



## ASSOCIATION BETWEEN RETINAL VASCULOPATHY AND CEREBRAL SMALL VESSEL DISEASE IN ISCHEMIC STROKE

### Neurology

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### KEYWORDS

Funduscopy, retinal vessel changes, MRI brain, small vessel disease.

#### INTRODUCTION:

Retina is the part of eye in continuation with the central nervous system. Blood supply of retina is similar to cerebrovascular system. Retinal vessel changes are more common in stroke patients. Assessment of correlation between retinal vessel changes and cerebral small vessel disease helps to predict ischaemic stroke events.

#### Aim:

To study the correlation between retinal vessel changes and cerebral small vessel ischemic changes in acute ischemic stroke patients.

#### Methods:

This is a prospective analytical study done in the stroke unit of Coimbatore Medical College Hospital in southern India. Retinal vessel changes were correlated with MRI brain.

#### Inclusion Criteria:

All patients presented with acute ischemic stroke were subjected to direct fundus examination and MRI brain.

#### Exclusion Criteria:

Patients who had retinal vessel changes due to non stroke causes were excluded.

#### Results:

In this study 124 patients with acute ischemic stroke were subjected to direct fundus examination. Mean age in males – 59.1 years (70.9%) Mean age in females - 62.7 years (29.1%). Fundus examination revealed arterial narrowing (91.9%-P<0.00001), Venous enlargement (40%-P<0.00001), Arterio-venous nicking (61.3%-P<0.00001), Retinal hemorrhage (17.7%-P<0.00001), Thrombosis (29%-P<0.00001), Exudate (12.9%-P<0.002), Micro-aneurysm (8.06%-P<0.00001), Disc changes (35.5%-P<0.00001), Macular changes (14.5%-P<0.00001), Foveal changes (4.8%-P<0.00001) Risk factors include Diabetes mellitus (83.9%-P<0.00001), Hypertension (83.9%-P<0.00001), Smoking (70.9%-P<0.00001), Alcohol (61.3%-P<0.00001), Dyslipidemia (70.9%- P<0.00001), Vasculitis (1.6%), Coronary artery disease (20.9%-P<0.00001), Anterior circulation stroke (70.9%), Posterior circulation stroke (29.1%-P<0.00001). MRI brain analysis showed small vessel disease changes (96.8%-P<0.00001). According to Fazekas scale for white matter disease grade-I (34%) grade-II (50.7%), grade 3 (12.3%). From this study it is evident that retinal vessel changes has the direct correlation with MRI small vessel ischemic changes (P<0.00001).

#### DISCUSSION

Retina is the innermost light sensitive layer of tissue of eye. The optics of the eye create a focused two dimensional image of the visual world on the retina, which translates that image into electrical neural impulses to the brain to create visual perception.

Fundus of the eye is the interior surface of the eye opposite the lens, and includes the optic disc, macula, fovea and posterior pole. Fundus can be examined by ophthalmoscopy or fundus photography. The fundus is the only part of the human body where the micro-circulation can be observed directly. Medical signs that can be detected through

observation of the fundus (generally by funduscopy) include hemorrhages, cotton wool spots, blood vessel abnormalities, such as arteriolar narrowing, venous dilatation and AV nicking (1).

The human retina is supplied by Central retinal artery and choroidal vessels, both of which arise from the ophthalmic artery. The inner retina is supplied by central retinal artery, which receives 20- 30 % of total ocular blood flow and enters the eye at the optic nerve head where it divides into two major branches. These branches divide into superior, inferior, nasal and temporal arterioles, which extends away from the optic disc to supply separate areas of retina.

Ischemic strokes are associated with decreased Fractal dimensions suggesting a loss of branching complexity (2).

Retinal micro circulation can be viewed non-invasively to give a unique perspective of the cerebral micro circulation. Studying the pathological changes of retinal blood vessels may help to understand the causes various cerebrovascular disorders (3).

Hypertensive retinopathy is damage to the retina and retinal circulation due to high blood pressure. Signs of damage to the retina caused by hypertension include arteriolar changes such as generalized arteriolar narrowing, focal arteriolar narrowing arteriovenous nicking, changes in the arteriolar wall (arteriosclerosis) and abnormalities at points where arterioles and venules cross. Manifestation of these changes include copper wire arterioles where the central light reflex occupies most of the width of the arteriole and silver wire arterioles where the central light reflex occupies all of the width of the arterioles and “arterio-venular nicking” or nicking” due to venous constriction and banking.

Diabetic retinopathy, also known as diabetic eye disease is a medical condition in which damage occurs to the retina due to diabetes mellitus. Signs include leaking blood vessels, retinal swelling, such as macular edema, pale fatty deposits on the retina (exudates) - signs of leaking blood vessels, any changes in the blood vessels. Advanced retinopathy lesions include micro-aneurysms, blot hemorrhages, ischemic changes (e.g. “cotton wool spots”), hard exudates and in severe cases swelling of the optic disc (optic disc edema), a ring of exudates around the retina called a “macular star” and visual acuity loss typically due to macular involvement.

Retinal micro vascular changes predicted subsequent vascular events after ischemic stroke, independent of traditional risk factors and stroke subtype. Thus retinal imaging has a potential role in predicting the risk if recurrent vascular events after ischemic stroke and in understanding novel vascular risk factors (4).

Fazekas's scale for white matter lesions is used to simply quantify the amounts of white matter T2 hyper intense lesions usually attributed to chronic small vessel is chemia. The scale divides the white matter in periventricular and deep white matter, and each region is given a grade depending on the size and confluence of lesions.

- Peri-ventricular white matter (PVWM)
- 0= absent

1=“caps” or pencil thin lining  
2= smooth halo  
3= irregular peri-ventricular signal extending into the deep white matter

• Deep white matter (DWM)

0= absent

1= punctuate foci

2= beginning confluence

3= large confluent areas

The common risk factors for ischaemic stroke were Diabetes, Hypertension, smoking, alcoholism, dyslipidemia and vasculitis.

This study revealed statistically significant changes in the retinal vessels including retinal arterial narrowing, venular dilatation, AV nipping, retinal hemorrhage, thrombosis, micro-aneurysm, cotton wool spots, disc, macular and foveal changes (4,5).

MRI brain revealed statistically significant small vessel ischaemic changes, according to Fazeka's scale for white matter disease grade-I (34%) grade-II (50.7%), grade 3 (12.3%).

Correlating the Fazeka's scale for white matter disease and retinal vessel changes in ischaemic stroke, retinal vessel changes are early marker of cerebrovascular ischaemic changes.

#### **CONCLUSION:**

This study concludes that retinal vessel changes have statistical significant association with cerebral small vessel ischaemic disease. Hence retinal vasculopathy are an early indicator of cerebrovascular ischaemic disease.

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