiography, wound imaging, and longitudinal surveillance provide extensive data for anatomical assessment, risk prediction, and procedural planning. AI may improve measurement consistency, identify clinically relevant patterns, and facilitate the comparison of treatment options.

CITATION
Erdil N, Tosun B, Demirkilic U. Artificial intelligence in vascular surgery: From decision support to decision control?. Turk J Vasc Surg. 2026;35(3):302-5.

Corresponding Author: Nevzat Erdil, Antalya City Hospital, Department of Cardiovascular Surgery, Antalya, Türkiye
Email: editor.nevzaterdil@gmail.com

A bibliometric analysis published in this journal in 2024 documented the rapid expansion of AI-related vascular surgery research [5]. Scientific productivity, however, should not be equated with clinical maturity. A 2026 systematic review of 288 computer vision studies in vascular surgery reported that only 15% were at low risk of bias, with retrospective designs predominating and peripheral arterial disease remaining underrepresented [6]. Recent vascular surgery literature similarly emphasizes the need to translate promising computational performance into clinically meaningful applications [7].

This distinction becomes particularly important when evaluating human–AI collaboration. A systematic review and meta-analysis across multiple domains found that human–AI combinations improved performance relative to humans alone on average, but did not consistently outperform the better-performing partner [8]. Although these findings cannot be directly generalized to vascular surgery, they challenge the assumption that combining clinical expertise with an accurate algorithm necessarily produces superior decisions.

Clinical evaluation should therefore examine how AI changes surgeons' decisions, whether these changes improve patient outcomes, and whether benefits justify additional costs and potential harms. Relevant endpoints include limb preservation, stroke, rupture, reintervention, quality of life, and resource utilization. Decision time, inappropriate treatment changes, and the recognition of erroneous recommendations also warrant attention.

When Decision Support Becomes Decision Dependence?

Clinical decision-making is susceptible to cognitive biases, whether or not AI is involved. Surgeons may be influenced by previous experience, familiarity with particular procedures, or established treatment preferences. AI can help counter some of these tendencies, but it can also introduce new forms of bias.

Automation bias occurs when users accept automated recommendations without sufficient independent verification. This may result in errors of commission, such as following an incorrect treatment recommendation, or errors of omission, such as overlooking a clinically important finding that the system fails to identify [9]. In vascular practice, either error could have serious consequences.

The objective should be appropriately calibrated trust: reliance on AI that reflects its demonstrated capabilities, limitations, and the clinical context [10]. Both excessive reliance and unwarranted rejection of reliable recommendations can compromise decision quality.

Decision autonomy is equally important. We use this term to describe the clinician's capacity to critically assess AI-generated recommendations, consider alternatives, and exercise independent professional judgment. Decision support risks becoming decision control when clinicians retain formal responsibility but are increasingly unable or reluctant to challenge algorithmic recommendations.

Repeated reliance on AI may also have implications for professional competence. Cognitive deskilling involves the potential weakening of independent assessment and reasoning, whereas technical deskilling concerns the loss of procedural capabilities. An observational study in colonoscopy has raised concerns about reduced unaided detection performance following exposure to AI-assisted practice [11]. Whether comparable effects occur in vascular surgery remains an open empirical question.

Surgical training should therefore integrate AI literacy with opportunities for independent image interpretation, treatment planning, and the maintenance of both open and endovascular skills. Trainees should learn to recognize inappropriate recommendations, articulate their reasons for disagreement, and manage situations in which automated assistance is unavailable or unreliable.

Responsibilities of Surgeons, Institutions, and Vascular Journals

Responsible implementation requires coordinated efforts from clinicians, researchers, healthcare institutions, professional societies, and journals. Surgeons should understand the intended use and limitations of AI systems, while institutions should establish mechanisms for clinical oversight, performance monitoring, and the investigation of errors.

For vascular journals, the challenge is to distinguish technological innovation from demonstrated clinical value. TRIPOD+AI and DECIDE-AI provide complementary guidance for reporting prediction models and early clinical evaluation of AI-based decision support, respectively [12,13]. CONSORT-AI and SPIRIT-AI address clinical trials and their protocols [14,15], while FUTURE-AI provides a broader framework for trustworthy implementation [16].

Evaluation should be proportionate to the intended use and clinical consequences of each application. Data provenance, external validation, calibration, subgroup performance, human–AI interaction, and prospective clinical impact deserve particular attention. Validation across different healthcare settings is also essential to address differences in patient populations, imaging infrastructure, and access to specialist expertise.

The editorial responsibility extends beyond evaluating clinical AI research. Our journal's existing AI policy reflects the importance of transparency and human accountability

in scientific publishing [17]. Recent research has identified substantial variation in generative AI policies across vascular surgery journals [18]. Clear disclosure requirements, scientific integrity, confidentiality, and independent editorial judgment must remain central to the responsible use of these technologies.

Conclusion: Better Decisions, Not Simply Better Algorithms

Returning to the patient with limb-threatening ischemia, the appropriate response to disagreement between the surgeon and the AI system is neither automatic acceptance nor reflexive rejection. It requires examining the evidence, understanding the assumptions behind each recommendation, and determining which treatment best reflects the patient's clinical circumstances and preferences.

In clinical practice, disagreement between a surgeon and an AI system should prompt a structured reassessment rather than automatic acceptance or rejection of the algorithmic recommendation. The clinician should first determine the intended use of the AI model and the specific outcome it predicts. The applicability of the model to the individual patient, including anatomical characteristics, disease severity, comorbidities, and available treatment options, should then be critically evaluated. Importantly, predicted procedural risk should not be confused with comparative long-term treatment benefit. Current clinical evidence, surgical expertise, and patient preferences should ultimately guide shared decision-making. AI should inform clinical judgment, not replace it.

The future of AI in vascular surgery should be guided by a commitment to demonstrated patient benefit, appropriately calibrated trust, equitable implementation, and the preservation of surgical expertise. Clinical accountability must remain with healthcare professionals and institutions, while patients remain active participants in decisions concerning their care.

Ultimately, the success of AI in vascular surgery should be judged not only by the accuracy of its predictions, but also by its ability to improve clinical decisions while preserving the capacity for independent clinical judgment.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

AI-Assisted Technologies: Generative artificial intelligence was used during manuscript drafting, structural revision, and language editing. ChatGPT (OpenAI, GPT-6) was used to assist with the substantive revision of the manuscript, including the organization of arguments, language refinement, and identification of relevant literature. The authors are responsible for verifying the accuracy of the scientific content and references and approving the final manuscript.

Editorial Independence: The authors' editorial roles and the arrangements for independent editorial handling and recusal should be disclosed in accordance with the journal's policies.

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