

# Role of optic nerve sheath diameter measured by ultrasonography in the detection of increased intracranial tension in patients with tuberculous meningitis

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## Abstract

**Introduction:** The diagnosis of elevated intracranial pressure (ICP) is both challenging and critical, because prompt recognition and treatment are essential to prevent possible brain damage or death this study was done with an aim to see the role of ONSD by sonography in the detection of raised ICP. **Aim and Objective:** To see the role of ONSD by sonography in the detection of raised ICP. **Methodology:** All the patients with age in between more than 18 yrs, suspected of Tuberculous meningitis Patients who consented for study were included (Study group). While all the healthy persons with age more than 18 were included in the **Control group**. Graph Pad Prism software was used to calculate unpaired t- test. **Result:** In Study group, overall, mean ONSD was 5.81 mm $\pm$  0.42) and in Control was 4.85 mm $\pm$  0.42 this difference was statistically highly significant (t'-unpaired=11.04, df=103, p<0.001\*\*\*HS, (95%CI= .788 to 1.132). **Conclusion:** less invasive, easy method of ultrasonography can used to detect raised ICP especially in the TBM patients

**Keywords:** Optic Nerve Sheath Diameter (ONSD), Tuberculous Meningitis (TBM), Raised Intracranial Pressure (ICP).

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## INTRODUCTION

The diagnosis of elevated intracranial pressure (ICP) is both challenging and critical, because prompt recognition and treatment are essential to prevent possible brain damage or death. Optic nerve is surrounded by a dural sheath that can inflate in cases of raised pressure in the cerebrospinal fluid. An enlarged ONSD, measured using

ocular sonography, has been found in patients with raised intra-cranial pressure (ICP)<sup>1</sup>. Increased ICP is transmitted to the subarachnoid space surrounding the optic nerve, causing optic nerve sheath expansion<sup>2</sup>. Measurement of the optic nerve sheath diameter (ONSD) has been studied in postmortem specimens,<sup>3</sup> intrathecal infusion models,<sup>4</sup> children with ventriculoperitoneal shunts<sup>5</sup> and emergency department (ED) patients with head injuries<sup>6,7</sup>. This study was done with an aim to see the role of ONSD by sonography in the detection of raised ICP.

## AIM AND OBJECTIVE

To see the role of ONSD by sonography in the detection of raised ICP.

## METHODOLOGY

All the patients with age in between more than 18 yrs, suspected of Tuberculous meningitis Patients who consented for study were included. All suspected patients

were first examined by ultrasonography those patients showing  $\text{ONSD} \geq 5$  were referred for MRI, Fundoscopy to see for intracranial pressure (ICP) thus the patients with confirmed with raised ICP were included in **Study group**: Patients with history of ocular pathology like glaucoma/ocular trauma and past history of head injury/surgery/epilepsy/hydrocephalus and those who does not give consent and age less than 18 were excluded. While all the healthy persons with age more than 18 were included in the **Control group**: Graph Pad Prism software was used to calculate unpaired t- test.

## RESULT

**Table 1:** Distribution of ONSD in Study and Control Group

ONSD in Study Group (Mean $\pm$ SD) (N=35)		ONSD in Control Group (Mean $\pm$ SD) (70)	
Rt Eye	Lt Eye	Rt Eye	Lt Eye
5.94 mm $\pm$ 0.42	5.79 mm $\pm$ 0.45	4.11 mm $\pm$ 0.39	3.94 mm $\pm$ 0.41
Mean $\pm$ SD		Mean $\pm$ SD	
5.81 mm $\pm$ 0.42		4.85 mm $\pm$ 0.42	
SEM=0.0710		SEM=0.0502	

t'-unpaired=11.04, df=103, p<0.001\*\*\*HS, (95%CI= .788 to 1.132)

**Table1:** Shows distribution of the mean ONSD with standard deviations in Study group(N=35) was Rt eye was 5.94 mm  $\pm$  0.42 and in Lt Eye was 5.79 mm  $\pm$  0.45, overall mean ONSD was 5.81 mm  $\pm$  0.42 where as in control group (N=70), ONSD with standard deviations in Control group(N=70) was in Rt eye was 4.11 mm  $\pm$  0.39 and in Lt Eye was 3.94 mm  $\pm$  0.41, overall mean ONSD was 4.85 mm  $\pm$  0.42. Un-paired t test was applied to see the significance in difference in ONSD of Study and Control group, the value of t'-unpaired=11.04, df=103, p<0.001\*\*\* which is significant (95%CI=.788 to 1.132).

## DISCUSSION

Tuberculosis constitutes a large global burden of disease. Central nervous system (CNS) tuberculosis can manifest as meningitis, arachnoiditis, and a tuberculoma. TBM, being the most common form of CNS tuberculosis, remains a common serious neurological emergency, especially in the developing world. The rupture of a tubercle into the subarachnoid space leads to TBM (; the resulting hypersensitivity reaction can lead to an elevation of the ICP and hydrocephalus. TBM is typically a subacute disease with symptoms that may persist for weeks before diagnosis. Increased ICP is a common feature or complications of TBM, this raised ICP presents with various clinical forms like severe headache, diminished vision all these symptoms could be due to optic changes of raised ICP causing optic changes, this can be documented or confirmed by Fundoscope, but these changes occurs lately or some time may not be

detected, so in early stage a noninvasive technique like measuring ONSD is definitely a safe with less expensive but sensitive to screen for ICP. In our study we found that mean ONSD with standard deviations in Study group (N=35) was Rt eye was 5.94 mm  $\pm$  0.42 and in Lt Eye was 5.79 mm  $\pm$  0.45, overall mean ONSD was 5.81 mm  $\pm$  0.42 where as in control group (N=70), ONSD with standard deviations in Control group(N=70) was in Rt eye was 4.11 mm  $\pm$  0.39 and in Lt Eye was 3.94 mm  $\pm$  0.41, overall mean ONSD was 4.85 mm  $\pm$  0.42. Un-paired t test was applied to see the significance in difference in ONSD of Study and Control group, the value of t'-unpaired=11.04, df=103, p<0.001\*\*\* which is significant (95% CI= .788 to 1.132). This indicates clearly there is increased intracranial tension in patients with  $\text{ONSD} \geq 5.81$  mm  $\pm$  0.42. These findings are similar to Samira Parikh *et al* (2015)<sup>8</sup> they found The upper limit of normal ONSD was 4.37 mm in control group. Those patients with TBM had a mean ONSD of 5.81 mm (SD 0.42). These results confirm that patients with tuberculosis meningitis have an ONSD in excess of the control data ( $P < 0.001$ ). Ocular USG is extensively and safely used for ophthalmic evaluation after more than 20 years without specific contraindication, except for wounds of the ocular globe.<sup>8</sup> Multipurpose USG units with high-frequency transducers (>7.5 MHz), now available in most intensive care unit systems, have high lateral and axial precision.<sup>9</sup> There is increasing evidence suggesting that increase in the sonographic ONSD is related to and suggests raised ICP. It was shown during a lumbar intrathecal infusion test that maximal ONSD dilation was achieved at peak CSF pressure.<sup>10</sup> High ONSD values have been observed in children with clinical signs of high ICP during hydrocephalus or hepatic failure.<sup>11,12</sup> In adults with moderate traumatic brain injury, the ONSD correlates with signs of high ICP on CT scan.<sup>13,14</sup> Before Soldatos and colleagues' paper, however, only one clinical study had compared sonographic ONSD with invasive ICP, which remains the gold standard<sup>15</sup>

## CONCLUSION

It is clear from study this indicates clearly there is increased intracranial tension in patients with  $\text{ONSD} \geq 5.81$  mm  $\pm$  0.42, so less invasive, easy method of ultrasonography can be used to detect raised ICP specially in the TBM patients but it requires more extensive clinical trial to establish the actual sensitivity of the test to detect ICP.

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