The Operative Role of Artificial Intelligence in Vascular Surgery: A Systematic Review of Literature

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Abstract:

Background: This study aims to systematically review existing literature on the impact of artificial intelligence (AI) on operative workflow and safety in vascular surgery.

Method: This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines and registered with the International Prospective Register of Systematic Reviews (CRD420251004635). A comprehensive literature search was conducted across PubMed, Embase (via Ovid), Scopus, Google Scholar, and Science Direct for studies published between January 2005 and February 2025. The initial search identified 817 studies, and after screening, studies that did not meet the criteria were excluded, leaving eight relevant studies. Six were retrospective studies, one prospective study and one hybrid (retrospective-prospective cohort) study.

Results: The review demonstrated predominant utilisation of AI in the preoperative phase for risk prediction, decision support, anatomical assessment, and operative planning. Intraoperatively, AI applications encompassed real-time risk updates and intraoperative guidance based on preoperative computed tomography, while postoperative models enhanced surveillance following endovascular procedures. Across the reviewed studies, conventional methods were often outperformed by AI models in predictive accuracy, workflow efficiency and safety. Overall, AI models achieved good technical performance for example AUROC 0.90 for CEA outcomes, ICC 0.94 for EVAR volumetry >80% accuracy for AVF maturation, indicating potential to enhance workflow efficiency and decision support.

Conclusions: AI application shows potential in improving operative workflow and safety in vascular surgery through enhanced decision support, risk prediction, and process automation. However, the

performance should be interpreted cautiously given current evidence limitations. Overall, the evidence remains limited by small, retrospective, and heterogeneous studies with potential bias, highlighting the need for large-scale prospective validation before routine clinical adoption.

Keywords:

Locally Advanced Breast Cancer, Neoadjuvant chemotherapy, RECIST criteria 1.1.