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Review article

The emotional stress and risk of ischemic stroke



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ABSTRACT

Stroke is the second leading cause of death worldwide, and the leading cause of acquired disability in adults in most regions. There have been distinguished modifiable and non-modifiable risk factors of stroke. Among them the emotional stress was presented as a risk factor. The aim of this review was to present available data regarding the influence of acute and chronic mental stress on the risk of ischemic stroke as well as discussing the potential pathomechanisms of such relationship. There is an evident association between both acute and chronic emotional stress and risk of stroke. Several potential mechanisms are discussed to be the cause. Stress can increase the cerebrovascular disease risk by modulating sympathetic activity, affecting the blood pressure reactivity, cerebral endothelium, coagulation or heart rhythm. The emotional stress seems to be still underestimated risk factor in neurological practice and research. Further studies and analyses should be provided for better understanding of this complex, not fully known epidemiological problem.

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1. Introduction

Stroke is the second (after ischemic heart disease) leading cause of death worldwide, and the leading cause of acquired disability in adults in most regions. There have been distinguished modifiable and non-modifiable risk factors of stroke. Among them the emotional stress was presented as a risk factor. The aim of this review was to present available data regarding the influence of mental stress on the risk of ischemic stroke including the potential pathomechanisms.

The modifiable risk factors of stroke account for 88.1–90.3% of the population-attributable risks (PAR) for the association of all strokes. The most important risk factors of

ischemic stroke described as PAR are the hypertension, lack of regular physical activity, ratio of ApoB to ApoA1 apolipoproteins and waist-to-hip ratio. As presented in the INTERSTROKE multicenter study, the psychosocial factors also may increase the risk of ischemic stroke. The psychosocial stress described as a combined measure of general stress at home and in the workplace (permanent or several periods of stress vs. no or some periods of stress in the past year) was responsible for ischemic stroke risk increase (OR 1.3, 99% CI: 1.04–1.62), PAR value was calculated as 4.7%. Depression defined as feeling sad, blue, or depressed for two or more consecutive weeks during the past 12 months also modified the risk (OR 1.47, 99% CI: 1.19–1.83), PAR value was 6.8% [1].

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2. Chronic emotional stress

First report of chronic psychological stress affecting the risk of ischemic stroke was revealed in a year 1990, where during 11.8 years of follow-up in 9998 men the grade of psychological stress in the last 5 years increased the risk of stroke (OR 2.0, 95% CI: 1.3–3.2, adjusted for significant risk factors only) [2]. The protocol of this report included the 5-years-lasting period of experienced stress (never or permanent) with definition of stress as a feeling of tension, anxiety and irritability. The answers were marked in a postal questionnaire by participants that might have led to not fully objective conclusions.

The association between self-reported stress frequency and intensity and risk of stroke was evaluated in a 13 years-lasting follow-up of 12,574 patients. Subjects with high stress intensity had almost a doubled risk of fatal stroke compared with subjects who were not stressed (relative risk 1.89, 95% CI: 1.11–3.21). Weekly stress was associated with an RR of 1.49 (95% CI: 1.00–2.23). There was no significant effect of stress in analyses of nonfatal strokes [3]. The definition of stress was partially different from the latter, i.e. tension, impatience, anxiety, sleeplessness. The presence of chronic stress in a 8.5-years follow-up was not related to increased risk of ischemic stroke, but a relationship was observed when highest-scoring group was compared to a lowest-scoring one (HR 1.59, 95% CI: 1.11–2.27) [4]. Another cohort study of 93,676 postmenopausal women in a follow-up to 18 years analyzed the score of stressful life events and their impact on the mood, additionally the social strain was evaluated as the measure of negative aspects of social relationships. The high social strain group was at higher risk of incident ischemic stroke when compared to low-risk group (HR 1.15, 95% CI: 1.02–1.28). On the other hand there was no association between risk of ischemic stroke and stressful life events [5]. In a follow-up of 6019 participants lasting for 16 years it has been shown that higher levels of anxiety symptoms were associated with higher risk of stroke (both ischemic and intracerebral hemorrhage). Findings suggested a dose–response relation, with every 1 SD increase in anxiety associated with a 17% increase in stroke risk when adjusting for demographic factors [6]. The investigation of only one factor such as anxiety indicates on the mental health well-being as the significant factor in the stroke pathogenesis, but should be distinguished from the stress as a general term. On the other hand anxiety may be more precisely defined and compared between researches with the use of neuropsychological tests. The high score of life events questionnaire and stressful habits were connected with higher risk of stroke in a case–control study on 150 stroke patients [7]. Even though there was relatively small sample size presented in this study, it should be noted that precise and clearly described methods were used in the research protocol such as Holmes & Rahe questionnaire of life events, recall scale of type A behavior (ERCTA), Quality of Life scale (SF12) and general health questionnaire (GHQ28).

There is an association between psychological distress and risk of death due to cardiovascular disease (ischemic heart disease and cerebrovascular disorders). In a total number of 68,652 participants, relative to those with no symptoms of psychological distress at baseline, people with psychological

distress had an increased risk of death from cerebrovascular disease (HR 1.66, 95% CI: 1.32–2.08) [8]. In a cohort study of 237,879 males the association of stress resilience in adolescence with subsequent stroke risk was investigated. Lowest stress resilience compared with the highest was associated with increased stroke risk, producing unadjusted HR of 1.54 (95% CI: 1.40–1.70). The results were consistent when stroke was subdivided into fatal, ischemic and hemorrhagic, with higher magnitude associations for fatal rather than non-fatal, and for hemorrhagic rather than ischemic stroke [9]. In a population-based study conducted on 4120 aged 65 and older participants the psychosocial distress was investigated in relation to stroke mortality and incident stroke over 6 years of follow-up. Psychosocial distress was an analytically derived composite measure of depressive symptoms, perceived stress, neuroticism, and life dissatisfaction. Adjusting for age, race, and sex, the hazard ratio (HR) for each 1 SD increase in distress was 1.47 (95% CI: 1.28–1.70) for stroke mortality and 1.18 (95% CI: 1.07–1.30) for incident stroke. Associations were reduced after adjustment for stroke risk factors and remained significant for stroke mortality (HR 1.29, 95% CI: 1.10–1.52) but not for incident stroke (HR 1.09; 95% CI: 0.98–1.21). Secondary analyses of stroke subtypes showed that distress was strongly related only to incident hemorrhagic strokes, but not ischemic strokes in fully adjusted models [10]. The variability of results in the sub-types of strokes may result from different pathogenetic background in the particular types of cerebrovascular episodes, thus we concentrate on the ischemic stroke. In the preceding year before stroke only the long-term severely threatening events were more often in 113 stroke patients compared to controls (26% vs. 13%, OR 2.3, 95% CI 1.1–4.9). Non-threatening events, events with only a short-term threat and difficulties were not increasing the risk of stroke [11].

Not only the stress assessed in a longer period, but also the neighborhood may affect the risk of stroke as shown in a study of 5789 participants. Neighborhood-level social cohesion measured by using the self-assessment protocol describing the selected aspects of neighborhood interactions. A higher score of calculated cohesion level was an independent factor reducing the stroke mortality. Each point of this calculated score was responsible for 53% reduction of stroke mortality (HR 0.47, 95% CI: 0.26–0.86). On the other hand there was no such an effect in relation to stroke incidence [12]. The socioeconomic status affects the risk of ischemic stroke by increasing the risk of incident ischemic stroke in the most disadvantaged neighborhoods among whites, but not among blacks [13]. There are also differences in stroke mortality rates depending on the level of poverty, education, population density, population mobility and race/ethnicity pattern [14]. Such observations may be connected with stress, but what is more likely – with the lifestyle, medication use and access to healthcare providers. This example indicates on a complex impact of the stress in the stroke pathogenesis and possibility of both direct and indirect impact on the risk of stroke. Supporting such a thesis it may be mentioned that the grade of socioeconomic status is associated with the major risk factors of stroke [15].

We presented different aspects of chronic stress affecting the risk of stroke. Another type of stressful factor is the workplace environment as a growing number of population

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