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Case Study

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OPTIC NERVE SHEATH DIAMETER ASSESSMENT AS A POINT OF CARE TOOL FOR ASSESSMENT OF INTRA- CRANIAL PRESSURE IN A PATIENT OF SEVERE ORGANOPHOPHORUS POISIONING IN ICU

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ABSTRACT

Monitoring of GCS in severe organophosphate induced poisoning can be a crucial tool in predicting the prognosis and ICU stay of patients. While advanced radiological investigations like Computed Tomography and Magnetic Resonance Imaging provide definitive signs of increased Intra Cranial Pressure, they are expensive and cumbersome to be performed on a daily basis. Optic Nerve Sheath Diameter Ultrasonography provides an easy to do investigation to monitor ICP on a daily basis. We report a case of a 48 year old male with a history of ingestion of an organophosphate poison (chlorpyrifos) with elevated intra-cranial pressure.

KEYWORDS: Optic Nerve Sheath Diameter, Ultrasonography, organophosphate, intra-cranial pressure.

INTRODUCTION

Organophosphorus poisoning can lead to life-threatening organ dysfunctions and neurotoxicity-related encephalopathy. Most patients exposed to organophosphates come into contact with insecticides. The first organophosphate insecticide was created in the mid-1800s but was not widely used until after World War II. Organophosphates are used as medications, insecticides, and nerve agents as a weapon. Organophosphate exposure may occur through inhalation, ingestion, or dermal contact. The key feature of organophosphate insecticides is the inhibition of carboxyl ester hydrolases, chiefly inhibition of acetylcholinesterase (AChE). This enzyme plays an important role in the breakdown of the neurotransmitter acetylcholine, found in both the peripheral and central nervous systems. These agents cause a number of hemodynamic and neurological symptoms based on its action at muscarinic and nicotinic receptors. The onset of symptoms is often within minutes, and it can take weeks to disappear.[1,2] Neurological symptoms like seizures are associated with significant morbidity and mortality. Status epilepticus in these patients can cause profound brain damage. Increase in intracranial pressure following organophosphate ingestion can be secondary to direct damage by organophosphate agent, hypoxia, or other metabolic causes such as hypoglycemia. Increased ICP carries poor prognosis in these patients. Therefore, frequent ICP monitoring by non invasive means provides an effective and safe way to measure the response to the treatment.

The optic nerve is a part of the central nervous system and is surrounded by the dural sheath. This sheath also enlarges as a reflection of ICP. It is possible to demonstrate the changes in the diameter of the nerve sheath using transocular ultrasound. Bedside ultrasound measurement of optic nerve sheath diameter (ONSD) is emerging as a non-invasive technique to evaluate and predict raised intracranial pressure (ICP). It has been shown in previous literature that ONSD measurement has good correlation with surrogate findings of raised ICP such as clinical and radiological findings suggestive of raised ICP.[3,4] Measurement of the optic nerve sheath diameter (ONSD) with ultrasound has been detected to have high sensitivity and specificity to demonstrate ICP; these measurements have been established to be safe when compared with images obtained with magnetic resonance imaging.[5,6] We use the following case of a 48 year old male with organophosphate poisoning to illustrate the usefulness of ONSD monitoring as a useful tool to monitor ICP in the ICU.

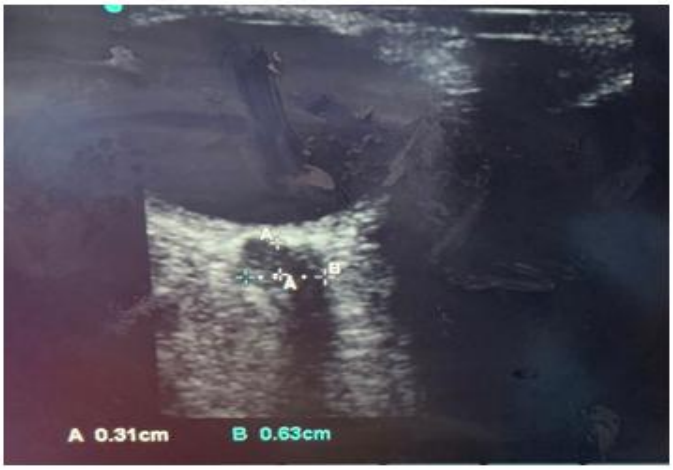
CASE REPORT

A 48 year old male presented to the casualty with history of vomiting, hypersalivation, lacrimation, urinary and bowel incontinence, altered sensorium following consumption of 200 ml of chlorpyrifos 50%. The patient was atropinised with 160 ml of atropine and pralidoxime at 2 g iv stat followed by 20ml/hr. Vitals at the time of presentation were as follows: HR- 80/min; BP- 92/60 mmHg; SpO2: 90% on supplemental oxygen with a GCS of E2V2M3. Bilateral Pupils were mid dilated and

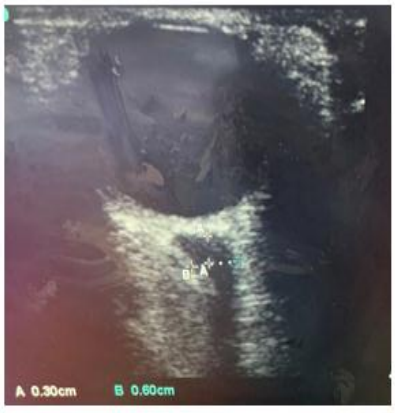
reactive to light. Patient had an episode of generalized tonic clonic seizure with deterioration of GCS to E1VTM3. The patient was dilantinised with Inj. Phenytoin 20mg/kg. Airway was secured following tracheal intubation. Post atropinisation, his vitals were as follows: HR- 120/min; BP- 120/70 mmHg; SpO2- 95% on Mechanical Ventilation and bilateral pupils were dilated. Patient was shifted to the ICU with a GCS of E1VTM1. Anti epileptics Inj. Phenytoin 100 mg IV 8 hourly and Tab. Leviteracetam 500 mg 12 hourly were administered to the patient. Tab. Piracetam 800 mg 12 hourly was also initiated. A CT scan of the brain and a fundoscopic examination was within the normal limits. The patient was put on Inj. Mannitol 100 ml IV once daily, Inj. Lasix 20 mg IV 12 hourly and Inj. Dexamethasone 4 mg IV 12 hourly.

We measured the Optic Nerve Sheath Diameter (ONSD) using a portable Ultrasound machine everyday after instituting the above therapy with the first reading serving as the baseline. The normal range of ONSD in adults is from 3.36 mm to 5.17 mm.

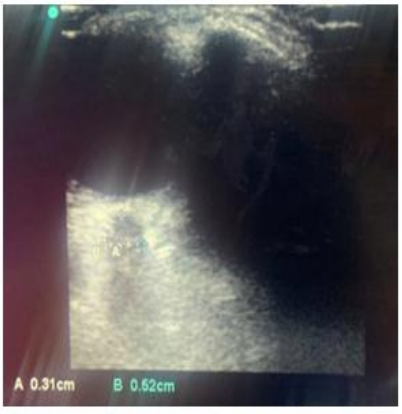
The baseline ONSD for this patient was 6.3 mm which was suggestive of raised ICP.



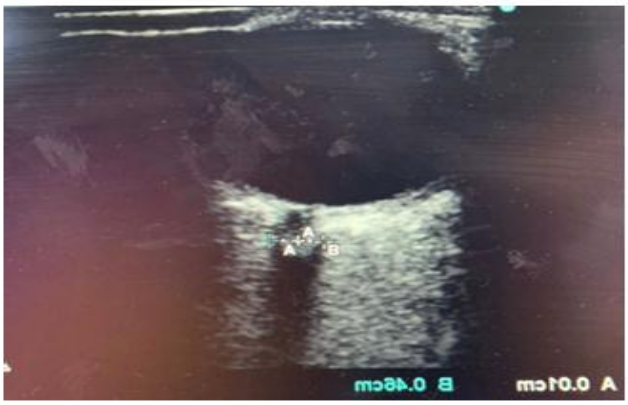
ONSD DAY 1
6.3 mm
GCS – E1VTM1



ONSD DAY 3
6.0 mm
GCS – E1VTM1



ONSD DAY 6
5.2 mm
GCS – E2VTM4



ONSD DAY 9

4.6 mm

GCS – E3VTM5

Trends Observed In ONSD and GCS

By 16th ICU day the patient was extubated with a GCS of E4V5M6 and infusion Atropine was tapered down to 8 ml/hour over the course of ICU stay. Inj Mannitol and Lasix were omitted and steroids were tapered. The patient was shifted to the ward for further management.

DISCUSSION

Intracranial pressure is a sign of numerous neurological disorders, and delay in diagnosis and treatment can have devastating consequences. Guidelines recommend targeting ICP<20–25 mmHg during follow-up for traumatic brain injury and other acute brain injuries.[7] Recent studies suggest that daily monitoring of ONSD measurement by ultrasonography can be useful for determination of increased ICP, it also can be used for evaluating the neurological prognosis of the patients.[8,9,10] Early detection of raised ICP is vital to avoid lasting neurological damage and decrease the overall mortality and improve prognosis. Invasive methods of monitoring the ICP are not available in all settings (particularly in emergency departments, rural, or resource poor settings) where immediate treatment for elevated ICP may be required. Even non invasive methods such as CT scans and Trans cranial doppler have their own set of logistic limitations such as patient transportation (especially for critically ill patients on mechanical ventilators) and expert knowledge and technical skill. Additionally radiation exposure with CT scan precludes its use for serial monitoring of ICP.

ONSD is a safe non invasive screening tool for detecting elevations in the ICP. Optic nerve sheath being an extension of the meninges swells with increasing intra cranial pressures. Although there is no consensus as to which ONSD value truly corresponds to raised ICP, most researchers feel that ONSD >= 5.2 mm has 100% predictive value of elevated ICP (95% CI=48%-100%).

CONCLUSION

To conclude, Optic Nerve Sheath Diameter assessment is a good, non invasive, easy to perform, point of care investigation for evaluation of elevated intra cranial pressure and in our experience, even with inter observer variability, it is more sensitive than other non invasive methods like CT in detecting raised intra-cranial pressure.

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