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Original Article

Histomorphometric study of basilar artery in normal and suicide persons

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ABSTRACT

Background: Depression in association with cerebro-vascular risk factors and white matter lesions is increasingly referred to as 'vascular depression'. There are several brain areas known for playing a role in patho-physiology of depression which may lead to suicidal tendencies, are fed by basilar artery. Therefore, the arterial histoarchitecture was studied in the normal and suicide individuals to establish a relationship between the vascular structural changes and depression.

Methods: 40 post-mortem samples (both sexes) of basilar artery have been collected and were grouped into normal and suicide groups. Samples were measured for arterial, lumen diameter and the thickness of tunica intima, media and adventitia using H & E stained sections. While, Orcein stained sections were used to estimate the volume fraction of elastic fibres, and Van Gieson stained sections to estimate the volume fraction of collagen fibres.

Results: The mean thickness of tunica media of basilar artery in suicide individuals (1.08 microns) showed a statistically significant decrease when compared to normal person (1.33 microns). Further, volume fraction of collagen (0.06 mm^3/mm^3) and elastic fibres (0.06 mm^3/mm^3) in suicide persons showed a statistically significant decrease when compared to normal person (collagen fibres 0.08 mm^3/mm^3; elastic fibres 0.09 mm^3/mm^3).

Conclusions: This study establishes a probable causative relationship between vascular structural abnormality and depression which may drive the individual to commit suicide.

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At a glance commentary

Scientific background

There are several brain areas known for playing a role in patho-physiology of depression which may lead to suicidal tendencies, are fed by basilar artery. Therefore, the arterial histoarchitecture was studied in the normal and suicide individuals to establish a relationship between the vascular structural changes and depression.

What this study adds to the field

This study does establish a probable causative relationship between vascular structural abnormality and depression. Till now this relation was more of hypothetical concept than the evidential concept from a scientific study. This study shows the structural alteration in an artery of an individual which may be responsible for neurodegeneration at a later stage.

Over the past 50 years, relationships between stress and the neurobiological changes seen in depressive disorders have been well-documented. Also, the depressive individuals commit suicide because of their inability to bear the stress, cognitive thought depressive symptoms of having hopelessness, worthlessness and helplessness is a fact well known. A majority of investigations in this area are focused to evaluate the role of different areas of brain which are supposed to play significant role in several depressive disorders. The areas which are proven in their role in depression are pre-frontal cortex, temporal cortex, superior temporal gyrus, thalamus, hypothalamic-pituitary-adrenal (HPA) axis, limbic areas, including the hippocampus and amygdaloid body [1–6].

It is also proved with consistent evidences that dysfunction of these areas are associated with cerebro-vascular disturbances which in turn increases the vulnerability for developing the major depressive syndrome. The function of these areas of brain may also be impaired in individuals who show grey matter volumetric reductions, histopathological abnormalities, and altered haemodynamic responses [3]. Some of these abnormalities are mood state-dependent, and appear in regions where cerebral blood flow increases during normal and pathological emotional states. It has also been proved beyond any doubt that cerebral blood flow increases in the different brain areas involved in depression [7].

However, the status of the histoarchitecture of the artery involved in the supply to the regions of the brain implicated in the depression is untouched. So, the present study is designed to evaluate the structural changes of the basilar artery as it supplies to those areas of the brain which are proved to be playing definitive role in depression.

Materials and methods

40 age matched post-mortem basilar artery samples were collected and grouped into two groups. One group (n = 20) of basilar artery is categorised as of normal persons which acted as control and another group (n = 20) of basilar artery as of suicidal persons with a history of depression. Cases with any type of head injuries were excluded.

The paraffin blocks of the basilar artery were processed by standard histological techniques [8]. 5 micron thick sections were cut using rotary microtome, 20–25 sections representing different regions of the artery were cut from each block and used for analysis.

Histological sections were stained with Hematoxylin–Eosin (H & E) for measuring arterial, lumen diameter and the thickness of tunica intima, media and adventitia. While, Orcein stained sections were used to estimate the volume fraction of elastic fibres and Van Gieson stained sections were used to estimate the volume fraction of collagen fibres. Histological evaluation was performed using a light microscope (Olympus Magnus – MLX) and digitized images of all the sections with various magnifications were obtained. The thicknesses of different layers of the artery were measured using commercial image analysis software (Digimizer image analysis software Version 3.6.0). Apart from this, volumes fraction of elastic and collagen fibres were estimated by point count method using eye piece graticule calibrated with the Digimizer image analysis software.

All the data was computed and the mean, standard error were calculated and Student's t-test were performed to know the level of significance using Microsoft excel (version MS office 2003). The $p < 0.05$ is considered as statistically significant.

Results

Thickness of tunica intima, media and adventitia

The mean thickness of tunica intima of basilar artery of normal persons was found to be 0.12 microns, of tunica media was 1.33 microns and of tunica adventitia was 0.81 microns. While the mean thickness of the tunica intima of basilar artery of suicide persons was 0.11 microns, the tunica media was 1.08 microns and that of tunica adventitia was 0.77 microns. Though all the results were indicative of decreased trend in the thickness, the tunica media of the suicide persons showed statistically significant decrease ($p < 0.05$) in thickness when compared to that of the tunica media of the normal persons [Table 1; Fig. 1].

Arterial and lumen diameter

The mean value of arterial diameter of normal person's basilar artery was 15.81 microns and lumen diameter was 12.84 microns. Further, the arterial diameter was found to be 15.10 microns and lumen diameter was 12.34 microns in the suicide persons. These results also reveal the decreased