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Preventive and Pharmacological Interventions for Stroke: A Narrative Review of Evidence, Challenges, and Future Directions

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ABSTRACT

Stroke remains one of the leading causes of death and long-term disability worldwide, exerting a significant burden on individuals, healthcare systems, and economies. Preventive strategies are critical in reducing the incidence and recurrence of stroke, especially among populations at high risk due to modifiable and non-modifiable factors. This narrative review synthesizes current evidence on pharmacological and non-pharmacological interventions aimed at stroke prevention. It begins by examining key modifiable risk factors, such as hypertension, smoking, excessive alcohol consumption, and physical inactivity. Hypertension, in particular, is highlighted as the most impactful risk factor, with studies showing that even modest reductions in blood pressure can significantly decrease stroke risk. Similarly, smoking cessation and regular physical activity are strongly associated with a reduced likelihood of stroke events. The review also explores pharmacological measures, including antiplatelet and anticoagulant therapies. Aspirin remains a widely used antiplatelet agent, especially in secondary prevention, although its efficacy must be balanced against potential bleeding risks. Alternatives like clopidogrel and combinations such as dual antiplatelet therapy (DAPT) are examined considering recent clinical trial evidence. In patients with atrial fibrillation, anticoagulants such as warfarin and newer direct oral anticoagulants (DOACs) like apixaban have demonstrated effectiveness in reducing stroke risk with varying safety profiles. This review identifies ongoing challenges, including patient adherence, personalized therapy decisions, and the need for broader public health implementation of preventive strategies. It concludes by highlighting the importance of integrating lifestyle interventions with individualized pharmacological treatments to optimise stroke prevention. Further research is recommended to refine these strategies and address existing gaps in knowledge, particularly in low-resource settings where the stroke burden continues to rise.

Keywords: Stroke prevention, Hypertension, Smoking cessation, Antiplatelet therapy, Anticoagulants.

INTRODUCTION

Stroke is a significant global public health concern, ranking as the second leading cause of death and the third leading cause of disability-adjusted life years (DALYs) worldwide (World Health Organization, 2022). In 2021, approximately 12 million new stroke cases were reported globally, with ischemic strokes accounting for about 7.8 million of these cases (Global Burden of Disease Study, 2021). The burden of stroke is projected to increase, particularly in low- and middle-income countries, driven by aging populations and the rising prevalence of modifiable risk factors (Feigin et al., 2022). This trend underscores the urgent need for effective prevention and management strategies to mitigate the impact of stroke on global health systems.

In the United Kingdom (UK), stroke incidence has been on the rise. NHS England reported a 28% increase in hospital admissions for stroke between 2004 and 2024, reaching over 111,000 admissions annually (NHS England, 2024). The economic impact is substantial, with stroke-related costs in the UK estimated at £43 billion in 2024, encompassing healthcare expenditures, social care, and productivity losses (Public Health England, 2024). These figures highlight the significant burden that stroke places on both the healthcare system and the broader economy. Although the age-specific incidence of stroke is declining, the overall incidence in the UK is driven by an ageing population and the continued prevalence of lifestyle-related risk factors such as hypertension, obesity, and smoking (Li, Scott & Rothwell, 2020; Akea et al., 2021; Livingstone et al., 2021).

Similarly, in the United States (US), stroke is a leading cause of death and long-term disability. Approximately 795,000 individuals experience a new or recurrent stroke each year, with about 140,000 deaths attributed to stroke annually (Centres for Disease Control and Prevention, 2022). The prevalence of stroke is increasing among younger adults, highlighting the need for effective prevention strategies (Martin et al., 2025). The economic burden of stroke in the US is also considerable, with direct medical costs and indirect costs due to lost productivity amounting to billions of dollars annually. The rising incidence of stroke among younger populations is particularly concerning, as it suggests that traditional risk factors are becoming more prevalent in this demographic.

Modifiable risk factors such as hypertension, diabetes mellitus, obesity, smoking, and physical inactivity significantly contribute to stroke risk (Khan et al., 2023). Lifestyle interventions targeting these factors have been shown to reduce stroke incidence. For instance, adherence to a healthy diet, regular physical activity, and smoking cessation are associated with a lower risk of stroke (Saad, Cherian & Benameur, 2024). Public health campaigns and community-based interventions play a crucial role in promoting these healthy behaviours. Additionally, healthcare providers are increasingly focusing on preventive care and early intervention to manage risk factors before they lead to stroke.

Pharmacological interventions also play a crucial role in stroke prevention. Low-dose aspirin has been widely used for the primary and secondary prevention of cardiovascular events, including stroke. However, recent evidence suggests that the benefits of aspirin for primary stroke prevention may be limited and must be weighed against the increased risk of bleeding (Zhao et al., 2021). The U.S. Preventive Services Task Force recommends individualized decision-making regarding aspirin use for primary prevention, particularly in older adults (Davidson et al., 2022). This recommendation reflects the complexity of balancing the potential benefits and risks of aspirin therapy, especially in populations at varying levels of risk for cardiovascular events.

Given the global burden of stroke and the evolving evidence on prevention strategies, this narrative review aims to provide an overview of the role of aspirin in preventing stroke among patients at high risk of vascular disease. Synthesizing the latest research findings, this review seeks to provide healthcare professionals with evidence-based guidance on the use of aspirin for stroke prevention. The goal is to inform clinical practice and public health policies to reduce the incidence and impact of stroke worldwide.

METHODS

This narrative review was conducted to synthesize contemporary evidence on preventive and pharmacological interventions for stroke, with a focus on modifiable risk factors, antiplatelet therapy, and anticoagulant therapy. A comprehensive search of the literature was performed using multiple electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search aimed to capture relevant articles published between January 2015 and April 2025. Additional manual searches of reference lists from key articles, guidelines, and consensus statements were conducted to ensure the inclusion of seminal and highly cited studies.

Search terms were developed using a combination of Medical Subject Headings (MeSH) and free-text keywords. Key search terms included "stroke prevention," "hypertension and stroke," "smoking cessation and stroke," "alcohol consumption and stroke risk," "physical activity and stroke," "aspirin and stroke prevention," "clopidogrel," "dual antiplatelet therapy," "anticoagulation," "warfarin," and "direct oral anticoagulants (DOACs)." Boolean operators (AND, OR) were used to combine terms and refine search results. No restrictions were placed on study design at the initial stage to ensure a broad capture of relevant literature, but emphasis was later placed on high-quality evidence such as randomized controlled trials (RCTs), systematic reviews, meta-analyses, and major clinical guidelines.

Studies were included if they (1) focused on preventive or pharmacological strategies for stroke, (2) involved adult populations (≥18 years), (3) reported on primary or secondary stroke prevention outcomes, and (4) were published in peer-reviewed journals. Articles that primarily addressed paediatric populations, animal studies, or stroke rehabilitation without a prevention focus were excluded. Preference was given to more recent studies and updated guidelines to reflect the evolving nature of stroke prevention practices.

Given that this is a narrative review, a formal systematic review protocol such as PRISMA was not adopted, and formal risk of bias assessments were not systematically performed. However, a critical appraisal approach was employed to prioritize inclusion of studies that demonstrated methodological rigor, appropriate sample sizes, relevant outcome measures, and clinical applicability. For pharmacological interventions, landmark trials such as the CHANCE, CAPRIE, POINT, ARISTOTLE, and WARSS studies were given particular attention, alongside updated systematic reviews and meta-analyses published in leading journals.

The review process was conducted in stages. First, titles and abstracts were screened for relevance. Full texts of potentially eligible articles were retrieved and assessed independently. Discrepancies regarding article inclusion were resolved through discussion among the authors. Data extracted from each study included authorship, publication year, study design, population characteristics, intervention details, comparator(s), outcomes related to stroke prevention, and major findings.

The synthesis of findings was narrative rather than quantitative, given the heterogeneity in study designs, interventions, and outcome measures. Studies were grouped thematically into preventive lifestyle interventions and pharmacological interventions to facilitate structured discussion. Where appropriate, evidence from different studies was compared, and areas of consensus and controversy were highlighted.

Ethical approval was not required for this review, as it was based exclusively on secondary analysis of published data. The review aimed to adhere to principles of transparency, thoroughness, and academic integrity in the reporting and discussion of findings.

RESULTS

Preventive Interventions Against Stroke

Effective prevention strategies are crucial in reducing the incidence and burden of stroke (World Health Organization, 2022). A central focus of stroke prevention efforts is the management of modifiable risk factors, which include hypertension, smoking, alcohol consumption, and physical inactivity (Martin et al., 2024). These factors have been consistently identified in both observational studies and clinical trials as significant contributors to stroke risk and addressing them is essential for both primary and secondary prevention (Saad et al., 2024).

Hypertension is recognized as the most important modifiable risk factor for stroke (Turnbull et al., 2023). Elevated blood pressure exerts continuous mechanical stress on the vascular endothelium, promoting atherosclerosis and increasing the risk of both ischemic and haemorrhagic stroke (Wang et al., 2025). Recent evidence highlights the profound impact of blood pressure reduction on stroke prevention. A meta-analysis of 123 RCTs found that for every 10 mm Hg reduction in systolic blood pressure, there was a corresponding 20% decrease in stroke incidence, regardless of the patients' baseline blood pressure levels (Ettehad et al., 2016). These findings emphasize that even modest reductions in blood pressure can have significant public health implications (Zhang et al., 2023). The STEP trial conducted by Zhang et al. (2023) provided further support for aggressive blood pressure management. This large randomized controlled trial showed that targeting an intensive systolic blood pressure goal of less than 120 mm Hg, compared to a standard goal of less than 140 mm Hg, significantly reduced the risk of stroke in elderly hypertensive patients. While concerns have been raised about potential adverse effects associated with intensive blood pressure lowering, including dizziness and falls, the overall benefits in reducing major cardiovascular events, including stroke, outweigh these risks in carefully selected patients (Kienzle et al., 2024). Effective antihypertensive therapy remains a cornerstone of stroke prevention strategies, and greater efforts are needed to ensure optimal blood pressure control in clinical practice (Wang et al., 2025).

Another critical area for intervention is smoking cessation. Cigarette smoking promotes atherosclerosis, increases blood viscosity, and impairs endothelial function, thereby substantially elevating the risk of both ischemic and haemorrhagic strokes (Wechsler et al., 2025). Wang et al. (2024) conducted a large prospective cohort study that highlighted the stark contrast in stroke risk between smokers and non-smokers. Smokers were found to have significantly higher rates of stroke, and the risk was dose-dependent, increasing with the number of cigarettes smoked per day and the duration of smoking history. Importantly, smoking cessation was associated with a rapid and substantial reduction in stroke risk. Within two to five years of quitting, former smokers' stroke risk approached that of individuals who had never smoked (Ding et al., 2025). These findings underscore the critical importance of comprehensive smoking cessation programs as part of national public health strategies. While pharmacological aids such as nicotine replacement therapy and varenicline have been shown to enhance cessation rates, behavioural interventions and societal policies, such as taxation and smoking bans, also play vital roles in reducing smoking prevalence and thus mitigating stroke risk (CDC, 2024; CDC, 2025a).

The relationship between alcohol consumption and stroke risk is more complex, with a U-shaped association commonly reported in the literature. Light to moderate alcohol consumption may confer a slight protective effect against ischemic stroke, potentially through mechanisms such as increased high-density lipoprotein (HDL) cholesterol levels and reduced platelet aggregation (Harvard Health, 2024). However, heavy alcohol consumption is unequivocally associated with an increased risk of both ischemic and haemorrhagic strokes (Smyth et al., 2023). Smyth et al. (2023), through an analysis of global data, confirmed that individuals engaging in heavy drinking had markedly higher odds of stroke, particularly haemorrhagic stroke. Beyond the vascular effects, recent studies have highlighted newer findings linking heavy alcohol intake with structural brain changes, cognitive decline, and increased risk of dementia, conditions that often co-occur with or exacerbate post-stroke disability (Karoly et al., 2024; Brennan et al., 2020). Given these findings, public health recommendations increasingly emphasize moderation, typically advising no more than one alcoholic drink per day for women and two

for men (Centres for Disease Control and Prevention, 2025). However, given the variability in individual risk factors, clinicians are encouraged to provide personalized advice regarding alcohol consumption, particularly for patients with a prior history of stroke or those at elevated cardiovascular risk (Sabia et al., 2018).

Physical inactivity constitutes another modifiable risk factor for stroke. Regular exercise improves endothelial function, lowers blood pressure, improves lipid profiles, and promotes insulin sensitivity, all of which contribute to vascular health and stroke risk reduction (Jeong, 2025). Current guidelines, including those from the American Heart Association (AHA, 2024), recommend that adults engage in at least 150 minutes of moderate-intensity aerobic physical activity or 75 minutes of vigorous-intensity activity each week. He et al. (2024) conducted a comprehensive cohort study examining different domains of physical activity and their relationship with stroke risk. Their findings revealed that leisure-time physical activity, such as sports and recreational walking, was strongly associated with a reduced risk of stroke. Interestingly, occupational and transportation-related activities, including walking or cycling to work, did not exhibit the same protective effect, possibly due to differences in intensity and consistency (De Santis et al., 2023). The study emphasized that it is not merely the volume of activity but the quality and purposefulness that matters in stroke prevention (Jeong, 2025).

Despite the strong evidence supporting lifestyle modifications, real-world adherence to preventive behaviours remains suboptimal. Barriers include lack of awareness, socioeconomic factors, cultural norms, and access to healthcare resources (Saad et al., 2024). Consequently, comprehensive stroke prevention strategies must incorporate both individual-level interventions, such as patient education and counselling, and population-level policies that create environments conducive to healthy behaviours. These may include urban planning that encourages physical activity, legislation to reduce tobacco and alcohol use, and healthcare initiatives to improve the detection and management of hypertension (Njohjam et al., 2025).

Future research should continue to explore innovative ways to improve adherence to preventive measures, personalize risk reduction strategies, and address disparities in stroke prevention outcomes (Schrage et al., 2025).

Pharmacological Interventions

Pharmacological interventions are a central pillar in stroke prevention strategies, particularly for individuals at high risk due to prior vascular events or atrial fibrillation. Among the pharmacological options available, antiplatelet and anticoagulant therapies have been extensively studied and incorporated into clinical guidelines to prevent both primary and recurrent strokes. These therapies aim to reduce the formation of thrombi that can obstruct cerebral arteries and result in ischemic events, although they must be administered carefully to balance efficacy with the risk of bleeding complications (Tornyos et al., 2022).

Aspirin remains a cornerstone in the secondary prevention of stroke. Its antiplatelet properties work by irreversibly inhibiting cyclooxygenase-1 (COX-1), thereby preventing the synthesis of thromboxane A2, a potent promoter of platelet aggregation (Ortega-Paz et al., 2023). Aspirin's widespread use stems from strong evidence supporting its ability to reduce the risk of recurrent stroke in individuals who have experienced a prior ischemic event. However, its use is not without challenges. The risk of gastrointestinal bleeding and haemorrhagic stroke, particularly in elderly populations or those with multiple comorbidities, must be carefully weighed against its benefits (Cleland et al., 2022). The CHANCE trial, a large, randomized study conducted in China, demonstrated that when aspirin was used in combination with clopidogrel and initiated within 24 hours of minor stroke or high-risk transient ischemic attack symptoms, there was a significant reduction in the risk of recurrent stroke without a concurrent increase in haemorrhagic events (Wang et al., 2013). These findings reinforced the potential role of DAPT in specific clinical contexts, particularly when started early after symptom onset.

Clopidogrel has emerged as a superior alternative to aspirin monotherapy in certain populations, particularly in patients who are aspirin-intolerant or at high risk for gastrointestinal complications. Clopidogrel acts by inhibiting the P2Y12 receptor on platelets, thus preventing ADP-mediated platelet activation and aggregation (Li, Zhang & Cao, 2023). The CAPRIE trial provided compelling evidence

for the benefits of clopidogrel over aspirin. It found that clopidogrel reduced the combined risk of ischemic stroke, myocardial infarction, and vascular death by a modest but statistically significant margin compared to aspirin (Galiuto & Patrono, 2021). More recently, a systematic review by Hackam and Spence (2021) reaffirmed that clopidogrel is particularly advantageous in patients with diabetes and those with previous peripheral artery disease, groups often at a higher risk of vascular events. However, genetic variability in the metabolism of clopidogrel, particularly involving CYP2C19 loss-of-function alleles, has emerged as an important consideration, influencing the responsiveness to therapy and underscoring the need for precision medicine approaches (Castrichini et al., 2023).

Dual antiplatelet therapy, typically combining aspirin and clopidogrel, has been explored extensively for the prevention of recurrent stroke and other vascular events, especially in the early period following minor stroke or transient ischemic attack. The POINT trial provided crucial insights into the benefits and limitations of DAPT. This trial showed that the combination of aspirin and clopidogrel, when initiated within 12 hours of a minor ischemic event and continued for 90 days, significantly reduced the risk of major ischemic events compared to aspirin alone (Li et al., 2021). However, it also demonstrated a clear increase in the risk of major bleeding with prolonged dual therapy, echoing similar concerns raised by previous studies (Valgimigli et al., 2021). These findings have informed current guidelines, which recommend limiting DAPT to a short-term course of 21 to 90 days after minor stroke or high-risk TIA, followed by a transition to single antiplatelet therapy thereafter (Powers et al., 2023).

Beyond antiplatelet therapy, anticoagulation plays a pivotal role in stroke prevention, particularly in patients with atrial fibrillation, a major risk factor for cardioembolic stroke. Warfarin, a vitamin K antagonist, has historically been the gold standard for anticoagulation in this context. Warfarin exerts its anticoagulant effects by inhibiting the synthesis of vitamin K-dependent clotting factors II, VII, IX, and X. The efficacy of warfarin in reducing stroke risk in atrial fibrillation has been well established, with meta-analyses indicating significant risk reduction compared to placebo (Benz et al., 2022). However, warfarin's use is fraught with practical challenges. It requires frequent monitoring of the international normalized ratio (INR) to ensure therapeutic anticoagulation without excessive bleeding risk. Dietary interactions, variable pharmacokinetics, and numerous drug interactions complicate its management, often leading to suboptimal anticoagulation control (Sharma et al., 2022).

The advent of DOACs such as apixaban, rivaroxaban, edoxaban, and dabigatran has revolutionized stroke prevention in atrial fibrillation. These agents offer the advantage of fixed dosing without the need for routine coagulation monitoring and have fewer dietary and drug interactions compared to warfarin (Connolly et al., 2022). The ARISTOTLE trial, which compared apixaban to warfarin in patients with atrial fibrillation, demonstrated that apixaban was superior in preventing stroke and systemic embolism while also being associated with a significantly lower risk of major bleeding (Al-Khatib et al., 2021). A network meta-analysis by Zheng et al. (2022) further confirmed that DOACs, as a class, are associated with better safety profiles and comparable or superior efficacy compared to warfarin across diverse patient populations. As a result, DOACs are now recommended as the first-line therapy for non-valvular atrial fibrillation in updated international guidelines.

Despite the proven efficacy of both antiplatelet and anticoagulant therapies in stroke prevention, several challenges remain. One of the major issues is ensuring patient adherence to long-term therapy, as non-adherence significantly diminishes treatment efficacy and increases the risk of recurrent stroke (Kato et al., 2024). Factors influencing adherence include the complexity of medication regimens, side effects, patient education, and socioeconomic barriers. Moreover, individualized risk stratification is increasingly recognized as essential in optimising therapy choices, balancing stroke risk reduction against the potential for adverse events such as haemorrhage. Risk scoring systems such as CHA_2DS_2-VASc for atrial fibrillation and HAS-BLED for bleeding risk are valuable tools in clinical decision-making, but they require thoughtful application alongside clinical judgment (Lip et al., 2021).

Future research should focus on enhancing adherence strategies, personalizing therapy based on genetic and clinical profiles, and expanding access to newer agents, particularly in low-resource settings where stroke burdens are disproportionately high (CDC, 2022; Adeniji et al., 2023; CDC, 2025b).

DISCUSSION

Although the efficacy of pharmacological interventions in stroke prevention is well established, several critical limitations warrant careful consideration. Antiplatelet therapies, such as aspirin and clopidogrel, offer substantial benefits in reducing recurrent ischemic events, particularly in patients with a history of minor stroke or transient ischemic attack (TIA). Nevertheless, their effectiveness is tempered by an increased risk of major bleeding events, a concern that becomes particularly pronounced in elderly and frail populations (Yu et al., 2025). The risk of haemorrhagic complications, including intracerebral haemorrhage, remains a significant limitation to their widespread and long-term use. Dual antiplatelet therapy (DAPT), which combines aspirin and clopidogrel, has demonstrated efficacy when initiated early after minor ischemic events, as shown in major trials. However, its long-term use remains controversial due to the cumulative bleeding risks associated with prolonged therapy (George et al., 2017). Current guidelines advocate for a limited duration of DAPT, usually 21 to 90 days, followed by a transition to monotherapy, emphasizing the delicate balance between maximizing ischemic protection and minimizing bleeding hazards.

Similarly, anticoagulants such as warfarin and DOACs have markedly improved outcomes in atrial fibrillation-associated stroke prevention. Warfarin has a longstanding record of efficacy but is limited by its narrow therapeutic window, requirement for regular INR monitoring, and significant dietary and drug interactions. DOACs, such as apixaban and rivaroxaban, offer the advantages of fixed dosing, fewer dietary restrictions, and improved safety profiles, notably with lower rates of intracranial haemorrhage compared to warfarin. However, adherence remains a major challenge in clinical practice, affecting the overall effectiveness of these therapies (CDC, 2025b). Real-world studies reveal that non-adherence rates for anticoagulation therapies are substantial, driven by factors such as medication costs, complexity of regimens, side effects, and patient perceptions about treatment necessity.

A further limitation pertains to the accessibility and affordability of newer anticoagulants, particularly in low- and middle-income countries. Although DOACs have transformed anticoagulation management in high-income settings, their high cost restricts widespread use in resource-constrained regions (Adeniji et al., 2023). This creates significant inequities in stroke prevention, with patients in lower-income settings often left reliant on warfarin despite its management challenges. Initiatives aimed at improving global access to affordable DOACs and implementing national programs for anticoagulation management are urgently needed to bridge this treatment gap.

Moreover, the real-world application of pharmacogenomics, particularly the tailoring of clopidogrel use based on CYP2C19 genetic polymorphisms, remains limited. Although CYP2C19 genotyping has the potential to identify patients who may not adequately metabolize clopidogrel and hence be at greater risk of treatment failure, widespread implementation is hampered by the cost of testing, lack of infrastructure, and limited clinician familiarity with genetic data interpretation (Yu et al., 2025). This underutilization reduces opportunities for personalized medicine approaches that could optimise stroke prevention outcomes.

Another important concern is the underrepresentation of diverse populations in clinical trials evaluating pharmacological stroke prevention strategies. Most landmark trials have disproportionately recruited participants from North America, Europe, and other high-income regions (George et al., 2017). This lack of diversity may limit the generalizability of findings, particularly given known ethnic variations in stroke risk profiles, drug metabolism, and response to therapy. Limited inclusion of socioeconomically disadvantaged groups further exacerbates disparities in knowledge and outcomes. Recent reviews (Adeniji et al., 2023) have called for greater emphasis on ensuring ethnic, geographic, and socioeconomic representation in future trials to ensure findings are applicable to broader global populations.

Thus, while pharmacological interventions represent powerful tools for stroke prevention, their real-world effectiveness is dependent on overcoming persistent clinical and public health challenges. These include improving therapy adherence, expanding access to affordable medications, integrating pharmacogenomic testing into routine care, and ensuring diversity in clinical research. Future efforts must prioritize equitable healthcare delivery, personalized risk assessment, and pragmatic solutions

tailored to the specific needs of diverse patient populations. Only through coordinated strategies can the full potential of pharmacological advances in stroke prevention be realized globally (Yu et al., 2025).

CONCLUSION

Effective stroke prevention necessitates a comprehensive, multifaceted approach that integrates both lifestyle modifications and pharmacological interventions. Stroke remains a leading cause of mortality and long-term disability worldwide, and addressing its burden requires strategies that operate at both individual and population levels. Managing modifiable risk factors remains the foundation of effective stroke prevention. Blood pressure control, smoking cessation, moderated alcohol consumption, and engagement in regular physical activity each contribute substantially to reducing the incidence and recurrence of stroke. These lifestyle interventions not only directly lower individual risk but also yield broad societal benefits, underscoring the importance of public health policies that promote healthy living environments, access to preventive healthcare, and community-based education initiatives.

Pharmacological therapies provide critical support, particularly for high-risk individuals, and are essential components of secondary prevention strategies. The use of antiplatelet agents such as aspirin and clopidogrel, alongside anticoagulants like warfarin and direct oral anticoagulants, has significantly improved outcomes for patients at elevated risk of ischemic events. However, the success of pharmacological interventions relies heavily on appropriate patient selection, adherence to treatment, and ongoing monitoring to balance the benefits of stroke prevention against the risks of adverse effects such as bleeding. Tailoring therapeutic approaches based on individual clinical profiles, genetic factors, and comorbidities is increasingly recognized as best practice, supported by growing evidence from precision medicine research.

Ongoing research and continuously updated clinical guidelines continue to refine these preventive strategies, aiming to enhance efficacy, minimize harm, and expand equitable access to care across diverse populations. Achieving significant and sustained reductions in the global burden of stroke will therefore require a coordinated effort involving healthcare providers, researchers, policymakers, and communities. Future initiatives must prioritize not only the dissemination of evidence-based interventions but also address barriers to implementation, ensuring that effective stroke prevention is accessible, affordable, and sustainable for all populations.

Conflict of Interest

The authors declare no conflicts of interest.

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