INTRODUCTION
Papilledema, which is a bilateral swelling of optic nerve
head secondary to raised intracranial pressure, is a
visually restricting complication of numerous neurological
disorders.1 Idiopathic/benign intracranial hypertension
(BIH) previously known as Pseudotumor cerebri is an
important cause of papilledema which is characterized
by raised intracranial pressure in the absence of space
occupying lesion.2,3 The criteria for diagnosis of BIH was
introduced by Walter Dandy for the first time in 1985.4
Clinically, BIH affect young to middle aged, obese
ladies who present with headache and visual field
loss.5 Patients, who complain of intractable headache
and visual/visual field loss, are treated with oral
acetazolamide but progression or persistence of
symptoms merits surgical intervention. Persistent
headaches are treated with cerebrospinal fluid (CSF)
shunting procedures while progression of visual field
loss is an indication for optic nerve sheath fenestration.5,6

Lumbar puncture (LP) is the goldstandard method for
intracranial pressure (ICP) measurement but invasive-
ness of the procedure is associated with various
complications.7 Non-invasive methods for assessment
of papilledema as an alternative to ICP measurement
remained an area of interest over last few decades.8

Neuroimaging modalities like CT scan and MRI have
been used in diagnosing raised ICP as well as space
occupying lesions as primary cause, however, these
modalities are time consuming, expensive and not
readily available especially in a third world countries,
where the tertiary care facilities are out of reach for a
common man.9

Ocular ultrasonography for assessment of optic nerve
sheath diameter (ONSD) has recently been proposed as
an important indicator of raised ICP. Ultrasound can provide a reliable, non-invasive tool to measure optic nerve sheath diameter in monitoring
the patients with benign intracranial hypertension (BIH).

REFERENCES
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ABSTRACT
Objective: To compare the mean optic nerve sheath diameter (ONSD) in patients with idiopathic intracranial hypertension
(IIH) versus normal healthy individuals using B-scan ultrasonography as diagnostic tool.
Study Design: Cross-sectional analytical study.
Place and Duration of Study: Armed Forces Institute of Radiology and Imaging, Rawalpindi, Pakistan, from June to
December 2015.
Methodology: Participants aged 30 - 50 years were divided into two groups. Group A (GP) comprised of patients who
were diagnosed cases of idiopathic intracranial hypertension while normal healthy adults who volunteered to participate
in the study were included in Group B (GC). Ocular B mode ultrasound scan was performed on all the participants and
each eye was considered separately. The optic nerve head was visualized as a linear hypoechoic structure, and ONSD
was measured 3 mm behind the retina. A total of three readings were taken by the same radiologist and the average of
three was recorded. Mean values of both groups were compared by t-test with significance at p < 0.05.

Results: Fifty-two eyes of 26 patients (26 eyes in each group) were included in the study. Twenty-four out of 26 in
Group A (GP) and 23 out of 26 in Group B (GC) were females. Mean age of the patients was 33.92 ±4.89 years in group
A (GP) while it was 34.69 ±4.79 years in group B (GC). Mean ONSD was 6.61 ±0.39 mm in group A (GP) and 4.33 ±0.38
mm in group B(GC) which was significantly different (p < 0.001).

Conclusion: Ultrasound can provide a reliable, non-invasive tool to measure optic nerve sheath diameter in monitoring
the patients with benign intracranial hypertension (BIH).

idopathic intracranial hypertension versus normal healthy individuals using B scan ultrasonography as diagnostic tool.

**METHODOLOGY**

This cross-sectional study was conducted at the Armed Forces Institute of Radiology and Imaging, Pakistan, from June to December 2015. The sample size was calculated through Open EPI info calculator using mean ONSD in normal and *Pseudotumor cerebri* patients. Patients aged 30 - 50 years were divided into two groups. Group A (GP) comprised of patients who were diagnosed cases of idopathic intracranial hypertension (*Pseudotumor cerebri*) while normal healthy adults who volunteered to participate in the study were included in Group B (GC). The diagnosis of BIH was made on the basis of Dandy Walter criteria by neurophyscian. Patients who had unilateral optic disc swelling, secondary papilledema or other optic nerve diseases such as demyelinating optic neuritis, ischemic optic neuropathy and pseudo-papilledema were excluded from the study. Patients in group A (GP) underwent detailed examination by an ophthalmologist at the Armed Forces Institute of Ophthalmology to rule out any other cause of optic disc swelling and establish the diagnosis of papilledema. Patients were also reviewed by neuro-physician for detailed neurological examination and lumbar puncture for ICP measurement.

Participants in both the groups underwent ultrasonography (USG) of both eyes in supine position using ultrasound (Toshiba Xario 200) with probe placed on superolateral aspect of the orbit against closed upper lid. The optic nerve head was visualized which appeared as linear hypoechoic structure. ONSD was measured 3 mm behind the retina. A total of three readings were taken by the same first author and the average of these was recorded.

Statistical Package for Social Sciences (SPSS 21.0) for windows was used for comparative analysis. The continuous data was described in terms of mean ±SD (Standard deviation) while categorical data was depicted in frequencies for each group. Independent sample t-test was used to compare the mean between idiopathic intracranial hypertension (IIH) and control groups (p < 0.05 significance level).

**RESULTS**

Fifty-two eyes of 26 patients (26 eyes in each group) were studied. Twenty-four (92.3 %) out of 26 in group A and 23 (88.4%) out of 26 in group B were females while 2 in group A and 3 in group B were males. Age of the patients ranged from 27 to 41 years, with mean age of 33.92 ±4.89 years in group A, and 26 - 42 years with mean of 34.69 ±4.79 years in group B (p=0.574). Mean ONSD was 6.61 ±0.39 mm in group A (GP) and 4.33 ±0.38 mm in group B (GC) which was significantly different (p < 0.001). The distribution of ONSD in groups A and B is depicted in Figures 1 and 2.

**DISCUSSION**

Optic nerve sheath diameter (ONSD) measurement with ultrasonography (USG) is a simple, quick, non-invasive and reliable method. Various studies over the last couple of years demonstrated the importance of this investigation and suggested it to be an important indicator of intracranial hypertension, however, this is the first study that has been carried out in Pakistani population.

Although the gold standard for measuring the ICP is the lumbar puncture, Wang *et al.* and Mehrpour *et al.* in their studies concluded that ONSD is positively correlated with ICP.11,12 In another study by Shirodkar *et al.*, it was reported that ONSD measured by ultrasonography was comparable to measurements performed by MRI.13 The value of ONSD is measured at a constant distance behind the retina at 3 mm in most of the studies to avoid the distance related variation in its diameter; and the value of ONSD measured by USG is considered reliable among different observers with a good inter-observer and intra-observer reliability.14,15 However, there has been no single unified cutoff value for ONSD, which should be considered as abnormal or a clear-cut indicator of raised ICP. Wang *et al.* concluded that mean ONSD to be 3.55 ±0.38 mm, ranging from 3.10 to 3.90 mm in normal individuals and 4.08 - 4.86 mm in patients with raised ICP. In this study, the mean ONSD in normal individuals was 4.33 ±0.38 mm, and 6.61 ±0.39 mm in patients with BIH which was higher than published results in the Chinese population.11
Dubourg et al. in their meta-analysis concluded that 5.10 mm to be the cutoff value for labelling raised ICP while other authors reported it to be slightly less than 5.0 mm. Maude et al. concluded that 95% of the normal individuals in Bangladesh have median ONSD of 4.41 mm, ranging from 4.25 to 4.75 mm. In this study, the range of ONSD was found to be less than 5.0 mm in normal controls and more than 5.0 mm in patients with raised ICP. This value is less than what is reported by Bauerle et al. in German population.

Despite a great debate over the normal and abnormal cutoff value of ONSD in different populations, the importance of this non-expensive, non-invasive investigation modality cannot be overlooked. It is quite conceivable that USG can provide a great deal of assistance in monitoring and follow-up of patient with BIH. After the initial diagnosis of BIH, based on neuroimaging and measurement of ICP by invasive methods, the subsequent follow-up of patients can be done by ONSD in comparison to its baseline value for monitoring the treatment.

Although sample size of this study was small because of the rarity of disease, these findings are important to establish a baseline value for normal subjects. However, studies over a larger data sets and for a longer follow-up should be carried out. Moreover, we did not include patients with papilledema secondary to other causes which should also be included in future studies to infer more comprehensive results.

CONCLUSION

There was a significant difference in the ONSD between normal subjects and those with ICP. Ultrasound can provide a reliable, non-invasive measurement tool and alternative to MRI and LP for monitoring of patients of BIH.

REFERENCES