



Bitesize Research: Deep Venous Reconstruction and the Future of Chronic Venous Disease Management

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Deep venous reconstruction remains a highly specialised area of vascular surgery, reserved for carefully selected patients with severe chronic venous insufficiency (CVI) or post-thrombotic syndrome (PTS) who have failed conservative and endovascular management. Although these procedures are uncommon, they represent an important area of practice for vascular scientists involved in pre-operative assessment and long-term postoperative surveillance.

This edition of bitesize we review four recent publications exploring the evidence surrounding deep venous reconstruction, ranging from clinical case series to systematic reviews and emerging applications of artificial intelligence (AI).

Paper 1: *Deep Venous Reconstruction – A Single-Centre Case Series*

Reference: Kosasih S, Moore H, Lane TR, Davies AH. *Deep Venous Reconstruction: A Case Series. Cureus. 2017 Jul 26;9(7):e1518. doi: 10.7759/cureus.1518. PMID: 28959513; PMCID: PMC5613925.*

This retrospective case series reviewed 19 patients who underwent deep venous reconstruction over a 19-year period using techniques including the Palma bypass, May-Husni bypass, femoral vein transposition and axillary vein transplantation. Patients had advanced chronic venous disease (CEAP C3–C6), with most having a history of deep vein thrombosis.

The study reported encouraging long-term results, with a cumulative primary patency rate of **89.5% at 58 months**, suggesting that open reconstruction can provide durable outcomes in carefully selected patients.

Strengths

The study's greatest strength is its long-term follow-up, demonstrating sustained graft patency over almost five years. All procedures were performed by a single consultant surgeon, providing consistency in surgical technique and patient selection. The use of duplex ultrasound-derived graft patency as the primary outcome also offers an objective and clinically meaningful measure of success.

Limitations

As a retrospective case series involving only 19 patients, the study provides relatively low-level evidence. The absence of a control group prevents comparison with conservative or endovascular treatments, while the long recruitment period (1994–2013) encompasses considerable advances in venous imaging and intervention that may limit the relevance of earlier cases to contemporary practice. In addition, patient-reported outcomes such as

quality of life and ulcer healing were not comprehensively reported.

Impact on Vascular Science Practice

Although these procedures are uncommon, vascular scientists play a pivotal role in both patient selection and postoperative surveillance. Comprehensive duplex ultrasound assessment is essential for identifying venous obstruction and reflux pre-operatively, while ongoing surveillance enables early detection of graft stenosis, thrombosis or recurrent reflux. Familiarity with these reconstructive procedures is particularly valuable for those working within tertiary vascular centres.

Paper 2: *Systematic Review and Meta-analysis of Deep Venous Reconstructive Surgery*

Reference: Maleti O, Orso M, Lugli M, Perrin M. *Systematic review and meta-analysis of deep venous reflux correction in chronic venous insufficiency. J Vasc Surg*

Venous Lymphat Disord. 2023 Nov;11(6):1265-1275.e5. doi: 10.1016/j.jvsv.2023.07.003. Epub 2023 Jul 13. PMID: 37453548.

This systematic review and meta-analysis evaluated 57 studies involving over 4,000 patients undergoing deep venous reconstructive surgery for primary venous incompetence and post-thrombotic syndrome.

Overall, the review demonstrated favourable outcomes, including high rates of ulcer healing, valve patency and symptom improvement, particularly among patients with primary valvular incompetence. Patients with post-thrombotic syndrome experienced less favourable but still encouraging results.

Strengths

As a systematic review and meta-analysis, this paper represents the highest level of evidence currently available for these surgical procedures. The review synthesised data from a large number of studies and examined multiple clinically relevant outcomes, including ulcer healing, valve competence, pain, oedema and postoperative complications. Importantly, it also compared outcomes between patients with primary valvular incompetence and those with post-thrombotic syndrome.

Limitations

Despite the rigorous review methodology, the quality of the available evidence remains limited. Most included studies were retrospective case series, with only three randomised controlled trials identified. Significant heterogeneity existed between studies in terms of patient populations, surgical techniques and outcome reporting, while few studies

compared reconstruction with modern endovenous therapies. Consequently, definitive conclusions regarding superiority of treatment cannot yet be drawn.

Impact on Vascular Science Practice

This review reinforces the importance of high-quality duplex ultrasound throughout the patient pathway. Vascular scientists remain central to pre-operative assessment, identifying suitable candidates for reconstruction, and to long-term surveillance of valve competence and graft patency. The findings also highlight the need for structured follow-up protocols, as ongoing surveillance is essential for maintaining long-term outcomes.

Paper 3: Femoral Vein Valve Repair – A Case Report

Reference: Zheng, W., Gu, Z., Zhao, H. et al. *Innovative femoral vein valve repair combined with deep femoral vein ligation for treatment of chronic venous insufficiency: a case report.* *J Cardiothorac Surg* 21, 366 (2026). <https://doi.org/10.1186/s13019-026-04048-2>

This paper presents a successful case of femoral vein valve repair combined with deep femoral vein ligation in a patient with chronic venous insufficiency and aneurysmal venous dilatation. The authors also provide a concise review of current surgical options including valve repair, valve transposition and valve transplantation.

Strengths

The report offers valuable insight into the management of a rare and technically demanding clinical scenario. It describes surgical decision-making in detail while pro-

viding a useful overview of the available reconstructive techniques and their respective indications. Such reports contribute practical knowledge for clinicians managing complex venous disease.

Limitations

As a single-patient case report, the findings cannot be generalised to wider clinical practice. The absence of a comparator, limited long-term follow-up and potential publication bias mean that conclusions regarding efficacy should be interpreted cautiously. Like many case reports, the paper demonstrates feasibility rather than effectiveness.

Impact on Vascular Science Practice

Although this case report is unlikely to alter routine clinical practice, it reinforces the essential role of vascular scientists in the assessment and surveillance of patients with complex deep venous disease. Duplex ultrasound is fundamental in identifying the location and severity of venous reflux, assessing valve morphology, and detecting associated abnormalities such as aneurysmal venous dilatation, all of which are critical in determining surgical suitability. Following intervention, vascular scientists are responsible for evaluating valve competence, venous haemodynamics, and the presence of recurrent reflux or thrombosis during long-term follow-up. The report also highlights the importance of understanding uncommon venous reconstructive procedures, as these patients may present for surveillance in specialist vascular centres. While endovenous treatments and conservative management remain the mainstay of care for most patients with chronic venous insufficiency, this paper demonstrates that complex



reconstructive surgery may offer clinical benefit in carefully selected cases. For vascular scientists, it emphasises the need for advanced knowledge of deep venous anatomy, haemodynamics, and postoperative duplex ultrasound assessment to support multidisciplinary decision-making and optimise patient outcomes.

Paper 4: Artificial Intelligence in Chronic Venous Insufficiency – Future Directions

Reference: Michael C. Wilkinson, Andrew Ayad, Sharon C. Kiang, Mary L. Grewal, *A review on the current applications of artificial intelligence in chronic venous insufficiency, JVS-Vascular Insights, Volume 3, 2025, 100261, ISSN 2949-9127, <https://doi.org/10.1016/j.jvsvi.2025.100261>*

The final paper takes a different perspective, reviewing the emerging role of artificial intelligence (AI) in chronic venous disease. Rather than evaluating surgical outcomes, the review explores how AI may support diagnosis, risk prediction, disease classification and clinical decision-making.

Early proof-of-concept studies suggest that machine learning and computer vision techniques, including automated

thermal image analysis, could improve diagnostic efficiency while reducing healthcare workload.

Strengths

This review provides an excellent overview of a rapidly developing field and introduces vascular professionals to technologies that may influence future clinical practice. It highlights several promising applications of AI while identifying important areas requiring further research and validation.

Limitations

The review is narrative rather than systematic, meaning study selection was not conducted using a predefined methodology. Much of the evidence remains exploratory, consisting of proof-of-concept studies that have yet to be externally validated or compared with current standards of care. Consequently, AI applications remain some distance from routine implementation within vascular laboratories.

Impact on Vascular Science Practice

Although AI currently has a limited role in the routine assessment of chronic venous insufficiency, this review highlights its potential to become an important adjunct to vas-

cular science practice in the future. Machine learning algorithms could assist vascular scientists by analysing large imaging datasets, identifying patterns that may be difficult to recognise visually, predicting disease progression, and supporting patient selection for intervention. Emerging technologies, such as automated thermal image analysis and AI-assisted image interpretation, may improve diagnostic efficiency and reduce healthcare workload. However, these tools are intended to support rather than replace clinical expertise. Vascular scientists will continue to play a central role in acquiring high-quality ultrasound data, interpreting haemodynamic findings within the clinical context, and validating AI-generated outputs. As AI technologies become increasingly integrated into vascular imaging, vascular scientists will require an understanding of their capabilities, limitations, and potential sources of bias to ensure they are applied safely and appropriately. Ultimately, this review suggests that AI is likely to enhance clinical decision-making and workflow efficiency, but robust prospective validation and regulatory oversight are essential before widespread implementation in clinical practice.

Overall Take-Home Messages

Collectively, these papers demonstrate that deep venous reconstruction remains an important treatment option for carefully selected patients with advanced chronic venous insufficiency, particularly when conservative and endovascular therapies have failed. Although the current evidence is largely based on observational studies, outcomes are generally encouraging, with good long-term graft patency and improvements in clinical symptoms.

For vascular scientists, these publications reinforce the central role of duplex ultrasound throughout the patient journey—from identifying deep venous reflux and obstruction during pre-operative assessment to providing long-term surveillance following reconstruction. As surgical techniques evolve and artificial intelligence begins to influence vascular imaging, maintaining expertise in venous haemodynamics while embracing technological innovation will be essential to delivering high-quality patient care. 🌟