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Original Article

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A Cross Sectional Study to Determine Usefullness of Ondc in Intracranial Pressure

Dr Arundas P[1]; Dr OB Belim[2]; Dr Rina Parikh[3]; Dr krunal pacholi[3]; Dr Jeet shah[4]

[1] 3rd year postgraduate resident, department of emergency medicine,SSG hospital, medical College Vadodara
[2] MS general surgery associate professor and I/C hod department of emergency medicine SSG hospital medical College baroda
[3] Associate professor, department of emergency medicine SSG hospital and medical College baroda
[4] Trainee doctor, department of emergency medicine SSG hospital medical College baroda

ABSTRACT

Background: Presentation of patients with altered sensorium to the emergency department is very common. Central nervous system (CNS) infections, cerebrovascular accidents and traumatic brain injury are common for such situation. Raised Intra cranial Pressure (ICP) is a dreaded complication of neurological disease and head injury, hydrocephalus, subarachnoid haemorrhage and intracranial haematoma that often leads to adverse outcomes either by reducing cerebral perfusion pressure (CPP) and causing cerebral ischemia or by compressing and causing herniation of the brain stem or other vital structures. Since there is paucity of literature, this study was undertaken to measure the optic nerve sheath diameter in patients presenting to the emergency department and correlation of optic nerve sheath diameter with raised intracranial pressure. **Materials and Methods**: A Comparative Analytical study of Optic Nerve Sheath Diameter in patients presented to Emergency Medicine Department was conducted. From an earlier study about measuring optic nerve sheath diameter using ultrasonography in increased intra cranial pressure, the sensitivity of Ultrasonography was 75% and specificity of 100%. All adult patients with clinical features suggestive of raised intracranial pressure brought to the Emergency Department in casualty, at SSG HOSPITAL, who underwent CT-brain. **Results**: History of trauma was present in 33.3% of the patients with raised intracranial pressure and 24.4% of the patients without raised intracranial pressure in this study. The history of fever was present in 10.4% of the patients with raised intracranial pressure and 14.6% of the patients without raised intracranial pressure. History of vomiting present in 61.5% of the patients with raised intracranial pressure and 62.5% of the patients without raised intracranial pressure. The history headache was present in 47.9% of the patients with raised intracranial pressure and 42.7% of the patients without raised intracranial pressure. The history of convulsion was present in 46.9% of the patients with raised intracranial pressure and 50.0% of the patients without raised intracranial pressure in this study. The history of unconsciousness was present in 55.2% of patients with raised intracranial pressure and 59.4% of the patients without raised intracranial pressure. This study had shown that, bradycardia was present in 52.1% of the patients with raised intracranial pressure and 34.4% of the patients without raised intracranial pressure. The elevated blood pressure was present in 59.4% of the patients with raised intracranial pressure and 52.1% of the patients without raised intracranial pressure in this study.

Key Words: *Intracranial pressure, cerebral perfusion, intracranial haemmorage*

***Corresponding Author**
Dr Jeet shah
Trainee doctor, department of emergency medicine SSG hospital medical College baroda

INTRODUCTION

Presentation of patients with altered sensorium to the emergency department is very common. Central nervous system (CNS) infections, cerebrovascular accidents and traumatic brain injury are common for such situation. The CNS infections include meningitis or meningoencephalitis are commonly seen in young adult patients. All patients with suspected CNS infections are often subjected for the cerebrospinal fluid (CSF) analysis to diagnosis the aetiology of the disease[1].

But the CSF examination is often contraindicated in patients with raised intracranial pressure since it may lead to the herniation of the brain and death. Patients with cerebrovascular accident also manifest with raised intracranial pressure as part of diffuse cerebral edema in case of ischemic stroke or because of the space occupying nature of hematoma in case of intracranial haemorrhage. Increased intracranial pressure is also common consequence of traumatic brain injury, and the rapid assessment and management can affect the long-term outcome of the patient with traumatic brain injury[2].

Raised Intra cranial Pressure (ICP) is a dreaded complication of neurological disease and head injury, hydrocephalus, subarachnoid haemorrhage and intracranial haematoma that often leads to adverse outcomes either by

reducing cerebral perfusion pressure (CPP) and causing cerebral ischemia or by compressing and causing herniation of the brain stem or other vital structures[3].

Increase in intracranial pressure as part of the disease process or due to complications including hydrocephalus contributes towards the clinical deterioration of the condition of the patients and may require treatment for the same in the form of anti edema measures or even surgical procedures. Hence the intracranial pressure plays a crucial role in management of these patients.

Clinical signs of raised ICP including head ache, blurred vision, feeling less alert than usual, vomiting, changes in behaviour, weakness or problems with moving or talking lack of energy or sleepiness are often unreliable or too late to manifest and may lead to unacceptable delay in therapeutic intervention. Neuro imaging by computed tomography (CT) or magnetic resonance imaging (MRI) scans entail transfer of a critically ill patient out of the emergency department or Intensive Care Unit (ICU), besides being an impracticable tool for repeat examinations at frequent intervals as may be necessary in patients with raised ICP. Invasive measurement by an intraventricular or intraparenchymal catheter is the gold standard and used extensively in the management of traumatic brain injury; however, it may not be feasible in a heterogenous group of medical patients[4]. The non-invasive procedures to measure the intracranial pressure are of keen interest. The introduction of transcranial doppler to assess intracranial pressure is one such approach. But the procedure demands high technical expertise and have poor reproducibility. Hence, in current clinical practice commonly employs computerized tomography or magnetic resonance imaging for raised intracranial pressure. They only give impression whether the intracranial pressure is raised or not at the point in time when the test is employed. These tests are expensive, time consuming, not frequently available in remote locations and cannot be employed as point of care testing[5]. Hence there is need for easy, rapid, inexpensive bedside test to assess for the raised intracranial pressure.

The optic nerve sheath is an anatomical extension of the duramater and the subarachnoid space around the optic nerve is continuous with the intracranial subarachnoid space[2]. Any pressure rise within the intracranial compartment impacts on the optic nerve head as swelling of the optic disc and papilledema. However, papilledema evolves over time and may be a delayed manifestation[6,7], besides requiring a skilled observer for precise identification Therefore, this technique is not applied in emergency conditions or when an acute increase in ICP is suspected. Dilatation of the optic nerve sheath has been shown to be a much earlier manifestation of ICP rise and can rapidly change with change in Intra-Cranial Pressure[8,9].

The optic nerve sheath is fairly easy to visualize by ultrasonography. A-mode ultrasonography was used to view the optic nerve sheath more than four decades ago; B-mode scanning was performed subsequently to assess intraocular lesions[10]. Evolution of ultrasound technology and the development of high frequency (> 7.5 MHz) linear probes with improved spatial resolution have enabled excellent views of the optic nerve sheath. The optic nerve sheath diameter (ONSD), measured at a fixed distance behind the retina has been evaluated to diagnose and measure intracranial hypertension[11,12,13].

Since there is paucity of literature, this study was undertaken to measure the optic nerve sheath diameter in patients presenting to the emergency department and correlation of optic nerve sheath diameter with raised intracranial pressure.

AIM AND OBJECTIVES OF THE STUDY

OBJECTIVES

- Primary objective is to detect increased intracranial pressure by optic nerve ultrasound and compare with CT Brain in a patients with clinical features suggestive of raised intracranial pressure.
- This study would help to triage patients who urgently need to undergo CT scan and emergent de-compressive surgery.
- This study would help to initiate immediate medical management of increased intracranial pressure in suspected patients.
- This study would help to derive a protocol for the emergency management of patient with raised ICP.

MATERIAL AND METHODS

A Comparative Analytical study of Optic Nerve Sheath Diameter in patients presented to Emergency Medicine Department was conducted. From an earlier study about measuring optic nerve sheath diameter using ultrasonography in increased intra cranial pressure, the sensitivity of Ultrasonography was 75% and specificity of 100%.

To predict the Intra Cranial Pressure by Optic Nerve Sheath Diameter (ONSD) Measurement using Ultrasonography in patient with Altered Mental Status (considering CT Brain as Gold standard), **192 patients** was taken with 95 % confidence and 10% precision.

INCLUSION CRITERIA:

All adult patients with clinical features suggestive of raised intracranial pressure brought to the Emergency Department in casualty, at SSG HOSPITAL, who underwent CT-brain.

EXCLUSION CRITERIA:

- Age <18 years
- Obvious ocular trauma
- Patients who didn't undergo CT brain scan.
- Patients not willing for admission and who took discharge against medical advice.
- H/O glaucoma or optic nerve pathology.

METHODOLOGY

This comparative analytical study was conducted for a duration of 12 months in the emergency ward of SSG Hospital and Medical College, Baroda. When a patient with clinical features suggestive of raised intracranial pressure presents to emergency department, the patients was resuscitated, simultaneously performing primary assessment and emergency clinical examination. Written informed consent was taken from patient relative.

PATIENT POSITION:

The patient was in 30 degree dorsal elevation(head up)

PROBE POSITION:

Gel was applied on the upper eyelid with eyes closed and a linear 7.5 MHz probe was first placed perpendicular and then parallel to eyelid. By convention, axial measurement of the ONSD is made 3 mm behind the globe. The ONSD in axial and coronal views is defined as the distance between the external borders of the hyperechogenic area surrounding the hypoechogenic optic nerve. Each ONSD was evaluated from the most optimized images obtained. Exclusive attention was given to assure a correct estimation of ONSD diameter by excluding hypoechogenic area outside the sheath, which corresponds to the dura mater. The ONSD in axial and coronal views were measured as the distance between the margins of the central hypoechoic area surrounded by Optic Nerve Sheath. For each optic nerve, 6 measurements were taken; 3 sagittal and 3 transverse. Optic Nerve Sheath Diameter >5 mm in any eye was taken as positive for increased ICP. After taking the ONSD reading patient was sent for NCCT BRAIN and NCCT BRAIN findings with the ONSD values were compared. Features of raised intracranial pressure in NCCT BRAIN are:

- Effacement of the ventricles, basal cisterns and other CSF spaces
- Brain herniation
- Loss of grey-white matter differentiation
- Midline shift
- Third ventricle diameter > 1 cm and significant oedema

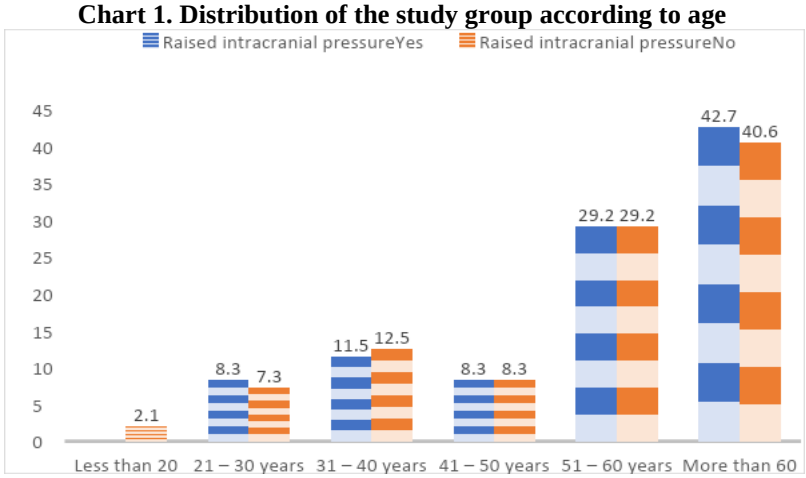
RESULTS AND ANALYSIS

Table 1. Distribution of the study group according to age

Age group	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Less than 20 years	0	2 (2.1)
21 – 30 years	8 (8.3)	7 (7.3)
31 – 40 years	11 (11.5)	12 (12.5)
41 – 50 years	8 (8.3)	8 (8.3)
51 – 60 years	28 (29.2)	28 (29.2)
More than 60 years	41 (42.7)	39 (40.6)
Total	96 (100)	96 (100)

χ^2 value= 2.16 **df=5** **p value, sig=0.827, NS**

Chart 1. Distribution of the study group according to age



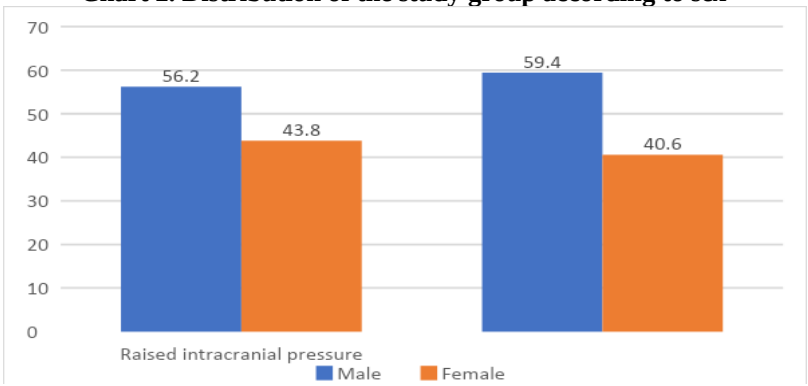
This study had shown that, about 42.7% of the patients with raised intracranial pressure and 40.6% without raised intracranial pressure were aged more than 60 years. This difference in age was not statistically significant.

Table 2. Distribution of the study group according to sex

Sex	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Male	54 (56.2)	57 (59.4)
Female	42 (43.8)	39 (40.6)
Total	96 (100)	96 (100)

χ^2 value= 0.192 df=1 p value, sig=0.661, NS

Chart 2. Distribution of the study group according to sex



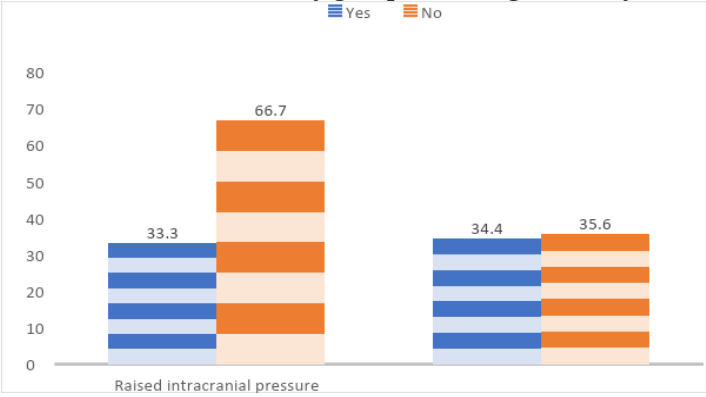
About 56.2% of the in raised intracranial pressure group and 59.4% in patients without raised intracranial pressure group were males. This difference was also not statistically significant.

Table 3. Distribution of the study group according to history of trauma

H/O trauma	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Yes	32 (33.3)	33 (34.4)
No	64 (66.7)	63 (65.6)
Total	96 (100)	96 (100)

χ^2 value= 0.023 df=1 p value, sig=0.879, NS

Chart 3. Distribution of the study group according to history of trauma



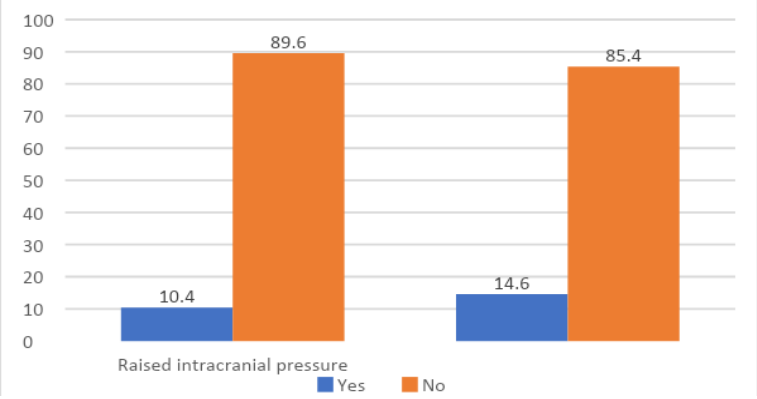
History of trauma was present in 33.3% of the patients with raised intracranial pressure and 24.4% of the patients without raised intracranial pressure. This difference was also not statistically significant.

Table 4. Distribution of the study group according to history of fever

H/O Fever	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Yes	10 (10.4)	14 (14.6)
No	86 (89.6)	82 (85.4)
Total	96 (100)	96 (100)

χ^2 value= 0.762 df=1 p value, sig=0.383, NS

Chart 4. Distribution of the study group according to history of fever



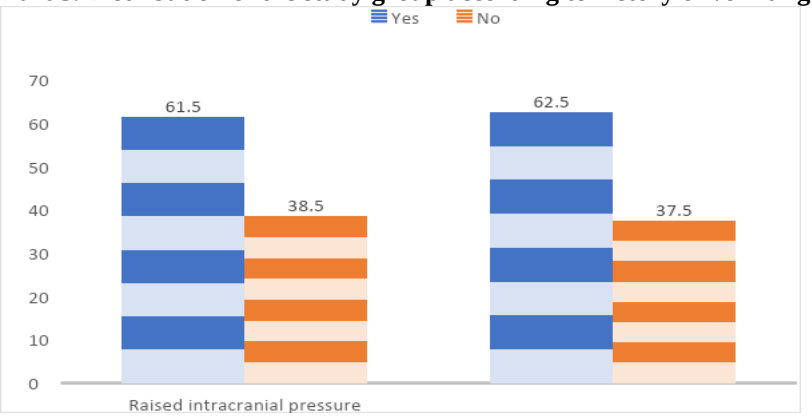
The history of fever was present in 10.4% of the patients with raised intracranial pressure and 14.6% of the patients without raised intracranial pressure. This difference was also not statistically significant.

Table 5. Distribution of the study group according to history of vomiting

H/O vomiting	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Yes	59 (61.5)	60 (62.5)
No	37 (38.5)	36 (37.5)
Total	96 (100)	96 (100)

χ^2 value= 0.022 df=1 p value, sig=0.882, NS

Chart 5. Distribution of the study group according to history of vomiting



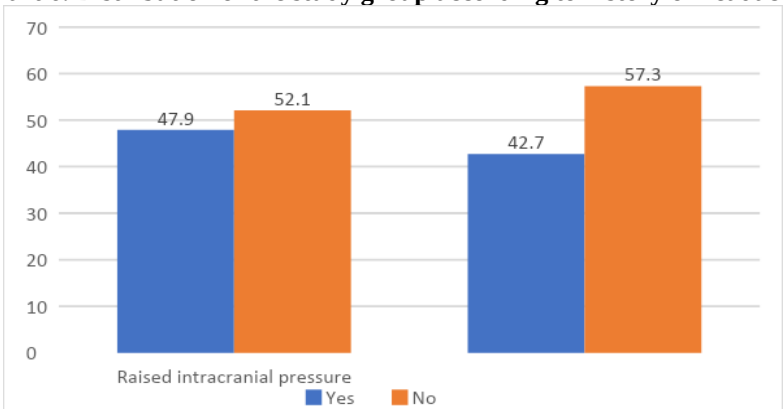
History of vomiting present in 61.5% of the patients with raised intracranial pressure and 62.5% of the patients without raised intracranial pressure. This difference was also not statistically significant.

Table 6. Distribution of the study group according to history of headache

H/O Headache	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Yes	46 (47.9)	41 (42.7)
No	50 (52.1)	55 (57.3)
Total	96 (100)	96 (100)

χ^2 value= 0.525 **df=1** **p value, sig=0.469, NS**

Chart 6. Distribution of the study group according to history of headache



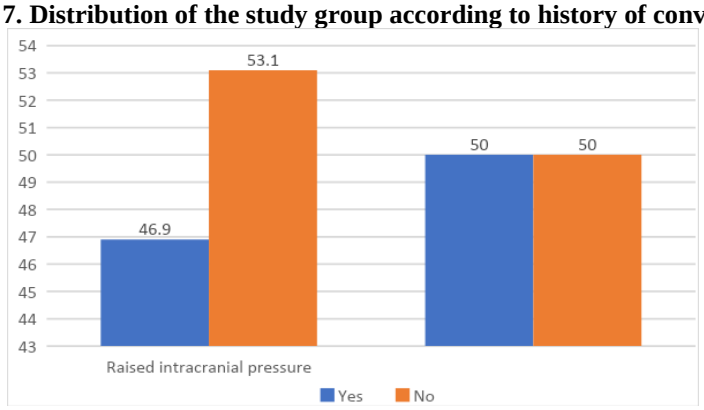
The history headache was present in 47.9% of the patients with raised intracranial pressure and 42.7% of the patients without raised intracranial pressure. This difference was not statistically significant.

Table 7. Distribution of the study group according to history of convulsion

H/O Convulsion	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Yes	45 (46.9)	48 (50.0)
No	51 (53.1)	48 (50.0)
Total	96 (100)	96 (100)

χ^2 value= 0.188 **df=1** **p value, sig=0.665, NS**

Chart 7. Distribution of the study group according to history of convulsion



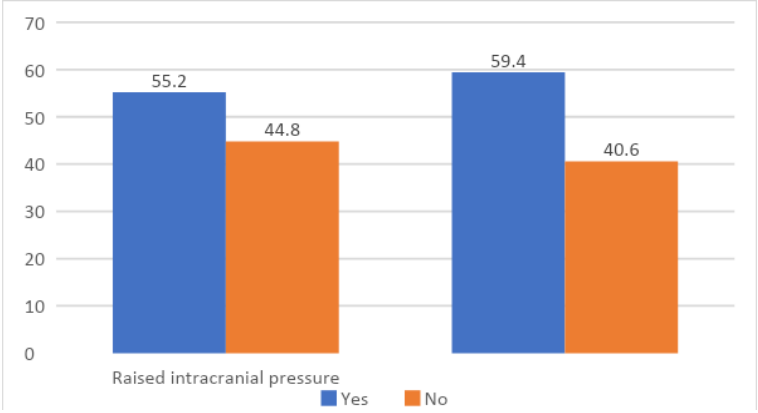
The history of convulsion was present in 46.9% of the patients with raised intracranial pressure and 50.0% of the patients without raised intracranial pressure. This difference was not statistically significant between the two groups.

Table 8. Distribution of the study group according to history of unconsciousness

H/O Unconsciousness	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Yes	53 (55.2)	57 (59.4)
No	43 (44.8)	39 (40.6)
Total	96 (100)	96 (100)

χ^2 value= 0.341 **df=1** **p value, sig=0.559, NS**

Chart 8. Distribution of the study group according to history of unconsciousness



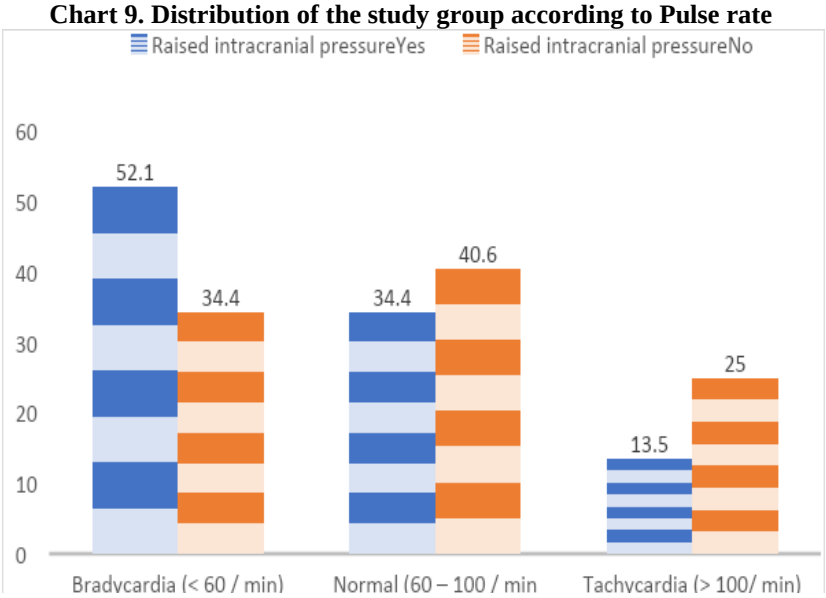
The history of unconsciousness was present in 55.2% of patients with raised intracranial pressure and 59.4% of the patients without raised intracranial pressure. This difference was not statistically significant.

Table 9. Distribution of the study group according to Pulse rate

Pulse rate	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Bradycardia (< 60 / min)	50 (52.1)	33 (34.4)
Normal (60 – 100 / min	33 (34.4)	39 (40.6)
Tachycardia (> 100/ min)	13 (13.5)	24 (25.0)
Total	96 (100)	96 (100)

χ^2 value= 7.252 **df=2** **p value, sig=0.027, Sig**

Chart 9. Distribution of the study group according to Pulse rate



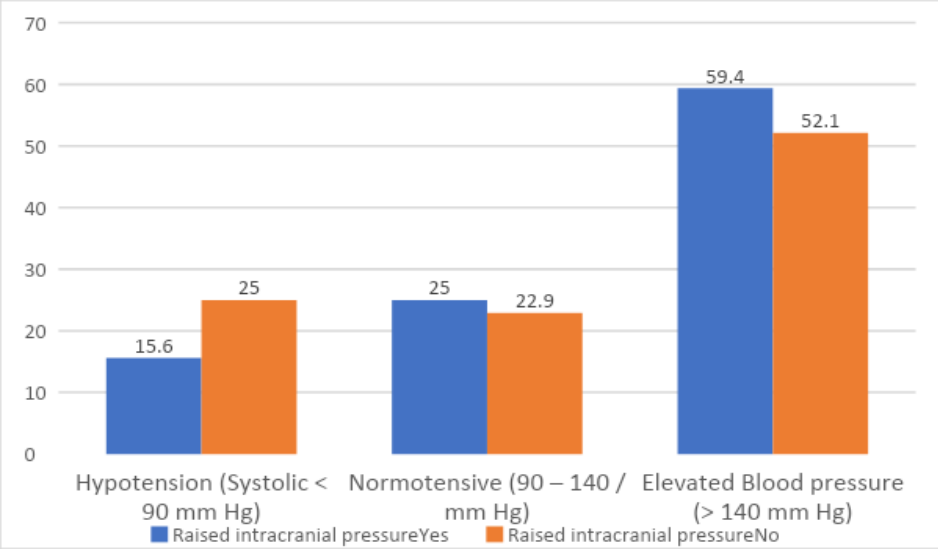
Bradycardia was present in 52.1% of the patients with raised intracranial pressure and 34.4% of the patients without raised intracranial pressure. This difference was statistically significant.

Table 10. Distribution of the study group according to systolic blood pressure

Systolic blood pressure	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Hypotension (Systolic < 90 mm Hg)	15 (15.6)	24 (25.0)
Normotensive (90 – 140 / mm Hg)	24 (25.0)	22 (22.9)
Elevated Blood pressure (> 140 mm Hg)	57 (59.4)	50 (52.1)
Total	96 (100)	96 (100)

χ^2 value= 2.622 df=2 p value, sig=0.27, NS

Chart 10. Distribution of the study group according to systolic blood pressure



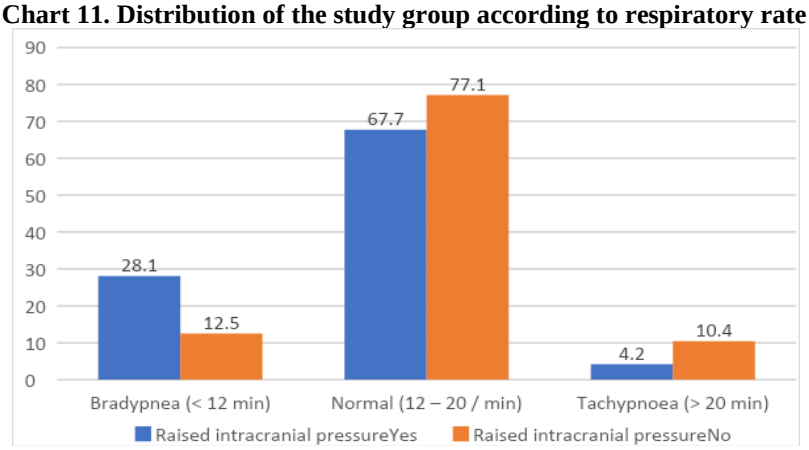
The elevated blood pressure was present in 59.4% of the patients with raised intracranial pressure and 52.1% of the patients without raised intracranial pressure. This difference was not statistically significant.

Table 11. Distribution of the study group according to respiratory rate

Respiratory rate	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Bradypnea (< 12 min)	27 (28.1)	12 (12.5)
Normal (12 – 20 / min)	65 (67.7)	74 (77.1)
Tachypnoea (> 20 min)	4 (4.2)	10 (10.4)
Total	96 (100)	96 (100)

χ^2 value= 8.923 df=2 p value, sig=0.012, Sig

Chart 11. Distribution of the study group according to respiratory rate



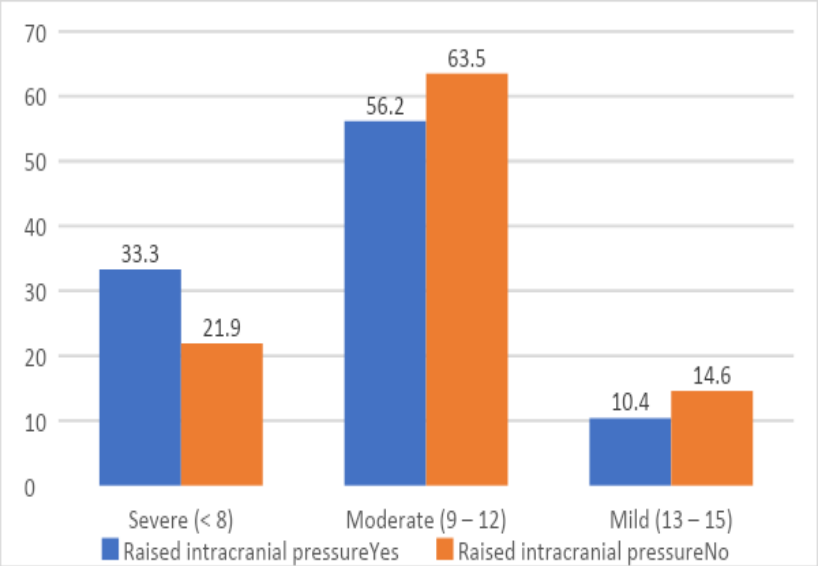
The bradypnea was present in 28.1% of the patients with raised intracranial pressures and 12.5% of the patients without raised intracranial pressure. This difference was not statistically significant.

Table 12. Distribution of the study group according to GCS severity

GCS severity	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Severe (< 8)	32 (33.3)	21 (21.9)
Moderate (9 – 12)	54 (56.2)	61 (63.5)
Mild (13 – 15)	10 (10.4)	14 (14.6)
Total	96 (100)	96 (100)

χ^2 value= 3.376 df=2 p value, sig=0.185, NS

Chart 12. Distribution of the study group according to GCS severity



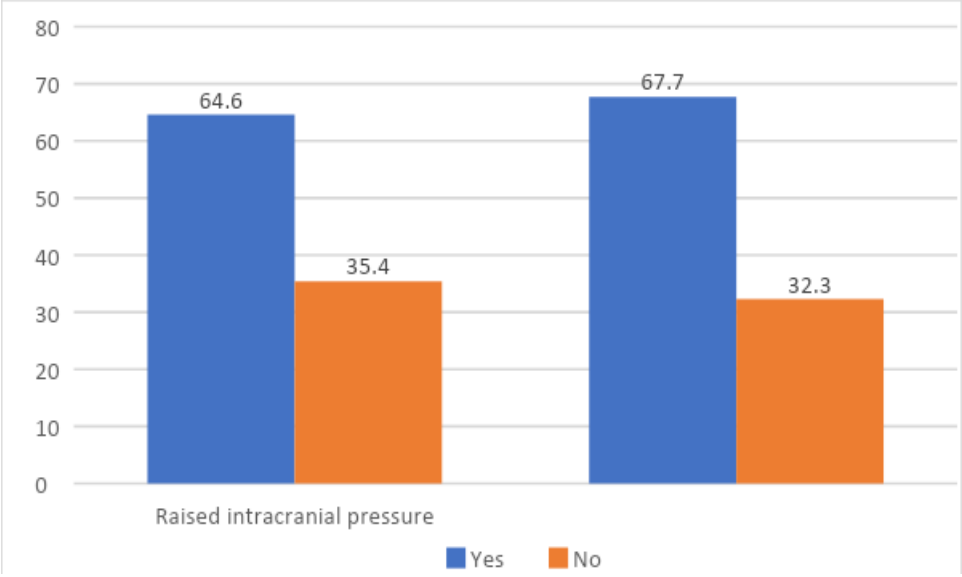
The GCS severity was severe in 33.3% of the patients with raised intracranial pressure and 21.9% of the patients without raised intracranial pressure. This difference was not statistically significant.

Table 13. Distribution of the study group according to focal neurological deficit

Focal neurological deficit	Raised ICP confirmed with CT scan	
	Yes n (%)	**No n (%)**
Yes	62 (64.6)	65 (67.7)
No	34 (35.4)	31 (32.3)
Total	96 (100)	96 (100)

χ^2 value= 0.209 **df=1** **p value, sig=0.647, NS**

Chart 13. Distribution of the study group according to focal neurological deficit



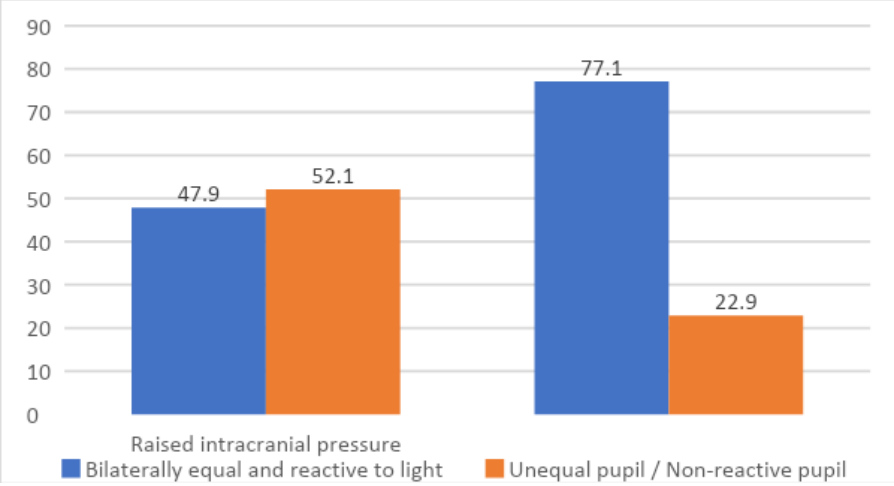
The focal neurological deficit was present in 64.6% of the patients with raised intracranial pressure and 67.7% of the patients without raised intracranial pressure. This difference was statistically significant.

Table 14. Distribution of the study group according to Pupil

Pupil	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Bilaterally equal and reactive to light	46 (47.9)	74 (77.1)
Unequal pupil / Non-reactive pupil	50 (52.1)	22 (22.9)
Total	96 (100)	96 (100)

χ^2 value= 17.422 df=2 p value, sig=0.000, Sig

Chart 14. Distribution of the study group according to Pupil



The pupil was bilaterally unequal and non-reactive in 52.1% of the patients with raised intracranial pressure and 22.9% of the patients without raised intracranial pressure. This difference in pupil was statistically significant.

Table 15. Distribution of the study group according to Mean ONSD

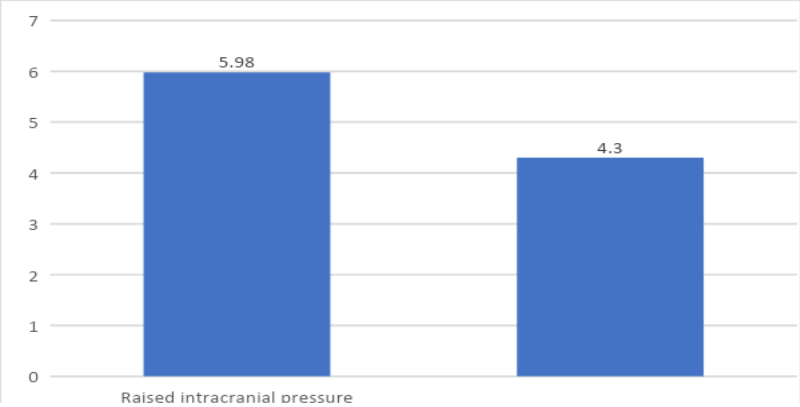
Mean ± SD	ONSD	
	Right eye	Left eye
Horizontal	5.28 ± 1.1	5.26 ± 1.1
Vertical	5.05 ± 1.0	5.06 ± 1.05
Mean	5.14 ± 1.04	5.14 ± 1.07

The mean ONSD of horizontal measurements was 5.28 and vertical measurement was 5.05 mm in right eye. The mean horizontal ONSD for left eye was 5.26 mm and vertical measurement was 5.06 mm.

Table 16. Distribution of the study group according to Mean ONSD right side

ONSD Right side	Raised ICP confirmed with CT scan		T value	P value, Sig
	Yes	No		
Mean ± SD	5.98 ± 0.76	4.3 ± 0.42	18.904	0.000, Sig

Chart 15. Distribution of the study group according to Mean ONSD right side

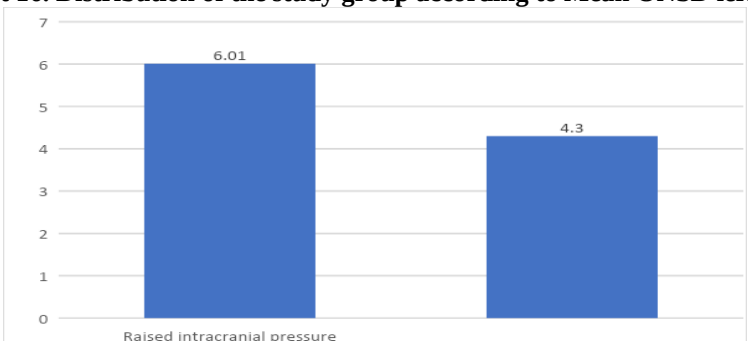


The mean ONSD was 5.98 mms in patients with raised intracranial pressure and 4.3% mm in patients without raised intracranial pressure. This difference in ONSD of right eye was statistically significant between the two groups.

Table 17. Distribution of the study group according to Mean ONSD left side

ONSD Left side	Raised ICP confirmed with CT scan		T value	P value, Sig
	Yes	No		
Mean ± SD	6.01 ± 0.78	4.3 ± 0.42	19.325	0.000, Sig

Chart 16. Distribution of the study group according to Mean ONSD left side



The mean ONSD of left eye was 6.01 mm in patients with raised intracranial pressure and 4.3 mm in patients without raised intracranial pressure. This difference of ONSD on left side was statistically significant between the two groups.

Table 18. Predictive accuracy of ONSD

ONSD	Raised ICP confirmed with CT scan	
	Yes n (%)	No n (%)
Abnormal	79 (852.3)	3 (3.1)
Normal	17 (17.7)	93 (96.9)

χ^2 value= 122.946 **df=1** **p value, sig=0.000, Sig**

Parameter (ONSD)	Percentage
Sensitivity	82.3
Specificity	96.9
Positive predictive value	96.3
Negative predictive value	84.3

The sensitivity of ONSD was 82.3% specificity was 96.9%, positive predictive value was 96.3% and negative predictive value was 84.3% in this study.

DISCUSSION

This study was mainly undertaken to study the usefulness of ONSD in measurement of intra cranial pressure. A cross sectional comparative analytical study was conducted in order to study the usefulness of ONSD in measurement of intracranial pressure and compared with CT scan findings

Age group

Majority of the study subjects in this study were aged more than 60 years in this study which was not statistically significant. A study by Shirodkar et al had noted, the mean age in normal cases was 27.44 years and 56.15 years in cases with raised intracranial pressure. A study by Chen et al had shown that, the mean age was 46.1 years among healthy volunteers.

Sex

Males outnumbered females in this study which was not statistically significant. In a study by Shirodkar et al, males outnumbered females[14]. A study by Chen et al enrolled 61.1% of the female healthy volunteers.

History of trauma

History of trauma was present in 33.3% of the patients with raised intracranial pressure and 24.4% of the patients without raised intracranial pressure in this study. No studies reported similar findings for comparison.

History of fever

The history of fever was present in 10.4% of the patients with raised intracranial pressure and 14.6% of the patients without raised intracranial pressure. No similar studies were reported by other studies for comparison.

History of vomiting

History of vomiting present in 61.5% of the patients with raised intracranial pressure and 62.5% of the patients without raised intracranial pressure. No studies reported similar findings.

History of headache

The history headache was present in 47.9% of the patients with raised intracranial pressure and 42.7% of the patients without raised intracranial pressure. Similar findings were not reported by available studies.

History of convulsion

The history of convulsion was present in 46.9% of the patients with raised intracranial pressure and 50.0% of the patients without raised intracranial pressure in this study. No studies were available to compare these results.

History of unconsciousness

The history of unconsciousness was present in 55.2% of patients with raised intracranial pressure and 59.4% of the patients without raised intracranial pressure. None of the studies reported such findings.

Pulse rate

This study had shown that, bradycardia was present in 52.1% of the patients with raised intracranial pressure and 34.4% of the patients without raised intracranial pressure. A study by Shirodkar et al had shown that the mean heart rate was 83.63 in raised intracranial pressure group and 92.28 in in normal ICP group.

Blood pressure

The elevated blood pressure was present in 59.4% of the patients with raised intracranial pressure and 52.1% of the patients without raised intracranial pressure in this study. A study by Shirodkar had shown that, the mean systolic blood pressure was 127.66 mm Hg in patients with raised ICP and 130.16 in patients with normal ICP.

Respiratory rate

The bradypnea was present in 28.1% of the patients with raised intracranial pressures and 12.5% of the patients without raised intracranial pressure in this study. A study by Shirodkar et al had noted that, the mean respiratory rate was 17.31 in raised ICP group and 18.96/ min in cases with normal ICP.

Glasgow Coma scale

This study had shown that, GCS severity was severe in 33.3% of the patients with raised intracranial pressure and 21.9% of the patients without raised intracranial pressure. Shirodkar et al had noted the mean GCS was 10.5 in cases with raised ICP and 12.04 in cases with normal ICP.

Focal neurological deficit

The focal neurological deficit was present in 64.6% of the patients with raised intracranial pressure and 67.7% of the patients without raised intracranial pressure in this study. No studies were available to compare these findings.

Pupil size

The pupil was bilaterally unequal and non-reactive in 52.1% of the patients with raised intracranial pressure and 22.9% of the patients without raised intracranial pressure in this study.

ONSD

The mean ONSD of right eye was 5.98 mm in patients with raised intracranial pressure and 4.3 mm in patients without raised intracranial pressure. The mean ONSD of left eye was 6.01 mm in patients with raised intracranial pressure and 4.3 mm in patients without raised intracranial pressure. This difference of ONSD was statistically significant between the two groups. A study by Shirodkar et al had shown that, the mean ONSD was 5.43 mm in cases with raised ICP and 4.61 mm in cases with normal ICP. A study by Chen et al had shown that, the mean ONSD in right eye was 5.1 mm and left eye was 5.0 mm. A study by Li et al noted that, the mean ONSD was 5.7 mm in right eye and 5.8 in left eye.

Predictive accuracy of ONSD

The sensitivity of ONSD for 5.0 mm was 82.3% specificity was 96.9%, positive predictive value was 96.3% and negative predictive value was 84.3% in this study. The sensitivity of ONSD for 4.716 mm was 77.8% in a study by Shirodkar et al. Liu et al reported that, at the level of 5.6 mm, the sensitivity of ONSD was 86.2% and specificity was 73.1%.A study by Raffiz et al had noted that, the sensitivity of ONSD at a level of 5.205 mm is 95.8% and specificity was 80.4% in detecting the raised ICP.

LIMITATIONS

ONSD examination is operator dependent. Interpretation depends on operator skills and experience.

In this study, ONSD exam is performed by only one emergency physician, So results may be affected by his personal experience and skills.

The sample size in our study was small. So we need to perform this study on larger scale before extrapolating in the Emergency Department Setting.

The person performing the ONSD examination was not blinded about clinical findings of patient hence a bias towards the diagnosis could not be eliminated.

SUMMARY

This study was mainly undertaken to study the usefulness of ONSD in measurement of intra cranial pressure. Majority of the study subjects in this study were aged more than 60 years in this study which was not statistically significant. Males outnumbered females in this study which was not statistically significant.

History of trauma was present in 33.3% of the patients with raised intracranial pressure and 24.4% of the patients without raised intracranial pressure in this study.

The history of fever was present in 10.4% of the patients with raised intracranial pressure and 14.6% of the patients without raised intracranial pressure.

History of vomiting present in 61.5% of the patients with raised intracranial pressure and 62.5% of the patients without raised intracranial pressure.

The history headache was present in 47.9% of the patients with raised intracranial pressure and 42.7% of the patients without raised intracranial pressure.

The history of convulsion was present in 46.9% of the patients with raised intracranial pressure and 50.0% of the patients without raised intracranial pressure in this study.

The history of unconsciousness was present in 55.2% of patients with raised intracranial pressure and 59.4% of the patients without raised intracranial pressure.

This study had shown that, bradycardia was present in 52.1% of the patients with raised intracranial pressure and 34.4% of the patients without raised intracranial pressure.

The elevated blood pressure was present in 59.4% of the patients with raised intracranial pressure and 52.1% of the patients without raised intracranial pressure in this study.

The bradypnea was present in 28.1% of the patients with raised intracranial pressures and 12.5% of the patients without raised intracranial pressure in this study.

This study had shown that, GCS severity was severe in 33.3% of the patients with raised intracranial pressure and 21.9% of the patients without raised intracranial pressure.

The focal neurological deficit was present in 64.6% of the patients with raised intracranial pressure and 67.7% of the patients without raised intracranial pressure in this study.

The pupil was bilaterally unequal and non-reactive in 52.1% of the patients with raised intracranial pressure and 22.9% of the patients without raised intracranial pressure in this study.

The mean ONSD of right eye was 5.98 mms in patients with raised intracranial pressure and 4.3% mm in patients without raised intracranial pressure. The mean ONSD of left eye was 6.01 mm in patients with raised intracranial pressure and 4.3 mm in patients without raised intracranial pressure.

The sensitivity of ONSD was 82.3% specificity was 96.9%, positive predictive value was 96.3% and negative predictive value was 84.3% in this study.

CONCLUSION

This study was mainly undertaken to study the usefulness of ONSD as a non-invasive tool to assess the intracranial pressure. This study had shown that, the ONSD can be effectively used as a non-invasive tool in assessment of intracranial pressure. ONSD had acceptable sensitivity and specificity levels. This study had shown important facts about the use of ONSD in measurement of intracranial pressure especially in emergency care settings. Further research in this direction helps to bring out more facts about the usefulness of ONSD in intracranial pressure assessment.

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