RISK FACTORS FOR CEREBRAL STROKE

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Abstract. Stroke is a major global health problem with high rates of morbidity and mortality. Key modifiable risk factors include hypertension, diabetes mellitus, smoking, alcohol abuse, obesity, and atrial fibrillation, while non-modifiable factors comprise age, sex, and genetic predisposition. Hypertension and smoking remain the strongest predictors, and comorbid conditions significantly worsen prognosis. Effective prevention strategies targeting modifiable factors are crucial to reducing the global burden of stroke.

Epidemiological studies have identified a wide range of risk factors for stroke, which are of great importance in both primary and secondary prevention. Stroke risk factors can be divided into two groups: modifiable and non-modifiable. Modifiable risk factors include hypertension, diabetes mellitus, hypercholesterolemia, cardiovascular diseases, physical inactivity, atrial fibrillation, smoking, and alcohol consumption [41, 59]. Non-modifiable risk factors are fewer in number and include age, sex, race, and heredity [12, 52].

Constitutional Risk Factors for Stroke. Age is a powerful determinant of stroke, with the risk doubling every decade after the age of 55. Age can also be regarded as a marker for the duration of exposure to other risk factors [22, 23, 24, 54].

Moreover, stroke is increasingly being observed among younger populations worldwide, leading to serious physical, psychological, and social consequences. Among young individuals, the prevalence of obesity, physical inactivity, alcohol consumption, and dyslipidemia as risk factors has risen [5, 10, 27]. The incidence of hemorrhagic stroke is also higher among young and middle-aged individuals, resulting in increased mortality and disability rates. In fact, disability has been reported to increase up to tenfold [4, 6, 19]. On the other hand, improved diagnostic capabilities have also contributed significantly to the higher reported incidence of stroke in this population group [3, 25].

International studies confirm that certain risk factors predominate depending on age. For example, arterial hypertension is considered a major risk factor in middle-aged and elderly individuals; however, as age advances, the relative

importance of hypertension decreases, while other risk factors such as atrial fibrillation and atherosclerosis become more prominent [11, 26].

In older individuals, stroke is predominantly associated with atherosclerotic changes, accounting for up to 70% of cases. Reduced myocardial contractility is also of considerable importance, being observed in up to 50% or more of patients. Atrial fibrillation, in particular, has been documented in 90% of elderly patients [31, 33].

In acute cerebrovascular accidents, the second most important constitutional risk factor is sex [12, 56]. Many studies have reported that stroke occurs more frequently among men than women. According to meta-analysis results, stroke is 33% more common in men compared to women, confirming male sex as a reliable risk factor [2, 57]. However, certain characteristics show that the male predominance is greatest at ages 35–44 and declines by the age of 75 [43, 60].

Genetic predisposition. A family history of ischemic heart disease, stroke, or arterial hypertension is considered a significant cardiovascular risk factor. Having first-degree relatives with acute cerebrovascular disease increases the risk of stroke by 1.5–1.7 times compared with individuals without such family history [34, 63].

Modifiable risk factors for stroke. Arterial hypertension (AH) is the strongest modifiable risk factor for stroke. Patients with hypertension are 3–4 times more likely to develop stroke [7, 20]. Each 7 mmHg increase in systolic blood pressure above the age-adjusted norm doubles the risk of stroke [37]. According to a meta-analysis covering the period 1980–2002, the prevalence of hypertension in the adult global population was 26.4%. Predictive estimates suggest that by 2025 this figure will reach 60%, and the increasing prevalence of hypertension will significantly elevate the likelihood of stroke. Among stroke patients, hypertension is observed twice as frequently as in the general population [51].

Hypercholesterolemia, together with hypertension and smoking, has been proven to be a major modifiable risk factor contributing to cerebrovascular and cardiovascular diseases [18, 38, 44].

The impact of smoking on stroke incidence. Stroke among hypertensive smokers is twice as common compared to hypertensive non-smokers, regardless of nicotine dose. Furthermore, studies show that even after controlling for other risk factors, smoking independently increases stroke risk, particularly ischemic stroke. Stroke risk rises with the number of cigarettes smoked. The relative risk of stroke among "heavy smokers" (over 40 cigarettes/day) is twice as high compared to "light smokers" (<10 cigarettes/day). Smoking has been shown to increase the risk of subarachnoid hemorrhage (SAH) 2–4 times. Importantly, stroke risk declines after smoking cessation, decreasing within 2 years and equaling that of non-smokers after 5 years [48].

Diabetes mellitus (DM) is one of the major independent risk factors for both primary and recurrent stroke. Stroke incidence in men with diabetes is 1.5–4 times higher, and in women 2–6 times higher, compared to non-diabetic individuals of the same age [21, 50].

The prevalence of diabetes among stroke patients ranges from 11% to 43%, compared to 4–6% in the general population. In diabetic patients over 65 years of age, stroke is considered the second most common complication after ischemic heart disease. The importance of diabetes as a stroke risk factor has been steadily increasing worldwide in recent years. Among diabetic patients, lacunar ischemic stroke is the most frequent subtype. However, the risk of hemorrhagic stroke in diabetic patients does not significantly differ from that of the general population [47].

In patients with diabetes mellitus (DM), the course of stroke tends to be more severe and leads to worse outcomes. Stroke-related mortality among diabetic patients is 2–5 times higher compared to non-diabetic patients, both during hospitalization and in the long term. Individuals with diabetes demonstrate increased susceptibility to atherosclerosis, elevated levels of pro-atherogenic factors, and atypical lipid profiles. Understanding this interrelationship largely defines the strategies for both treatment and prevention [16].

Cardiac diseases of ischemic origin are also important risk factors for stroke. For instance, patients with cardiac arrhythmias have a 3.5-fold increased risk of stroke, while those with a history of myocardial infarction face a 2.9–5-fold higher risk [15]. Chronic or paroxysmal atrial fibrillation (AF), even in the absence of valvular heart disease, raises the risk of ischemic stroke 4–5 times. Thromboembolism due to AF accounts for about 10% of ischemic strokes, predominantly in the elderly. The presence of AF worsens stroke severity and prognosis. In some cases, AF is first diagnosed at the time of stroke onset [1, 14].

Among modifiable risk factors, obesity also plays a considerable role. Numerous studies have shown that increased body mass index (BMI) elevates the risk of cardiovascular diseases, including ischemic heart disease and stroke. However, in recent years, the assessment strategy for physical condition has shifted. It is now recognized that not only elevated body weight but also waist circumference (abdominal obesity) is a major determinant. A waist circumference greater than 80 cm in women and 94 cm in men is associated with arterial hypertension [40, 49], which itself is a leading risk factor for cardiovascular diseases. It should be noted that when obesity and body weight gain are studied as risk factors for stroke, emphasis is rarely placed on the specific type of cerebrovascular disease. This is due to the multifactorial pathogenic influence of obesity on stroke [8, 28, 36, 46].

Alcohol abuse is another established risk factor for both ischemic and hemorrhagic stroke. Alcohol negatively affects the cardiovascular system and

blood coagulation [55, 62]. There is evidence that small doses of alcohol may exert neuroprotective and cardioprotective effects due to antithrombotic properties; however, contrary to earlier assumptions, alcohol does not possess anti-atherosclerotic effects [42]. On the other hand, high alcohol intake has been consistently associated with a marked increase in both primary and recurrent stroke incidence. It has also been shown that the risk of subarachnoid and intracerebral hemorrhage is three times higher among alcohol abusers compared to non-drinkers [55]. Lifelong regular consumption of high doses of alcohol significantly increases the probability of ischemic stroke [13, 30].

The combined impact of multiple risk factors further increases the likelihood of stroke. Comorbidities are present in 74.5% of all stroke cases. Some authors report that the combination of hypertension and diabetes is observed in 22.7% of stroke patients. The coexistence of DM, post-infarction cardiosclerosis, and hypertension has been documented in 7.8% of cases. According to research findings, an increase in comorbidity burden is positively correlated with worse functional outcomes and higher mortality rates [39].

A number of other potential risk factors for stroke have been proposed, although they are less well documented. These include the use of oral contraceptives, vasculitis, inflammatory processes, migraine, sleep apnea, deficiency of prothrombin activator complex, hypotension, elevated C-reactive protein, and neurocysticercosis [9, 29, 32, 35, 58].

The rising incidence of stroke is closely associated with the population's insufficient awareness of stroke risk factors and their warning signs. Raising awareness about the risk factors leading to stroke encourages adherence to preventive measures, while knowledge of early symptoms facilitates timely hospitalization of patients in appropriate medical facilities [53, 61].

International studies have reliably demonstrated that 10 major risk factors account for 88.1% of all stroke cases. The key risk factors for all types of stroke include hypertension, smoking, abdominal obesity (waist-to-hip ratio), unhealthy diet, insufficient physical activity, diabetes mellitus, alcohol abuse, psychological stress and depression, heart disease, and dyslipidemia [17, 22, 23, 24, 45, 52].

Conclusion. Analysis of the scientific literature demonstrates that hypertension remains one of the leading stroke risk factors worldwide, regardless of racial differences. The future is expected to bring a further increase in stroke incidence, especially in high-risk countries, highlighting the urgent need to improve awareness of risk factors.

At present, it has been firmly established that preventing stroke is easier and more effective than attempting complete treatment after its onset. Therefore, stroke prevention strategies must focus on reducing modifiable risk factors across society.

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