

Policy Frameworks for Bridging the Gap Between Vascular Surgery and Rehabilitation Through Physiotherapy

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ABSTRACT

Vascular surgery successfully restores blood flow and stops limb loss, but patients often only fully recover because of weak rehabilitation links after surgery. Through graded exercise, mobility training, and risk-factor counselling, physiotherapy is a key part of improving quality of life, endurance, and freedom. However, there are still policy and system-level gaps in areas like how to suggest patients, how to collect data, how to reimburse providers, and how to train healthcare workers. This leads to fragmented care and unequal access. This article suggests a six-pillar policy strategy that would make it easy for physiotherapy to fit into the pathways for vascular care. The system includes Outcomes and Data Infrastructure, Payment Reform, Workforce Competencies, Digital Enablement, Governance and Equity, and Integrated Care Pathways. A 12-month implementation plan with measurable KPIs (like referral uptake, adherence, ABI improvement, PROMs, and readmission reduction) shows how to go from the design phase to the full implementation phase. The framework aims to turn successful procedures into long-lasting functional recovery by making physiotherapy a standard of care that is reimbursed, based on data, and supported online.

KEYWORDS: Vascular surgery, Physiotherapy, Rehabilitation policy, Integrated care, Payment reform, Tele-rehabilitation, Outcome measurement.

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INTRODUCTION

Vascular illnesses, like peripheral arterial disease and aneurysmal conditions, are becoming more common in older people and people who already have diabetes, high blood pressure, or smoke. Vascular surgery, whether open or endovascular, is a life-saving procedure for many patients because it returns blood flow, eases ischaemic pain, and stops limb loss [1]. However, technical outcomes like patency rates or lower ischaemic burden are often used to measure the success of surgery. However, the main goal of recovery—getting patients back to functional independence and quality of life—depends heavily on how well they are rehabilitated. Physiotherapy is an important part of this continuum because it helps patients with graded exercise, retraining their gait, cardiovascular conditioning, and learning how to control risk factors. Even though there is a lot of clinical proof that early and structured physiotherapy improves endurance, mobility, and vascular health, many health systems still have trouble coordinating the move from surgery to rehabilitation [2].

There is a delay between surgery and rehabilitation follow-up because of problems with both structure and policy. Referral to physiotherapy after vascular surgery is not always the same; it depends on the doctor's choice or the patient's idea. Also, rehabilitation services often have trouble getting paid, being fully integrated into care routes, and seeing their own data in electronic health records. Because of this, patients who would benefit most from targeted rehabilitation—especially those with critical limb ischaemia, frailty, or multiple illnesses—often miss chances for directed recovery [3]. Inequality persists because people may not be able to get physiotherapy based on their clinical need but on where they live, their socioeconomic status, or the resources available at their school.

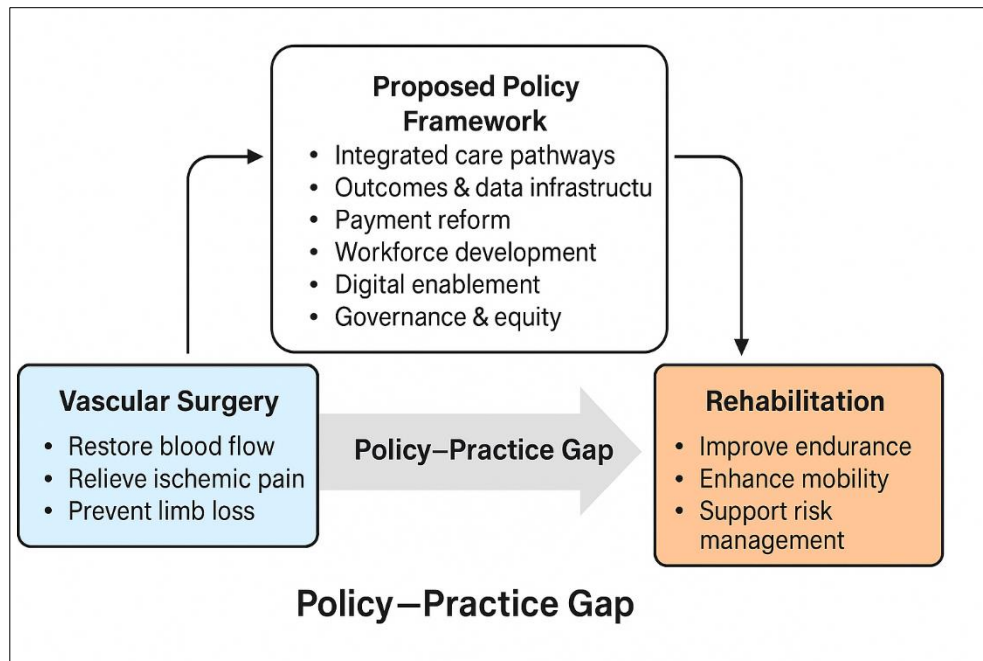


Figure 1. Policy-practice Gap

To close this gap, we need a comprehensive program that sees rehabilitation not as an extra, but as an important part of vascular care. Policies need to change from separating surgery and treatment into separate models to embracing unified, multidisciplinary paths. A well-thought-out policy framework can make sure that people are automatically referred to the right care, that supervised exercise therapy is paid for, that physiotherapists are trained in vascular-specific skills, and that outcome measures are consistent across the care continuum [4]. By including physiotherapy in bundled payment models and quality measures that are based on data, healthcare systems can encourage both functional recovery and procedural success.

We present a practical, six-pillar policy framework in this study that aims to improve the link between vascular surgery and rehabilitation led by physiotherapy. The framework talks about how to combine care pathways, results, and data infrastructure. It also talks about payment reform, workforce development, digital enablement, and fair governance. By making these pillars workable, healthcare organisations can make changes go more smoothly, improve patient outcomes, and provide value-based care that is also cost-effective. This introduction lays the groundwork for a useful plan that shows how to recover from surgery in a way that includes regaining mobility, freedom, and vascular resilience.

PROBLEM STATEMENT AND POLICY LANDSCAPE

Vascular surgery has come a long way in minimally invasive methods, preoperative care, and long-term graft patency, but functional recovery after surgery is still not up to par with what doctors expect. One big reason for this difference is that there isn't a structured and unified rehabilitation route that links patients, vascular surgeons, and physiotherapists across the whole spectrum of care. Rehabilitation is still not a required part of vascular care in most healthcare systems, which causes referral problems, delays in mobilisation, and less-than-ideal results [5]. This fragmentation is both a clinical problem and a policy failure, because the lack of standardised standards makes it hard for everyone to get services, the quality of those services varies, and the delivery of services is inefficient.

2.1 Fragmented Care Pathways

At the moment, it's not easy to make the change from vascular surgery to therapy. A lot of the time, patients are sent home without clear reporting guidelines or a plan for ongoing care. Electronic health records (EHRs) don't have automatic referral systems and don't have standard discharge summaries, which mean that chances to get people moving quickly are missed [6]. Because of this, patients usually only get physiotherapy when they need it, instead of structured, evidence-based programs that are meant to improve circulation and useful mobility.

2.2 Limited Financial Coverage and Incentives

Procedures are usually given more weight than long-term functional results in current reimbursement models. The most important parts of vascular rehabilitation—supervised exercise treatment, gait retraining, and patient education—are either not paid for or not reimbursed [7]. This imbalance makes hospitals and rehab centres less likely to offer complete programs, especially in places with few resources [8]. Physiotherapy isn't given enough credit because it doesn't have bundled payments or episode-based care models. This is a shame because it saves money by lowering readmissions and improving long-term results.

2.3 Data and Outcome Silos

It's not often that rehabilitation results like walking endurance, ankle-brachial index (ABI) improvement, and patient-reported quality of life measures are recorded or added to vascular networks [9]. Monitoring outcomes, setting benchmarks, and evaluating

policies are all harder when there isn't a unified data system. Also, researchers and lawmakers can't figure out the real economic and functional effects of integrated rehabilitation programs [10] because the data is broken up.

2.4 Workforce and Competency Gaps

Most physiotherapists don't have official training in vascular-specific rehabilitation routines, like how to prescribe exercises in ischaemic conditions, how to move with wounds in mind, and how to manage cardiovascular risk. There is still a lot of variation in clinical practice because there are no focused skill development or certification paths. Also, vascular surgeons, nurses, and physiotherapists don't always talk to each other in an official way because they don't have organised case conferences or shared decision-making models [11].

2.5 Access and Equity Barriers

Disparities in geography and socioeconomic status make the problem worse. Patients from rural or low-income areas have trouble getting to specialised physiotherapy services because of things like high transportation costs and a lack of services in their area [12]. New digital options, like tele-rehabilitation, are being developed, but they aren't being used much because people have trouble connecting, don't know how to use technology, and there aren't any policies that support online reimbursement. This makes it hard for some people to get therapy [13].

2.6 Regulatory and Governance Limitations

As a standard of care, therapy after arterial surgery is not required in many places. Different institutions have different levels of implementation because there aren't any control structures in place to oversee integration, make sure standards are met, and apply quality standards [14]. Also, keeping track of recommendations, completion rates, or patient results at the general level doesn't hold people accountable.

POLICY DESIGN APPROACH

A multi-layered and evidence-based design method is needed to create a complete policy framework that will help bridge the gap between vascular surgery and recovery led by physiotherapy. This study used a method that includes policy analysis, community involvement, building agreement, and implementing changes over and over again. Each step was planned to make sure it was possible, scalable, and in line with real-life clinical and management limits.

3.1 Scoping Synthesis

To start, a broad review of current vascular rehabilitation guidelines, health policy frameworks, and successful integration models from cardiac and pulmonary rehabilitation were put together. This step was meant to find best practices that could be used elsewhere, point out problems with implementation, and set basic standards for functional outcomes like walking distance, the Ankle-Brachial Index (ABI), and patient-reported outcomes (PROMs). The synthesis also included differences in how healthcare systems handle reimbursement and referrals, giving the next steps in the design process a solid basis of evidence.

3.2 Mapping of Stakeholders

Because vascular therapy involves a lot of different fields, a stakeholder mapping exercise was done to find the most important people who affect policy. Vascular surgeons, physiotherapists, nurses, primary care doctors, payers, hospital managers, and patient advocacy groups were some of these people. To figure out what each stakeholder brings to the process of making and enforcing policy, their role, impact, and expectations were looked at. This made sure that the suggested framework was a good mix of clinical effectiveness, operational feasibility, and patient-centeredness.

3.3 Co-Design Workshops

After identifying the stakeholders, co-design meetings were set up to help people work together to plan and come to an agreement. Participants in the meetings were able to come up with common goals, minimum rehabilitation packages, and ways to integrate workflows into electronic health record (EHR) systems. A focus was put on making a standard but adaptable path that could work with different institutional capabilities. Through interactive meetings, scheduling, automated referrals, and ways for surgical and rehabilitation units to share data were all made more useful.

3.4 Modified Delphi Consensus

A modified Delphi agreement method was used with experts in the field to improve and confirm important parts of the structure. This structured method used multiple rounds of polls and comments to help people agree on important things like who should be referred, how much to rehab, how to measure success, and safety rules. The Delphi process made sure that the methods were sound and that bias was kept to a minimum by mixing numerical scoring with qualitative comments. It took at least 80% agreement to make sure that each policy piece was included.

3.5 Pilot Testing and Making Changes

A study project was started in two places to see if the proposed policy scheme would work in real life. Integrated care paths with automated recommendations, organised rehabilitation schedules, and result tracking dashboards were put in place at pilot sites. Referral rates, time until first physiotherapy treatment, adherence, and early gains in functional ability were all tracked. Plan-Do-Study-Act (PDSA) cycles were used on a regular basis to improve data capture, smooth out routines, and fix practical problems.

3.6 Scaling and Evaluation

After the trial tests went well, the framework moved on to the growth phase, where it was gradually put into use across more vascular units. The plan for growth focused on keeping an eye on performance all the time using set key performance indicators

(KPIs), such as the number of qualified leads, completion rates, ABI improvement, and PROM gains. A built-in review system with feedback loops, quarterly audits, and yearly reporting made sure that policy changes were still based on data and results.

3.7 Ethical and Governance Considerations

At every step, ethical standards were followed, with a focus on patient liberty, giving informed permission for data collection, and making sure that everyone had equal access to recovery services. Multi-stakeholder steering groups were set up as governance frameworks to keep an eye on quality, safety, and responsibility. By including equality audits in the evaluation system, extra care was taken to reduce differences as much as possible.

PROPOSED POLICY FRAMEWORK

The suggested framework offers an organised, six-pillar plan to close the policy–practice gap between vascular surgery and recovery lead by physiotherapy. Each pillar focusses on a different problem in the system and makes sure that policy tools like reimbursement models, digital tools, and worker standards are in line with healthcare goals. The goal is to make exercise a standard part of vascular surgery that is based on data and is paid for by insurance.

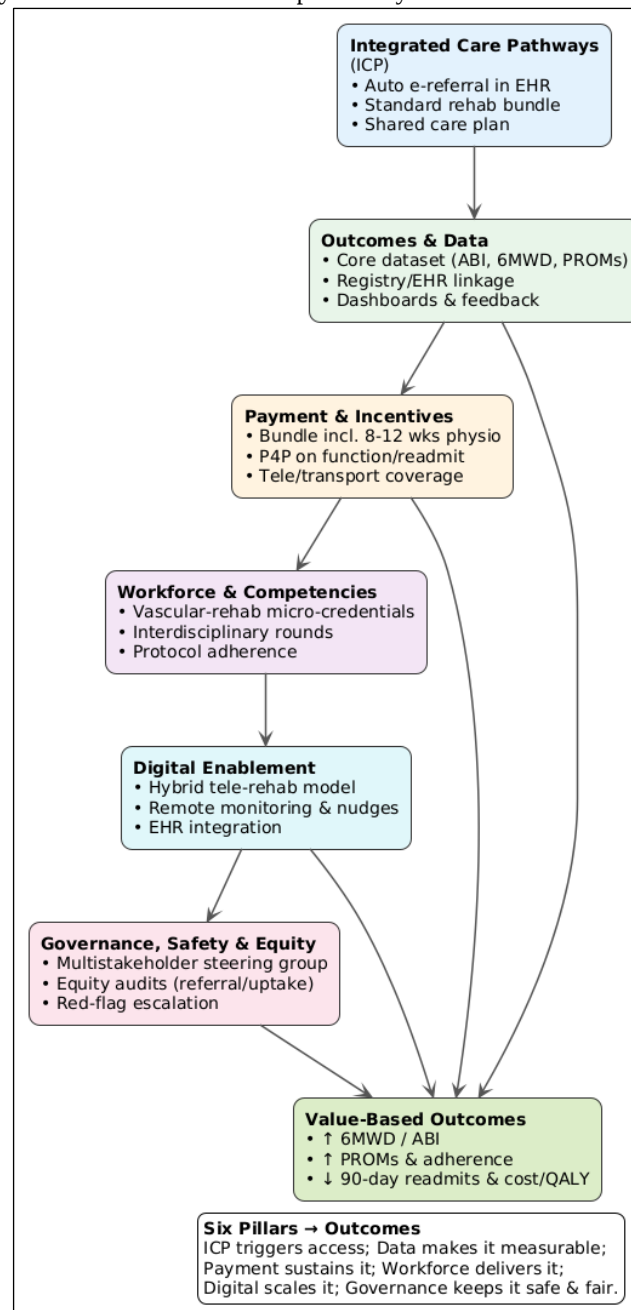


Figure 2. Proposed Six Pillars Policy Framework

Pillar 1: Integrated Care Pathways (ICP)

An Integrated Care Pathway that connects vascular surgery and physiotherapy through a standard process is a basic need for care that flows smoothly. At the time of discharge, all qualified patients should automatically be sent to the right specialist through their electronic health record (EHR). This way, doctors don't have to rely on their own judgement as much. The ICP sets up

structured rehabilitation bundles that are based on the type of operation and the patient's risk. These bundles include an initial assessment, supervised exercise therapy, and home programs. Shared care plans that surgeons, physiotherapists, and primary care workers can all see ensure continuity, clear roles, and early mobilisation without putting wound safety at risk.

Key Actions:

- Develop electronic referral templates within EHRs.
- Mandate automatic referral for eligible vascular cases.
- Embed shared progress notes accessible across care teams.

Pillar 2: Outcomes and Data Infrastructure

Accountability that can be measured is needed for policy action to work well. This pillar adds a core dataset that combines clinical, functional, and patient-reported outcomes into vascular registries and EHR screens that are already in place. Changes in ABI, 6-minute walk distance, PROMs (like VascuQOL-6), and rehabilitation adherence are all examples of standard measures. Clinicians and managers can get feedback through monthly dashboards, which also allow for benchmarking and performance-based incentives.

Key Actions:

- Define and implement a core outcomes dataset.
- Link physiotherapy metrics with surgical registries.
- Use dashboards to track performance and variation.

Pillar 3: Payment Reform and Incentives

Realigning finances is needed for long-term rehabilitation absorption. Adding bundled or episode-based fees that cover physiotherapy for 8 to 12 weeks will make sure that everyone is covered. Extra pay-for-performance (P4P) incentives can be used to promote functional improvements, fewer readmissions, and strict adherence. Transport vouchers or telehealth reimbursements take away barriers for patients who live far away, making involvement more fair.

Key Actions:

- Introduce rehabilitation-inclusive bundled payments.
- Implement P4P tied to outcome improvement.
- Reimburse tele-rehab and community sessions.

Pillar 4: Workforce Development and Competencies

Physiotherapists need specific training in ischemia-safe exercise prescription, wound-aware mobilisation, and cardiovascular fitness in order to provide specialised vascular rehabilitation. This pillar encourages the creation of micro-credentialing programs and cross-disciplinary training modules that are made with the help of vascular groups. Regular joint ward rounds and case talks make it easier for everyone to work together and support an integrated practice culture.

Key Actions:

- Establish vascular-specific rehabilitation training.
- Incorporate competency-based micro-certifications.
- Promote interdisciplinary learning and ward-based rounds.

Pillar 5: Digital Enablement and Tele-Rehabilitation

Digital tools help more people get care and keep it going. A hybrid approach that combines in-person assessments with tele-rehabilitation gives patients more options, especially those who live in rural areas or have trouble getting around. Mobile apps or SMS reminders help people stick to their plans, and tracking vital signs and symptoms from afar keeps them safe. Integration with EHR lets you get updates in real time, get comments automatically, and supervise from afar.

Key Actions:

- Deploy hybrid tele-rehabilitation systems.
- Integrate remote data capture and adherence reminders.
- Offer digital onboarding and technical support to patients.

Pillar 6: Governance, Safety, and Equity

A steering group with clinicians, physiotherapists, policymakers, and patient representatives will be in charge of implementation, quality assurance, and ongoing growth. Equity audits look for differences in access and results between groups based on gender, location, and income. Standardised safety practices make sure that red-flag symptoms like wound infection and ischaemic pain are found quickly, and there are ways for surgical teams to be notified.

Key Actions:

- Establish a governance body for oversight.
- Conduct quarterly audits with equity metrics.
- Enforce red-flag monitoring and escalation procedures.

Together, these six pillars make an integrated, outcome-focused, and fair policy model possible that changes the way rehabilitation is thought of as an optional add-on to vascular care and makes it an important part of it. Together, they build the structure for application in the real world, scalability, and long-term success.

IMPLEMENTATION ROADMAP

With a phased plan, you can get started quickly and have strict feedback loops. The six bases guide the activities, who is responsible for them, and how to measure success.

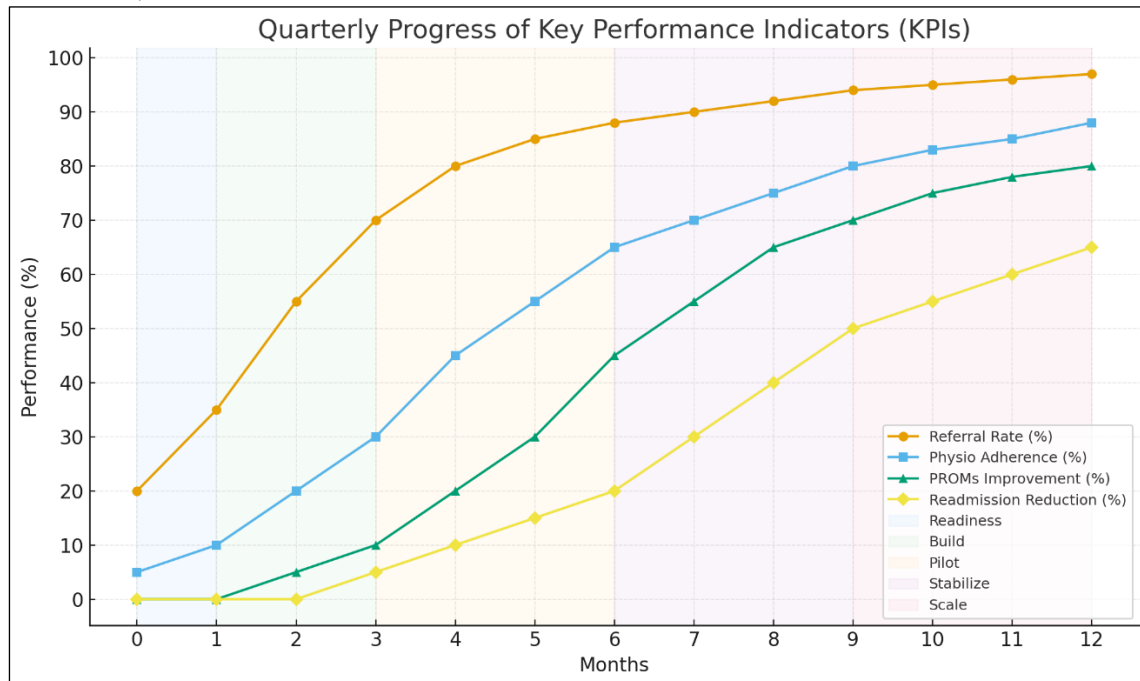


Figure 3. Quarterly trajectory of key performance indicators (KPIs) during the 12-month implementation roadmap

Figure 3 shows how the timing of implementation maturity and result realisation line up. Rapid increases in the referral rate during the Readiness and Build phases show that automation and clinician contact are working well. Adherence slowly rises as the Pilot adds more supervised sessions and digital reminders. As consistent involvement builds, PROM improvements that show how well the patient thinks they are recovering appear in the middle. Readmission reduction—an result that needs both physiological improvement and self-management—shows a slow but significant drop by the Scale phase, confirming that the change has affected the whole system. The phased colour bands help lawmakers figure out when each action has a value that can be measured. The chart shows how an integrated policy can help in the long run. Early changes to the structure (like e-referrals and incentives) can help with behavioural and clinical results (like adherence, PROMs, and utilisation). Overall, the fact that all six lines are going up shows that the six-pillar framework can turn policy design into long-term results.

CONCLUSION

To close the gap between vascular surgery and rehabilitation led by physiotherapy, we need more than just kindness from doctors. We need to take deliberate, evidence-based policy action. This paper suggested a six-pillar policy framework that would turn physiotherapy from an extra that isn't required into an organised, paid for, and outcome-monitored part of vascular care. Health systems can make sure that patients are taken care of smoothly from the time they are admitted to the hospital until they are fully recovered by using electronic referrals, standardised care pathways, large datasets of outcomes, fair payment changes, credentialing for staff, digital enablement, and strong governance. The 12-month implementation plan, which is backed up by measurable KPIs, shows how early structural changes, like automated referrals and bundled payments, lead to better adherence, patient-reported outcomes, and fewer readmissions. The framework is adaptable to different health systems, whether they have a lot of resources or not enough. This keeps equality at the centre. In the end, including physiotherapy in the spectrum of vascular care makes patients more independent, makes the best use of resources, and moves value-based healthcare forward. Policymakers, doctors, and insurance companies should all support this unified plan to turn successful surgery into complete recovery, making sure that every repaired vessel leads to a restored life.

REFERENCE

1. Feigin, V.L.; Brainin, M.; Norrving, B.; Martins, S.O.; Pandian, J.; Lindsay, P.; Grupper, M.F.; Rautalin, I. World Stroke Organization: Global Stroke Fact Sheet 2025. *Int. J. Stroke* 2025, 20, 132–144.
2. Katyal, A.; Bhaskar, S.M.M. Value of pre-intervention CT perfusion imaging in acute ischemic stroke prognosis. *Diagn. Interv. Radiol.* 2021, 27, 774–785.
3. Shaban, S.; Huasen, B.; Haridas, A.; Killingsworth, M.; Worthington, J.; Jabbour, P.; Bhaskar, S.M.M. Digital subtraction angiography in cerebrovascular disease: Current practice and perspectives on diagnosis, acute treatment and prognosis. *Acta Neurol. Belg.* 2022, 122, 763–780.
4. Qin, C.; Yang, S.; Chu, Y.-H.; Zhang, H.; Pang, X.-W.; Chen, L.; Zhou, L.-Q.; Chen, M.; Tian, D.-S.; Wang, W. Signaling pathways involved in ischemic stroke: Molecular mechanisms and therapeutic interventions. *Signal Transduct. Target. Ther.* 2022, 7, 215.

5. Ravindran, A.V.; Killingsworth, M.C.; Bhaskar, S. Cerebral collaterals in acute ischaemia: Implications for acute ischaemic stroke patients receiving reperfusion therapy. *Eur. J. Neurosci.* 2021, 53, 1238–1261.
6. Sinha, A.; Gupta, M.; Bhaskar, S.M.M. Evolucollateral dynamics in stroke: Evolutionary pathophysiology, remodelling and emerging therapeutic strategies. *Eur. J. Neurosci.* 2024, 60, 6779–6798.
7. Lip, G.Y.H.; Lane, D.A.; Lenarczyk, R.; Boriani, G.; Doehner, W.; Benjamin, L.A.; Fisher, M.; Lowe, D.; Sacco, R.L.; Schnabel, R.; et al. Integrated care for optimizing the management of stroke and associated heart disease: A position paper of the European Society of Cardiology Council on Stroke. *Eur. Heart J.* 2022, 43, 2442–2460.
8. Li, X.; He, Y.; Wang, D.; Rezaei, M.J. Stroke rehabilitation: From diagnosis to therapy. *Front. Neurol.* 2024, 15, 1402729.
9. Biswas, R.; Wijeratne, T.; Zelenak, K.; Huasen, B.B.; Iacobucci, M.; Killingsworth, M.C.; Beran, R.G.; Gebreyohannis, M.; Sekhar, A.; Khurana, D.; et al. Disparities in Access to Reperfusion Therapy for Acute Ischemic Stroke (DARTS): A Comprehensive Meta-Analysis of Ethnicity, Socioeconomic Status, and Geographical Factors. *CNS Drugs* 2025, 39, 417–442.
10. Steinmetz, J.D.; Seeher, K.M.; Schiess, N.; Nichols, E.; Cao, B.; Servili, C.; Cavallera, V.; Cousin, E.; Hagins, H.; Moberg, M.E.; et al. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: A systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurol.* 2024, 23, 344–381.
11. Reid, L.B.; Boyd, R.N.; Cunningham, R.; Rose, S.E. Interpreting Intervention Induced Neuroplasticity with fMRI: The Case for Multimodal Imaging Strategies. *Neural Plast.* 2016, 2016, 2643491.
12. Guimarães de Almeida Barros, A.; Roquim, E.S.L.; Pessoa, A.; Eiras Falcão, A.; Viana Magno, L.A.; Valadão Freitas Rosa, D.; Aurelio Romano Silva, M.; Marques de Miranda, D.; Nicolato, R. Use of biomarkers for predicting a malignant course in acute ischemic stroke: An observational case-control study. *Sci. Rep.* 2023, 13, 16097.
13. Sun, M.Y.; Bhaskar, S.M.M. When Two Maladies Meet: Disease Burden and Pathophysiology of Stroke in Cancer. *Int. J. Mol. Sci.* 2022, 23, 15769.
14. Sun, M.Y.; Bhaskar, S.M.M. Bridging the Gap in Cancer-Related Stroke Management: Update on Therapeutic and Preventive Approaches. *Int. J. Mol. Sci.* 2023, 24, 7981.