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Causes of Decreased Consciousness in Patients with Intracerebral Hemorrhage Stroke

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ABSTRACT

Background: Intracerebral hemorrhagic stroke is a focal or general neurological deficit that occurs suddenly within seconds or hours caused by a rupture of intracerebral blood vessels. Intracerebral hemorrhagic stroke is a type of hemorrhagic stroke that has a high mortality rate of 50% in the first month after the attack and only 20-25% can live independently within 6 months. In China, the incidence of ICH has increased from 8.6 per 100,000 people per year to 161 per 100,000 people per year. ***Objective:*** This study aims to determine the factors that play a role in decreased consciousness in patients with intracerebral hemorrhage stroke. ***Method:*** In this literature Using the PubMed database and Web of Science, this literature review examines research published between 2008 to 2024. ***Result:*** The causes of decreased consciousness in individuals with intracerebral hemorrhagic stroke were identified in this literature review. Most adult hemorrhages are caused by hypertension. In people who are more vulnerable, bleeding can be caused by arteriovenous malformation (AVM) and cerebral amyloid angiopathy (CAA). Furthermore, there are risk factors that are both modifiable and nonmodifiable.

Keywords: decreased consciousness; intracerebral hemorrhage; risk factors.

INTRODUCTION

Hemorrhagic stroke is a focal or general neurological deficit that occurs suddenly or abruptly within seconds or hours caused by the rupture of an intracerebral blood vessel [1]. Intracerebral hemorrhagic stroke is a type of hemorrhagic stroke that has a high mortality rate, reaching 50% in the first month after the attack and only 20-25% can live independently within 6 months [2]. Many factors including hypertension, cerebral amyloid angiopathy (CAA), cerebral vascular malformations, tumor, aneurysms, the size of the bleeding area, and other causes, may contribute to decreased consciousness[3]. This review summarizes the current knowledge about risk factors for decreased consciousness in patients with primary intracerebral hemorrhage stroke.

METHODS

In this literature Using the PubMed database and Web of Science, this literature review examines research published between 2008 to 2024. The same inclusion and exclusion criteria were then used to screen these mentioned papers.

REVIEW

Epidemiology

According to the meta-analysis's result, the annual incidence of ICH remained constant at 29.9 per 100,000 people per year, which did not decrease. In China, this figure increased from 8.6 per 100,000 people per year to 161 per 100,000 people per year. Compared to other continents, Asia has a greater incidence of ICH. The most prevalent site for ICH is the basal ganglia, and men are more likely than women to encounter it. Regarding risk factors, cardiac disease and excessive alcohol use are the next most common causes of ICH, after hypertension[4].

Etiology

(1) Hypertension

The most frequent cause of spontaneous ICH in adults is hypertension. Blood pressure in small arteries that emerge from cerebral vasculature is

related to the process. In response to hypertension, small vessels can develop intimal hyperplasia, intimal hyalinization, and medial degeneration, which are triggers for focal necrosis and rupture [5]. High blood pressure over a long period of time will damage the walls of the arteries, causing the artery walls to become more easily widened, narrowed, or even ruptured [6].

(2) Cerebral amyloid angiopathy (CAA)
CAA is a common cause of intracerebral hemorrhage in old age due to the deposition of amyloid-β in cortical arteries [7]. Although the exact mechanism of deposition is still unclear, certain alleles of the apolipoprotein E gene and mutations in the amyloid precursor protein seem to be linked to it [5].

(3) Arteriovenous malformation (AVM)
AVMs are rare in ICH and are usually more common in young patients. The mortality rate of ICH patients with AVMs is lower compared to ICH without AVMs. It is believed that the hematoma due to rupture of the AVM is only on the side of the vein that is malformed so that the brain parenchyma can still be saved and has the potential to provide a better outcome [8].

(4) Neoplasm
Glioblastoma multiforme is the most prevalent type of malignant glioma, and acute bleeding is a symptom of it. Intracerebral metastases can also cause bleeding. Choriocarcinoma, melanoma, thyroid, renal cell, breast, and lung cancers are the most frequent causes [9].

(5) Cerebral aneurysm
Aneurysm is common in SAH cases. Aneurysmal bleeding ICH without SAH occurs due to the rupture of an aneurysm that leads to or is embedded in the cerebral parenchyma. Patients with SAH accompanied by ICH due to rupture of aneurysm have worse outcomes with mortality rates reaching 38% to 58%. Data on cases of ICH with aneurysm are rare. Aneurysm in ICH can occur in the middle anterior cerebral artery (MCA), distal anterior cerebral artery (ACA), internal carotid artery (ICA), and rarely in the posterior circulation (PC)[10].

Pathophysiology
Chronic hypertension causes smooth muscle cell proliferation, and smooth muscle cell necrosis, which is eventually replaced by collagen that is structurally stiff and fragile compared to normal vessel wall elements. The affected arterioles will dilate and form Charcot Bouchart aneurysms. If the thin-walled vessels are exposed to high pressure, they will rupture. The rupture of intracerebral vessels due to microaneurysms or arteriosclerosis is still debated [3].

The accumulation of amyloid-β peptide in capillaries, arterioles, and small and medium-sized arteries in the cerebral cortex, leptomeninges, and cerebellum is referred to as cerebral amyloid angiopathy (CAA). Age-related changes in the genes encoding apo lipoprotein E epsilon 2 and 4 on chromosome 19 are linked to CAA in cerebral blood arteries [11].

Risk factors

A. Nonmodifiable ICH risk factor

• Age
Stroke is becoming more prevalent as people age, and its incidence doubles every ten years [12]. ICH patients are 53 years old on average [13]. According to a Chinese study, younger ICH patients had higher BMIs and white blood cell counts than older patients. Secondary ICH usually occurs higher in younger patients [14].

• Race
Blacks have twice the risk of stroke. Compared with whites, stroke mortality is higher in blacks. Blacks are associated with better functional outcomes than whites [15]. Research conducted in the United States states that black, Hispanic, Asian, or Pacific Islander patients have higher rates of complications in hospitals and hospital costs compared to white patients. While white patients have higher mortality rates [16]. Further research is needed regarding the differences in intracerebral hemorrhage based on race to make it easier for medical personnel to provide therapy.

• Sex
At a young age, women have higher risk factors compared to men. At an older age, men have relatively higher risk factors than women. This is related to pregnancy and postpartum conditions and hormonal factors such as the use of hormonal contraception. Research conducted in 8 countries in Europe showed that the risk of stroke increased by 9% per year in men and 10% per year in women [12]. Young and female patients have protective characteristics, but at the age of over 60 years, the incidence rate becomes the same as in men [16]. In another study, it was mentioned that men experience spontaneous intracerebral hemorrhage more often than women. The prevalence of events in men is also related to younger age and experiencing internal bleeding more often than women. This is influenced by various risk factors that can contribute to the occurrence of ICH [17].

• Gen
Individuals who have siblings with a history of ICH will increase the risk of ICH two-fold in the individual. A family history of ICH can increase the risk of developing ICH six-fold. The gene that plays a role is APOE on chromosome 19 and encodes a polymorphic glycoprotein involved in lipid transport and metabolism, and maintaining cell membranes. APOE * ε4 plays a role in cerebrovascular amyloidosis, CAA will accumulate in the walls of medium and small meningeal and cortical blood vessels, this will cause blood vessels to swell and increase the risk of rupture [18].

B. Modifiable ICH risk factor

• Hypertension
Blood pressure will increase with age. Someone aged ≥ 65 years more than two-thirds suffer from hypertension. Hypertension is a risk factor for primary ICH. Good hypertension control and selection of treatment can reduce the prevalence of hypertension.

In addition to treatment and control of hypertension, sufferers are encouraged to make lifestyle changes such as changes in diet and increased physical activity to reduce the impact of hypertension [12]. High blood pressure increases the risk of blood vessels in the brain rupturing. This also triggers an increase in the size of the hematoma [13].

(1) Diabetes mellitus

Diabetes can double the risk of stroke and contribute to 20% of deaths. Prediabetes can also increase the risk of stroke. Behavioral modification and medical therapy in people with diabetes can reduce the risk of stroke [12].

(2) Smoke

Nicotine through α7-nAChR agonist (α-7 nicotinic acetylcholine receptor agonist) has a function as a potential neuroprotective agent that mediates the cholinergic anti-inflammatory pathway. This can reduce nerve cells and inflammatory cell infiltration into the perihematomal area with sensorimotor and survival outcomes [19]. Although an increased risk of stroke is associated with smoking, it is less well-known that there is sufficient scientific evidence to show a strong relationship between smoking and stroke risk [20].

(3) Dyslipidemia

Total cholesterol plays a role in maintaining the integrity of the blood vessel wall. As a result of low total cholesterol levels can cause smooth muscle cell necrosis. Cholesterol levels affect platelet activation factors, hypocholesterolemia can cause decreased platelet aggregation which can contribute to increased ICH size [21].

(4) Alcohol

Alcohol consumption in large amounts and for a long time can increase blood pressure. Alcohol can increase the activity of the sympathetic nervous system and the renin-angiotensin-aldosterone system and increase the contractile response to vasoconstrictor agents such as noradrenaline, phenylephrine, and endothelin-1. Alcohol increases the formation of reactive oxygen species (ROS) and promotes oxidative stress that causes endothelial dysfunction. Increased and uncontrolled blood pressure causes rupture of small blood vessels in the brain. Alcohol also causes liver dysfunction and vitamin K malabsorption which inhibits platelet segregation and increases fibrolysis that triggers bleeding tendencies [22].

Clinical manifestations

Most ICHs can occur during physical activity. Neurological symptoms worsen within minutes or hours. Clinical symptoms that usually occur in patients with hemorrhagic stroke are focal neurological deficits with sudden onset, decreased level of consciousness, vomiting, headache, seizures, very high blood pressure, bradycardia, paralysis, vertical visual field paralysis, and nonreactive pupils. Sudden headache, vomiting, stiff neck, and increased blood pressure are neurological signs that develop rapidly and are common clinical manifestations of hemorrhagic stroke. Headaches generally occur in patients with large hematoma sizes due to traction of meningeal pain fibers, increased intracranial pressure, or blood in the cerebrospinal fluid. Vomiting is related to increased intracranial pressure. Patients with large ICHs may experience decreased consciousness due to increased intracranial pressure and compression of the thalamus and brainstem [11].

Medical management of ICH

ICH patients with decreased consciousness due to acute mass effect should be treated rapidly with hyperosmolar agents and external ventricular drainage should be placed as soon as possible. Hypertonic saline is poorly tolerated in patients with volume overload and monitors are contraindicated in patients with renal disease. Bleeding that occurs in the intraventricular can form a thrombus that blocks the channel resulting in hydrocephalus. This is a strong indication of external ventricular fibrillation (EVD) placement. Appropriate blood pressure control to reduce blood pressure rapidly without causing hypotension. Nicardipine is the initial treatment used. Avoid antihypertensive drugs that increase intracranial pressure such as hydralazine, nitroprusside, and nitroglycerin. The guidelines used are Interact 2 and ATACH2. The target SBP that must be achieved is <140 or <180 mmHg [23].

GCS

GCS (Glasgow Coma Scale) is the first assessment scale to assess the patient's level of consciousness. The GCS score can be used to evaluate the severity of brain injury. The assessments carried out are motor, verbal, and eye-opening responses. In 1974, neurosurgery professors Bryan J. Jenett and Graham Teasdale of the University of Glasgow's Institute of Neurological made a discovery of GCS. There are three scoring criteria on the GCS maximum eye-opening (E) 4 points, maximum verbal response (V) 5 points, and maximum motor response (M) 6 points. The scores are then added up to give a total score of 3 to 15 [24].

CONCLUSIONS

Intracerebral hemorrhage stroke (ICH) is a neurological deficit that occurs suddenly or suddenly within seconds or hours. The highest incidence of ICH occurs in Asia with the largest population being male. There are various etiologies such as hypertension which is the most common cause of ICH in adults, cerebral amyloid angiopathy (CAA), arteriovenous malformation (AVM) which is common in young patients, neoplasms, and cerebral aneurysms. The pathophysiology of ICH is still not fully understood because of the many risk factors that cause ICH to occur. Hypertension which is a risk factor for primary ICH causes smooth muscle cell proliferation, and smooth muscle cell necrosis, which is replaced by collagen tissue causing blood vessel dilation and forming an aneurysm. This aneurysm will make the blood vessels easily rupture. Other risk factors are divided into modifiable and non-modifiable.

Non-modifiable risk factors consist of age, gender, race, and genetics. Modifiable risk factors consist of hypertension, diabetes mellitus, smoking, dyslipidemia, and alcohol consumption. Clinical symptoms that often appear in ICH are sudden onset neurological decline, decreased consciousness, vomiting, headache, and seizures. Decreased consciousness due to the effect of mass pressure must be treated immediately. Bleeding that occurs in the intraventricular can be done by installing an external ventricle (EVD). Decreased consciousness can be measured by the Glasgow coma scale (GCS) which consists of eye-opening, verbal, and motor responses.

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