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To Evaluate the Severity of Hypertensive Retinopathy in Patients with Stroke and Hypertension Using Keith-Wegener-Barker (KWB) Classification

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ABSTRACT

Stroke is a significant global health problem and a major cause of morbidity and mortality in developed countries. Hypertensive retinopathy is associated with other indicators of end-organ damage and may be a risk marker of future clinical events like stroke, CHF and CV mortality. This study aims to evaluate the severity of hypertensive retinopathy in patients with stroke and hypertension using Keith-Wegener-Barker (KWB) classification. A retrospective, Observational study was carried out between February 2023 and September 2024 including 50 consecutive patients of stroke admitted in a corporate hospital of Central Gujarat. All patients underwent dilated fundus examination using indirect ophthalmoscope and +20 D lens for presence of hypertensive retinopathy changes. Grading of retinopathy was done using Keith-Wegener-Barker classification. Total 50 patients of stroke were enrolled in the study. Out of these patients, 35 were male and 15 were female. Of the 50 patients, 35 (70%) patients had ischaemic stroke, 12 (24%) patients had hemorrhagic stroke and 3 (6%) patients had unclassified stroke. Two (4%) patients were diagnosed to have grade IV retinopathy, 8 (16%) patients had grade III retinopathy, 22 (44%) patients had grade II retinopathy, 13 (26%) patients had grade I retinopathy and 5 (10%) patients had no retinopathy. Patients with stroke and hypertension have significant changes in both sclerotic phase (grade I and II) and in break down phase (grade III and IV).

INTRODUCTION

Stroke is a significant global health problem and a major cause of morbidity and mortality in developed countries^[1]. Stroke is the fourth leading cause of death in India and fifth leading cause of disability^[2]. Hypertension represents the first risk factor for stroke and that prevention of stroke benefits the most from blood pressure lowering^[3]. The risk of developing stroke in an individual can be assessed by assessing the cerebral vasculature. However, assessment of cerebral vasculature required highly specialized and expensive equipment and are not suitable for widespread screening of patients^[4]. A simple, non-invasive, inexpensive and more suitable technique is required for evaluating the risk of developing stroke in individuals with hypertension. Retinopathy changes in the eye occur due to hypertension is a chronic process. This results from pathophysiological changes that occur in the retinal, choroidal and optic nerve circulation in response to elevated blood pressure (BP)^[5]. In patients with hypertensive stroke, there is tiny lipohyalinotic aneurysms formation called Charcot-Bouchard aneurysm along the lenticulostriate arteriole supplying the basal ganglia region which when rupture, resulting in intra parenchymal hemorrhage. Thus, contributing to the pathogenesis of the cerebral changes^[6]. Retinal and cerebral microvasculature share many physiological and morphological properties and both undergo morphological changes in context of increasing blood pressure^[7,8]. Hypertensive retinopathy has been suggested to be a significant sign of hypertensive target-organ damage and stroke risk prediction^[9,10]. The Keith-Wagener-Barker (KWB) classification system is the most classic classification method of hypertensive retinopathy and was first proposed for prognosticating survival and it is also the foundation of many other classification^[11]. Various studies have been carried out in supporting the evidence that hypertensive retinopathy as a risk factor for prediction of stroke in patients with hypertension. The purpose of this study is to evaluate the severity of hypertensive retinopathy in patients with stroke and hypertension using Keith-Wagener-Barker (KWB) classification.

MATERIALS AND METHODS

A hospital based retrospective observational study was carried out in a corporate hospital of Central Gujarat between February 2023 and September 2024. This study included 50 consecutive patients with stroke and hypertension admitted in the hospital.

Inclusion Criteria:

- All patients with stroke and hypertensive were included in the study.
- Hypertension was defined as systolic blood pressure (SBP) of 140mm Hg or higher, diastolic blood pressure (DBP) of 90mm Hg or higher or both.

Exclusion Criteria:

- Patients having diabetes.
- Patients with hyperlipidemia.
- Patients with history of alcohol and cigarette consumption.

All patients underwent necessary radiological examination to categorise them as cerebral infarct (thrombotic or embolic infarction), haemorrhagic stroke(subarachnoid or intracranial haemorrhage) and unclassified causes. Dilated fundus examination was done using indirect ophthalmoscope and +20D VOLK lens. Pupil was dilated using 0.8% tropicamide and 5% phenylephrine eye drops. The following retinopathy signs were documented: retinal haemorrhages (dot-blot and flame shaped), microaneurysms, soft exudates, hard exudates, macular oedema, intra retinal microvascular abnormalities, venous beading, new vessels at disc or elsewhere, disc oedema and laser photo coagulation scars. Severity of retinopathy was graded as no retinopathy, grade I, grade II, grade III and grade IV based on Keith-Wagener-Barker Classification system. Grade I retinopathy was defined as mild or moderate generalized arteriolar narrowing, arteriovenous tortuosity. Grade II retinopathy was defined as definite focal narrowing and arteriovenous nicking. Grade III was defined as signs of grade II retinopathy along with retinal hemorrhages, exudates and cotton wool spots. Grade IV retinopathy was defined as grade III retinopathy with papilloedema or/and retinal e\oedema. Data was entered and analyzed using EPI INFO6 Software Programme with internal consistency check.

RESULTS AND DISCUSSIONS

Table 1: Showing Distribution of Stroke Patients Based on Etiology

Etiology of stroke	Number of patients	Percentage
Ischaemic stroke	35	70%
Haemorrhagic stroke	12	24%
Unclassified stroke	3	6%

Total 50 consecutive patients of stroke and hypertension admitted to the hospital were enrolled in the study. Seventy percent of these patients were male. Out of these, 35(70%) patients suffered ischaemic stroke, 12 (24%) patients were diagnosed to have hemorrhagic stroke and 3 (6%) patients had unclassified stroke. (Table 1) shows the distribution of stroke patients based on etiology.

Table 2: Showing the Stroke Patients with Different Grade of Hypertensive Retinopathy

Grade of retinopathy	No. of patients	Percentage
No retinopathy	5	10%
Grade I retinopathy	13	26%
Grade II retinopathy	22	44%
Grade III retinopathy	8	16%
Grade IV retinopathy	2	4%

Apart from generalized arteriolar narrowing, the most common sign of hypertensive retinopathy was focal

arteriolar narrowing seen in 30 (60%) patients. Arteriovenous nicking was seen in 20 (40%) patients. Other signs (flame shaped hemorrhage, blot hemorrhage, retinal oedema and disc oedema) were seen in 12(24%) patients. (Table 2) shows the patients with severity of hypertensive retinopathy and stroke.

Table 3: Showing the Correlation Between Grade of Hypertensive Retinopathy and Different Etiologies of Stroke

Grade of retinopathy	Ischaemic stroke patients	Hemorrhagic stroke patients	Unclassified patients
No retinopathy	2 (4%)	2 (4%)	1 (2%)
Grade I	9 (18%)	2 (4%)	2 (4%)
Grade II	18 (36%)	4 (8%)	0
Grade III	5 (10%)	3 (6%)	0
Grade IV	1 (2%)	1 (2%)	0

We observed that, hypertensive retinopathy is more common in patients suffering ischemic stroke and least common in patients with unclassified stroke. Significant changes in retinal vessels are seen in stroke patients in both sclerotic (grade I and II) and break down phase (grade III and IV) stage of hypertensive retinopathy. (Table 3) shows the correlation between the grade of hypertensive retinopathy and stroke. This study aimed to evaluate the severity of hypertensive retinopathy in patients with stroke and hypertension. We found that males outnumbered females and similar findings were observed in other studies. However, the Shibata study^[12] and other study by Chen^[13] had a greater number of female patients with stroke and hypertensive retinopathy. This may be attribute to the fact that most men leave town due to work and female residents were easier to include in the study. There is a positive relationship of hypertensive retinopathy and incidence of first stroke^[13]. This may be attributed to the anatomical, physiological and embryological similarities between retinal and cerebral vasculature. According to embryology, the retina is an extension of the diencephalon and both retina and brain share a similar pattern of vasculature during development^[14]. Endothelial barrier in retinal and cerebral micro circulations have anatomically and physiologically similar functions^[15]. Microvascular damage in both retinal and cerebral circulation are caused by hypertension. In retinal circulation, the main manifestation in the sclerotic phase is tunica media hyperplasia, hyaline degeneration of the arteriolar wall and vessel attenuation, which may be associated with arteriovenous nicking and arteriolar tortuosity. Continuously raised blood pressure may lead to educative changes and blood retinal barrier breakdown, with fibrinoid necrosis, luminal narrowing and ischaemia. Similar changes also occur in the cerebral micro circulation, including hyaline arteriosclerosis, leading to luminal narrowing,

correlating to systemic hypertension. In our study, patients with hypertensive stroke had significant changes in retinal vessels in both sclerotic phase (grade I and II) and break down phase (grade III and IV).

CONCLUSION

In conclusion, retinal vascular changes, a chronic marker of hypertensive damage can be used as the predictor of risk for development of stroke in patients with hypertension. Changes of both sclerotic and breakdown phase of hypertensive retinopathy can correlate with the cerebral vascular changes occurring in hypertensive stroke patients.

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