MONITORING INTRACRANIAL PRESSURE USING OPTIC NERVE SHEATH DIAMETER IN NON-TRAUMA EMERGENCY PATIENTS

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Introduction

- Intracranial pressure (ICP) monitoring is a vital element in the diagnosis and management of several neurological disorders, such as head injury, hydrocephalus, subarachnoid hemorrhage, and intracranial hematoma.
- The optic nerve sheath is in direct contact with the subarachnoid space. This relationship provides the physiological foundation for using the optic nerve sheath to assess intracranial pressure. Since the optic nerve sheath is loosely attached to the nerve, the subarachnoid space in this region more distensible, and appears bulbous on ultrasound. Dilation of the optic nerve sheath, in contrast to papilloedema, occurs faster, and can be a sign of increased intracranial pressure.
- The advancements of ultrasound modalities enabled researchers to enhance optic nerve sheath diameter (ONSD) measurements, with further research that concentrated on determining the best distance behind the globe to measure OSND. According to a 1996 study, ONSD increased by up to 60% at 3 mm behind the globe compared to only 35% at 10 mm. Later studies showed that the measuring should be performed 3 mm behind the globe, since ultrasound contrast is superior at this depth with a linear probe, allowing for reproducibility.

Aim of the work

- The aim of this study was to assess the validity of emergency ultrasonography of ONSD for evaluation of the progress of intracranial pressure, when compared to computer tomography (CT) brain imaging.

Patients

- Study was carried out on 80 patients who were suspected to have elevated ICP (EICP) without trauma directly after admission to Emergency Departments.

Methods

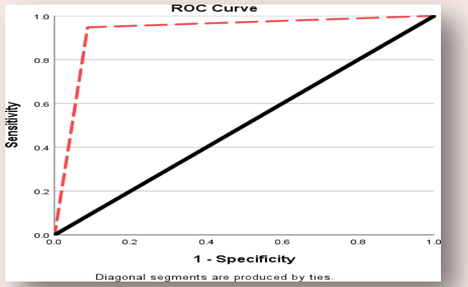
- In this prospective observational study, 80 patients with suspected elevated ICP were subjected to both CT brain imaging and optic nerve US assessment. Then, according to the CT findings, they were mentioned as two groups. Only fifty-seven patients (71.3%) were diagnosed with EICP "CT positive group". Twenty-three patients (28.7%) were not diagnosed with EICP "CT negative group".
- Findings from optic nerve ultrasonography were compared with CT brain imaging to detect the diagnostic performance of ONSD.
- Patients with positive findings were followed up using second assessment clinically and radiologically using CT brain imaging and optic nerve ultrasonography after 24 hours or when indicated.

Results

Diagnostic performance of initial optic nerve ultrasonography

US	ONSD at a cut-off point of 5.4mm	95% C.I	
		LL	UL
AUC	0.930 (p<0.0001)	0.855	1.000
Sensitivity	94.74%	85.38%	98.90%
Specificity	91.30%	71.96%	98.93%
PPV	96.43%	87.76%	99.03%
NPV	87.50%	69.79%	95.50%
+LR	10.89	2.89	41.02
-LR	0.06	0.02	0.17
Accuracy	93.75%	86.01%	97.94%

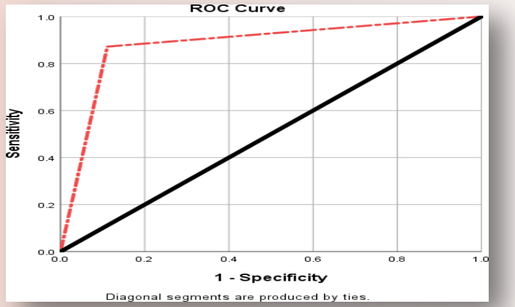
Receiver Operating Characteristics (ROC) curve of initial US (ONSD) to detect EICP



Diagnostic performance of follow-up optic nerve ultrasonography

Follow-up US	24-ONSD at a cut-off point of 5.4mm	95% C.I	
		LL	UL
AUC	0.880 (p<0.0001)	0.776	0.985
Sensitivity	87.18%	72.57%	95.70%
Specificity	88.89%	65.29%	98.62%
PPV	94.44%	82.07%	98.44%
NPV	76.19%	58.14%	88.06%
+LR	7.85	2.11	29.14
-LR	0.14	0.06	0.33
Accuracy	87.72%	76.32%	94.92%

Receiver Operating Characteristics (ROC) curve of follow- up US (24-ONSD)



Conclusion

- In the present study, in non traumatic patients with suspected EICP, ONSD of equal or more than 5.4 mm was an excellent tool to detect EICP with excellent sensitivity (94.74%), specificity (91.30%) and accuracy (93.75%). Emergency physcian-performed optic nerve ultrasonography evaluation of ONSD may serve as an accurate easy-to-perform screening tool to triage non traumatic patients with suspected EICP.