

BIDIRECTIONAL RELATIONSHIP BETWEEN HYPERTENSION AND NEUROLOGICAL DISORDERS

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Abstract: Hypertension and neurological disorders frequently coexist, suggesting a complex interplay. This abstract highlights the bidirectional relationship between these conditions. While hypertension is a known risk factor for various neurological disorders, including stroke and cognitive impairment, emerging evidence suggests that certain neurological conditions can, in turn, contribute to the development or exacerbation of hypertension. This review explores the mechanisms underlying this bidirectional relationship, including the role of inflammation, autonomic nervous system dysfunction, and shared risk factors. Understanding this complex interaction is crucial for improving prevention, diagnosis, and treatment strategies for both hypertension and neurological disorders.

Keywords: neurological complications, cognitive decline, hypertension, aneurysms, stroke, Alzheimer's disease.

Introduction: Hypertension is a significant public health issue in Uzbekistan. More than 1.78% of total deaths in Uzbekistan are from hypertension, obesity is one of the major cause of hypertension with the study of Uzbekistan health examination survey (UHEAS) 2758 men age 15-59 and 6102 women age 15-59. Over 31% of men and 29% of women are overweight or obese. Hypertension can lead to various neurological disorders including stroke (both hemorrhagic and ischemic), dementia and hypertensive encephalopathy, due to damage to brain blood vessels and tissue. It is a major risk factor for developing neurological abnormalities. Infact many hypertensive emergencies may also have a neurological presentation a very well known example of such scenario is hypertensive encephalopathy. Acute severe hypertension hypertension above a mean arterial pressure of approximately 150mmHg which exceeds the brain's capacity of auto regulation subsequently leading to increased cerebral blood flow and then to hypertensive encephalopathy. Stroke risk is increased 3-5 folds when their is an pathological effect of hypertension.

Chronic hypertension predisposes to cerebral vasculature atherosclerosis, luminal narrowing, impaired arterial relaxation, medial hypertrophy, endothelial dysfunction, and decreased ability to augment cerebral blood flow. Hypertension is a major factor for dementia and cognitive development through multifactorial mechanisms including cerebral small vessel disease, cerebral atrophy, cerebral microbleeds, neurofibrillary tangles, amyloid plaque deposition and white matter disease.

Hypertensive encephalopathy occurs when blood pressure exceeds the upper limit of cerebral autoregulation. A major risk factor for hypertensive encephalopathy is development of a hyperadrenergic state. A number of epidemiological studies have shown some association between rest leg syndrome and hypertension. Hypertension can also contribute to aneurysms which can rupture, causing bleeding in the space around the brain (subarachnoid hemorrhage). Cognitive and motor problems can also be caused due to periventricular white matter disease, which is due to damage caused by hypertension to small blood vessels.

Hypertension also worsens the Alzheimer's disease. Hypertension has also emerged as a pathogenic factor both in cognitive impairment on vascular bases and in Alzheimer's disease. As well as their are not any promising results shown by use of anti hypertensive medications for prevention of cognitive impairment. While the modern imaging techniques and various imaging modalities have an upper edge in finding link between neurovascular dysfunction and the pathobiology neurodegeneration like Alzheimer's.

cerebral circulatory insufficiency may cause non-systemic vertigo as a subjective equivalent of postural instability. Hypertensive retinopathy is also one of the major cause of the hypertension it causes retinal damage. retinal function is limited due to the damage caused to the retinal vasculature and optic nerve due to hypertension. Optic nerve is supplied by peripapillary choroidal vessels and posterior ciliary arteries. Hypertensive retinopathy is also very common in patients more than 40 years of age and its occurrence ranges between 13 to 15% According to world health organization (WHO) it is also a very severe complication.

Purpose of study: To determine the relationship between neurological complications and disorders with respect to hypertension. Finding out risk factors and predictors and exploring potential therapeutic targets, also a effective and comprehensive Can be provided by health care. As well as an complex interplay can be understood between cardiovascular and neurological systems.

Material and methods : On the basis of the Samarkand branch of the republican scientific center for Emergency medical care and the samarkand regional branch of the Republican specialized scientific and practical medical center of cardiology and internal medicine, a cohort study was performed on 196 patients with diagnosis of hypertension out of which 88 (45%) were male with average age of 40.5 years and 108 (55%) were female with an average age of 42.5 years. The diagnosis of hypertension in these patients were made on the basis of history and clinical signs and symptoms, most importantly ambulatory monitoring of blood pressure is done with brief recording of blood pressure over a certain time period. Follow up of all these patients were done routinely to check on the manifestation of neurological disorders. These patients were subdivided into groups according to the severity of the hypertension. group 1 consist of 55 patients (28%) with grade 1 hypertension, out of 55, 30 (55%) were male and 25 (45%) were female. Group 2 consist of 62 patients (32%) with grade 2 hypertension, out of which 25 (40%) were male and 37 (60%) were female. Group 3 consists of 79 (40%) Patients with grade 3 hypertension out of which 33 (42%) were male and 46 (58%) were female. The diagnosis of various neurological disorders due to hypertension such as stroke (both hemorrhagic and ischemic), dementia, hypertensive encephalopathy, due to damage to brain blood vessels and tissue, restless leg syndrome (RLS), cerebral small vessel disease, cerebral atrophy, cerebral microbleeds, neurofibrillary tangles, amyloid plaque deposition, white matter disease. Were done on the basis of various imaging techniques such as MRI (magnetic resonance imaging), CT (computed tomography) scan, PET (positron emission tomography) scan, SPECT (single photon emission computed tomography), EEG (electroencephalography), fMRI (functional magnetic resonance imaging), cerebral angiography, MRS (magnetic resonance spectroscopy). As well as several hematological parameters were considered accordingly. A statistical analysis was also done to compare the occurrence of neurological disorders in patients of hypertension with their severity accordingly in order to analyze the proper preventive measures and precautions. Severity of the neurological complications were also analyzed according to the respective protocol.

Results: in group 1 patients which were having hypertension of grade 1 severity, did not shown any neurological disorder or not even any neurological manifestations, except a 55 year old male with a past history of stroke, suffered from a subarachnoid hemorrhage. Which suggests that patient with past history of stroke, irrespective of severity of hypertension is at high risk of having a recurrent attack of stroke and is to be managed with intensive care, proper treatment protocol. In group 2 patients which were having hypertension with grade 2 severity, 15 patients (24%) have shown neurological complications out of which

10 patients (67%) were male with an average of age of 42.5 years .and 5 patients (33%) were female with an average of age of 43.5 (08%) patients were shown to have white matter hyperintensities out of which 3 were male with average age of 41 years and 2 were female with averageage of 43 years. White matter hyperintensities are associated with increased risk of cognitive impairment, hyperintensities were due to ischemia (reduced blood flow) associated with cerebral small vessel disease. Which was further confirmed by CT angiography and MRI scan. 6 (9.5%) patients were shown to have cognitive decline. Out of 6 patients 4 were male with average age of 45.5 years and 2 were female with average age of 44.5 years. In group 2, 3 patients were already having a history of Alzheimer’s disease out of 3 all 3 (100%) patients condition got worsened due to the hypertension, no link was found in relieve of Alzheimer’s after the initial therapy with antihypertensive medications. Worsening of condition was determined on the basis of symptoms. In group 2, 4 patients (6.5%) had a stroke, out of which 3 were male and one was female. Group 3 consist of patients with hypertension of grade 3 severity 60 patients (76%) shown up with neurological complications out of which 28 patients (47%) were male with an average age of 43.5 years and 32 patients (53%) were female with an average age of 42 years. In 12 patients (20%) were diagnosed with hypertensive encephalopathy with symptoms such as visual disturbances, altered mental status, headache, nausea, vomiting. Out of the 12 patients 7(58%) were female and 5 (42%) were male. 8 patients (13%) shown cognitive decline out of which 4 patients (33%) were already diagnosed with Alzheimer’s disease and subsequently their symptoms got worsened. 9 patients (15%) shown hypertensive retinopathy due to damage to retinal circulation. 10 patients (17%) had stroke, all the stroke were hemorrhagic stroke. Out of the 10 patients 6 (60%) were male and 4 (40%) were female. Stroke was shown to be the most severe complication with very high risk of mortality. 6 patients (10%) shown aneurysm in brain due to weakening of blood vessel wall due to hypertension. And rest 15 patients (25%) patients shown various neurological symptoms such as dementia, visual disturbances, headache, confusion. And our of the 15, 5 (33%) patients had episodes of seizures.

Groups	Severity	Number of patients shown neurological complications (%)	Total number of patients in each group
Group 1	Grade 1	0	55
Group 2	Grade 2	24%(15 patients)	62
Group3	Grade 3	76%(60 patients)	79

Conclusion: As a result of the study it can be concluded that the risk of developing neurological complications and severity of the hypertension are in direct proportion.the patient with grade 3 severity are at very high risk of developing neurological complications which is about 75%. Patient with grade 1 severity have very little risk of developing neurological symptoms until they do not have a previous history of stroke, Alzheimer’s disease or any other neurological complications. Patient with grade 2 severity also have risk of developing neurological complications which is about 25%. most major and the severe complications seen the patient were of hemorrhagic stroke having very high mortality. Cognitive decline is also very common and appeared mainly in patient with grade 2 and grade 3 severity. Major complications such as hypertensive encephalopathy, hypertensive retinopathy, and development or rupture of aneurysms were mainly seen in grade 3 hypertensive patients. Worsening of symptoms of Alzheimer’s disease are seen in all 3 groups irrespective of severity and no link was found between antihypertensive medications use and relieve of symptoms of Alzheimer’s disease.

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