

ORIGINAL RESEARCH

Ultrasound guided measurement of optic sheath diameter in suspected raised intracranial pressure

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Received: 02 September, 2023

Accepted: 25 September, 2023

ABSTRACT

The optic nerve, as a part of the central nervous system, is surrounded by a subarachnoid space and experiences the same pressure change as the intracranial compartment. The intra orbital part of the sheath, and particularly its retrobulbar segment, can distend when ICP is elevated. The study was conducted in department of emergency medicine in emergency ward and medical intensive care units. Every case was examined in detail on the lines of the proforma designed for cases of suspected raised ICP, taking in to consideration history, symptoms, clinical signs, laboratory tests, USG optic sheath and CT Scan. Present study of 100 cases left optic sheath diameter was more than 5mm in 86 cases, among them 5.1-5.5mm diameter was observed in 56 cases and 5.6 to 6mm was observed in 30 cases. Present study of 100 cases right optic sheath diameter was more than 5mm in 86 cases, among them 5.1-5.5mm diameter was observed in 45 cases and 5.6 to 6mm was observed in 41 cases.

Key words: Ultrasound guided, optic sheath diameter, raised intracranial pressure

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INTRODUCTION

Raised intracranial pressure (ICP) is usually associated with increased morbidity, mortality, and poor neurological outcomes. The etiology could be varied viz stroke, liver failure, meningitis, meningoencephalitis, metabolic encephalopathy and post resuscitation syndrome¹. Early detection and prompt treatment of raised ICP in such situations is essential. However, it may pose challenges at the same time. Invasive ICP monitoring is the gold standard. It is associated with complications such as infection, bleeding and being expensive. Regular assessment and comparison by computed tomography (CT)/magnetic resonance imaging (MRI) in these critically ill-patients is fought with dangers of transporting to radiology.^{2,3}

The optic nerve, as a part of the central nervous system, is surrounded by a subarachnoid space and experiences the same pressure change as the

intracranial compartment. The intra orbital part of the sheath, and particularly its retrobulbar segment, can distend when ICP is elevated^{2,4}.

The use of bedside ocular ultrasonography (USG) in measuring optic sheath diameter (OSD) can be a useful method for detecting raised ICP. It has the advantage of being a non-invasive, portable, easily performed at bedside in minimum time. It can be repeated for re-evaluation without risk of radiation.

METHODOLOGY

The study was conducted in department of emergency medicine in emergency ward and medical intensive care units.

Every case was examined in detail on the lines of the proforma designed for cases of suspected raised ICP, taking in to consideration history, symptoms, clinical signs, laboratory tests, USG optic sheath and CT Scan.

The patient were thoroughly examined clinically and Radiologically and investigated for other risk factors and followed.

STUDY DESIGN

- Study design was hospital based prospective study.

SAMPLE SIZE

- A total of 100 cases with suspected raised ICP were taken for the study.
- Sample method: Sample size for the study was calculated considering the 80% of the average past 3 year hospital statistics.

INCLUSION CRITERIA

All patients above the age of 18 years coming to ED With

- Head injury
- Cerebro vascular accident
- Meningitis

EXCLUSION CRITERIA

- Patients with Ocular trauma
- Patient with Optic neuritis
- Patients with Optic Nerve tumour
- Glaucoma

All investigations and interventions were done under direct supervision and guidance of our guide.

RESULTS

Table 1: Association of USG guided left OSD with ICP

Lt. OSD	No. Cases	Raised ICP
3.9-5	14	0
5.1-5.5	56	56
5.6-6.0	30	30
Total	100	86

Mean OSD= 5.25 ± 0.514, P value =0.492, Fischer exact value=0.0

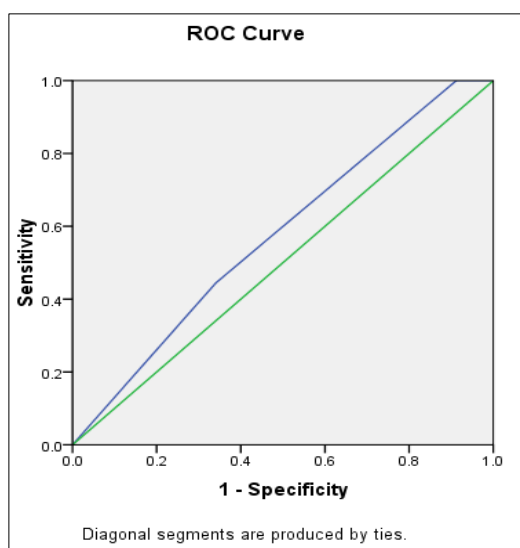
Present study of 100 cases left optic sheath diameter 5.5mm dimeter was observed in 56 cases and 5.6 to was more than 5mm in 86 cases, among them 5.1- 6mm was observed in 30 cases

Table 2: Association of right USG guided OSD with ICP

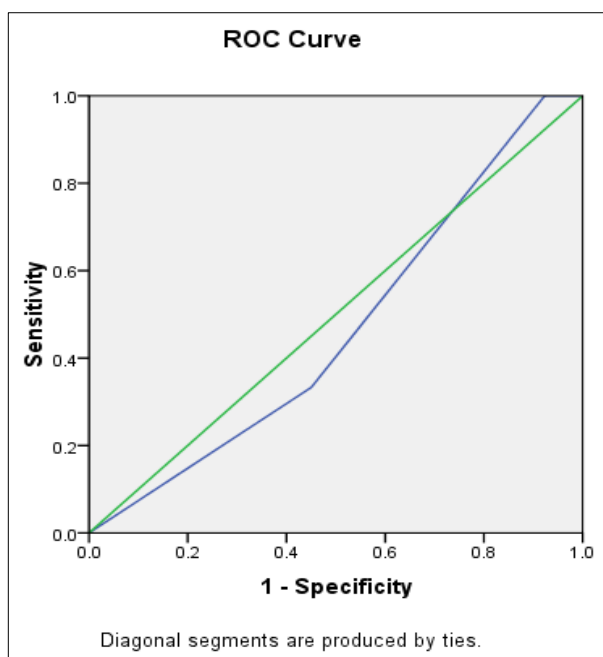
Rt ONSD	No of Cases	RAISED ICP
3.9-5.0	14	0
5.1-5.5	45	45
5.6-6.0	41	41
TOTAL	100	86

Mean OSD= 5.32 ± 0.4364, P value =0.454, Fischer exact value=0.00

Present study of 100 cases right optic sheath diameter 5.5mm dimeter was observed in 45 cases and 5.6 to was more than 5mm in 86 cases,among them 5.1- 6mm was observed in 41 cases.



Graph 1: Sensitivity and Specificity distribution of USG guided lt. OSD with ICP



Graph 2: Sensitivity and Specificity distribution of USG guided Rt. OSD with ICP

In present study of 100 cases, ROC curve shows the association between sensitivity and specificity of OSD in raised ICP, left optic sheath diameter showing higher correlation between specificity and sensitivity.

DISCUSSION

Table 3: Comparison of CT brain and USG guided OSD

Study by	OSD positive (%)	CT brain positive (%)
Blaivas <i>et al</i> ⁵	100	80
Present study	86	90

In the study conducted by Blaivas *et al.* 35(100%) patients were enrolled; 28(80%) had CT results consistent with EICP. All cases of EICP were correctly predicted by OSD over 5mm on US. The mean OSD for the 35 patients with CT evidence of EICP was 6.27 mm (95% CI¼ 5.6 to 6.89), and it is comparable to present study.

Table 4: Comparison with time

Study	Total patient <48hrs	OSD positive in
Geeraerts T <i>et al</i> ⁶	50	40
Present study	100	86

Geeraerts T *et al.* OSD was measured with a 7.5-MHz linear ultrasound probe. Two TBI groups were defined on the basis of ICP profile, each group consisting of 50 patients. If ICP exceeded 20 mmHg for more than 30 min in the first 48 h (before any specific treatment), patients were considered to have high ICP; if not, they had normal ICP. The largest ONSD value (the highest value for the right and left eye) was significantly higher in high ICP patients (6.3 ± 0.6 vs. 5.1 ± 0.7 mm in normal ICP patients and 4.9 ± 0.3 mm in control patients).

Table 5: Comparison of USG guided OSD of right and left eye

OSD	Right OSD(mean)	Left OSD(mean)
Sangani parikh <i>et al</i> ⁷	5.83	5.78
Present study	5.32 ± 0.4364	5.25 ± 0.514

In present study group of 100 cases, 86 cases were having the mean OSD of right optic sheath is 5.32 ± 0.4364, Pvalue =0.454, fischer exact value=0.00 and left optic sheath diameter is 5.25 ± 0.514, Pvalue =0.492, fischer exact value=0.00. As noted by Sangani Parikh *et al.* OSD of more than 5 mm was considered abnormal. All the patients in there study group had increased OSD bilaterally. In there study group, average OSD in the right eye was 5.83

mm (SD 0.42) and in the left eye was 5.78 mm (SD 0.43) ($P = 1$).

As noted in Tintinalli JE text Book Of Emergency medicine⁸ normal OSD in adults is 5mm, children 4.5mm and Infant 4mm. OSD more than 5mm in adult is considered abnormal and increased ICP should be suspected, and it is comparable to present study.

CONCLUSION

- Optic Sheath diameter was measured and grouped as 3.9-5, 5.1-5.5 and 5.6-6.0.
- The Left eye OSD was between 3.9-5 in 14 cases and none of 14 had raised ICP.
- There were 86 patients in group between 5.1- 6.0 and all were positive for raised ICP.
- Similar incidence was observed in Right eye OSD.
- Optic Sheath Diameter can act as single, simple and diagnostic tool for raised ICP monitoring and it has added advantage of non invasive nature.

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