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A Comparative Study of the Cerebrospinal Fluid -Albumin Levels in Normal Patients and in Patients With Systemic Hypertension

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**Core idea:** The main purpose of this study was to find the effect of systemic hypertension in blood-brain-barrier and indirectly csf-albumin levels. And its contribution as a predictor of Stroke in the future which mostly occurs due to disruption of BBB.

**Abstract**

**Aim:** To compare the Cerebrospinal fluid Albumin levels in normal patients and patients with systemic hypertension and hence to analyse the effect of systemic hypertension in the blood-brain-barrier. 

**Materials and methods:** The study was conducted in Chennai Medical College Hospital and Research Center, Irungalur, Trichy from May to June 2013. Hospital ethical committee approval was attained and informed written consent was also obtained from all patients participating in the study. All patients fulfilling inclusion and exclusion criteria were included in the study. Both hypertensive and normal patients undergoing sub-umbilical surgeries under subarachnoid block were included in the study after obtaining informed consent. 49 patients in each group, Group A included patients with systemic hypertension on treatment and Group B were normal patients without any co-morbid conditions. Under strict aseptic precautions lumbar puncture was done using 25 G Quincky needle and 0.5ml of CSF was collected in a sterile container and send for biochemical analysis. Patients who had traumatic tap were excluded from the study. CSF -albumin levels were calculated by immunodensitometric method and then were statistically analyzed using Chi-square test and Students–t Test.

**Results:** Demographic data was analyzed using Chi-Square test and found that there was not any statistical significance. While, CSF albumin levels in normal group was 137.25 ± 28.77 while it was 289.41 ± 54.05 in hypertensive group .This difference was statistically significant.

**Discussion:** The albumin in the blood reaches CSF through the process of diffusion\(^1\). This restricted exchange of materials between blood and perivascular and extravascular fluid is done through the blood-brain barrier in the central nervous system. Disruption of tight junctions in the BBB is the hallmark of not only many CNS patholgy but also systemic diseases\(^7\). One such diseases is systemic hypertension which brings about inflammatory changes in the body including neuro-inflammation. This not only causes disruption of BBB but also increases the Para cellular permeability i.e. bends without breaking them. This cellular change in the BBB due to hypertension may increase its permeability to albumin which in...
turn increases the CSF albumin levels. In our study, CSF albumin level was higher in hypertensive group compared to normal patients. This difference was statistically significant. This difference signifies the changes occurring in the BBB in hypertensive individuals which could lead to stroke in the future. Whether CSF albumin levels could be used as a predictor of stroke and its relation to years of hypertensive state are to be analyzed in our next study.

**Key words:** CSF Albumin levels; Blood-Brain-Barrier (BBB); Diffusion.

### INTRODUCTION

Cerebrospinal fluid is an ultra filtrate of plasma produced by choroid plexus which circulates in the subarachnoid and ventricular system. It is a dynamic and metabolically active substance which is closely connected to the brain and hence any variations in its composition indirectly reflect an alteration in the brain tissue. Therefore plays a vital role as a diagnostic aid in various infectious and non-infectious diseases. Its change in composition can occur in many systemic diseases as well. Of which, systemic hypertension needs a special mention. Pathological changes like increase in cerebral blood flow, acceleration of atherosclerosis, effect on cerebral auto regulation, increase in intracranial pressure causes alteration in CSF composition. This change is due to the increase in permeability of blood-brain-barrier in hypertension. Blood-brain-barrier (BBB) is a monolayer of cells that regulate passage of solutes between blood and brain. More than a physical barrier it is viewed as a regulatory interphase which controls passage of solutes across them. CSF - albumin is one such important component, which solely depends on diffusion of the BBB to reach the CSF. It is purely a blood derived protein and normal range is 100-250mg/l. The study conducted by Ibrahim et al. demonstrated that CSF albumin levels are elevated in hypertensive rats. The aim of our study is to analyses the level of CSF-albumin levels in normal and hypertensive patients and its indirect relationship to the integrity of blood-brain-barrier.

### MATERIALS AND METHODS

The study was conducted in Chennai Medical College Hospital and Research Center, Irungalur, Trichy from May to June 2013. All patients fulfilling inclusion and exclusion criteria were included in the study.

**Inclusion criteria**
- Hypertensive patient on treatment
- Normal serum albumin levels
- Age > 35yrs

**Exclusion criteria**
- Age <35yrs
- CNS disorders
- Traumatic tap

Both hypertensive and normal patients undergoing sub-umbilical surgeries under subarachnoid block were included in the study after obtaining informed consent. Fifty (50) patients in each group, Group A included patients with systemic hypertension on treatment and Group B were normal patients without any co-morbid conditions.

**Preoperative period:**
All details were entered into the Performa attached. It included number of years of hypertension and drug therapy that patients were on. Patients were asked to continue anti hypertensive on the day of surgery.

**Intraoperative period:**
Under strict aseptic precautions lumbar puncture was done using 25 G Quincky needle and 0.5ml of CSF was collected in a sterile container and send for biochemical analysis. Patients who had traumatic tap were excluded from the study. CSF - albumin levels were calculated by immunodensitometric method and then were statistically analyzed.

**Post-operative period:** All patients were monitored up to two days in the post-operative period for PDPH.
RESULTS

Table 1. Sex distribution in Group A and Group B

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Chi-Square Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>29(59.2%)</td>
<td>20(40.8%)</td>
<td>0.8</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>27(55.1%)</td>
<td>22(44.9%)</td>
<td>(not significant)</td>
</tr>
</tbody>
</table>

Table 2. Height distribution in Group A and Group B

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>157.85</td>
<td>8.911</td>
<td>0.713</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>158.44</td>
<td>6.846</td>
<td>(not significant)</td>
</tr>
</tbody>
</table>

Table 3. Weight distribution in Group A and Group B

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>52.142</td>
<td>10.37</td>
<td>0.5</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>57.428</td>
<td>11.946</td>
<td>(not significant)</td>
</tr>
</tbody>
</table>

Demographic data including sex, height and weight were statistically analyzed. Sex difference between the two groups were analyzed using Chi-Square test while height and weight were analyzed using Students-t Test. All the above mentioned variables differences were not statistically significant.

Table 4. CSF Albumin levels in Group B and Group A

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>137.35</td>
<td>28.778</td>
<td>0.000</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>289.41</td>
<td>54.05</td>
<td>(significant)</td>
</tr>
</tbody>
</table>

CSF albumin levels in normal group was 137.25 ± 28.77 while it was 289.41 ± 54.05 in hypertensive group. This difference was statistically significant.

DISCUSSION

The cerebrospinal fluid proteins are derived from two major sources: 1. Brain, 2. Blood. Of which, albumin, which is a major fraction of CSF proteins originates from blood. Its level changes with respect to age. For example, at around birth, it is seen in highest concentration, by around 4 months of age, it decreases. Then again increases in juvenile age group. These changes are physiological and have valid causes like permeability of blood-brain-barriers (BBB), elongation of spinal cord etc. The albumin in the blood reaches CSF through the process of diffusion. This restricted exchange of materials between blood and perivascular and extravascular fluid is done through the blood-brain barrier in the central nervous system. These are high resistance electrical tight junctions. These BBB are very different from other tissue barriers in the body. Disruption of tight junctions in the BBB is the hallmark of not only many CNS pathology but also systemic diseases. One such disease is systemic hypertension which brings about inflammatory changes in the body including neuro-inflammation. This not only causes disruption of BBB but also increases the Para cellular permeability i.e. bends without breaking them. This cellular change in the BBB due to hypertension may increase its permeability to
albumin which in turn increases the CSF albumin levels. In our study, CSF albumin levels in normal group were 137.25 ± 28.77 while it was 289.41 ± 54.05 in hypertensive group. This difference was statistically significant. This difference signifies the changes occurring in the BBB in hypertensive individuals which could lead to stroke in the future. Weather CSF albumin levels could be used as a predictor of stroke and its relation to years of hypertensive state are to be analyzed in our next study.

REFERENCES

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Competing interest / Conflict of interest
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