Optic nerve sheath diameter as a noninvasive adjunct tool in the evaluation of intracranial pressure

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DESCRIPTIONS

An infant presented with the abrupt onset of esotropia of the left eye, followed by an esotropia of the right eye over the subsequent 48 hours. Physical examination revealed bilateral papilledema, and apart from esotropia of both eyes (figure 1), the neurological assessment was unremarkable. The optic nerve sheath diameter (ONSD) was measured using the linear probe of the Sonosite M Turbo ultrasound device. ONSD values were 5.3 mm in both the right and left eyes, supporting the clinical suspicion of increased intracranial pressure (ICP) (figure 2A, B). Routine laboratory tests to rule out secondary causes of increased ICP were normal, and a neurosonogram yielded normal results. ONSD measured with MRI was 4.5 mm on both sides with no other structural abnormalities or masses (figure 3). The lumbar puncture demonstrated an elevated opening pressure of 30 cm cerebrospinal fluid (CSF) with normal CSF composition. A provisional diagnosis of idiopathic intracranial hypertension (IIH) was established. The child was started with oral acetazolamide at the dose of 25 mg/kg. As the resolution of papilledema oral acetazolamide was discontinued after 4 weeks, given the persistent esotropia even after 4 weeks, botulinum toxin injection was administered in the medial recti of both eyes. Esotropia started resolving in 24 hours after the administration of botulinum toxin and the effect persisted even after 1 month.

IIH, or pseudotumor cerebri, is a condition of elevated ICP in the absence of clinical, laboratory or radiological evidence of an intracranial space-occupying lesion that can occur in the paediatric population.[1] While strabismus can be a symptom of IIH, there is limited data available on its specific incidence within the IIH population. The incidence of strabismus in IIH varies, and it is not always explicitly reported in the literature. However, the prevalence was reported to be 18%.[2]

Figure 1 Esotropia of both eyes.

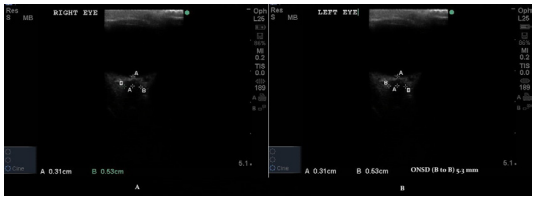

Figure 2 (A) ONSD 5.3 mm in the right eye (B) ONSD 5.3 mm in the left eye. ONSD: optic nerve sheath diameter.

Figure 3 ONSD 4.5 mm in both eyes (measured with MRI). ONSD: optic nerve sheath diameter.

ONSD, a bedside practice, can be employed to assess increased ICP. An ONSD of greater than 4 mm in infants under 1 year and 4.5 mm or greater in older children is considered abnormal.[3] There is growing evidence that point-of-care ultrasound measurement of the ONSD correlates with ICP.[4] This makes it a valuable extension of the physical examination, particularly in emergency medicine and critical care settings, for the initial non-invasive assessment of patients with suspected raised ICP. MRI is not an accurate method for measuring ONSD. Intra-rater and inter-rater reliabilities of ONSD assessment using MRI are poor to moderate.[5] The use of a widespread MRI sequence (3D

T1) to measure ONSD is not an accurate method since it may overestimate measurements and is dependent on an operator.[5]

Learning points

- Idiopathic intracranial hypertension (IIH) is a disorder of unknown aetiology, remains a diagnosis of exclusion and is characterised by increased intracranial pressure without an evident underlying cause.
- Elevated optic nerve sheath diameter (ONSD) values play a crucial role in supporting the diagnosis of IIH. When interpreted in conjunction with clinical presentation and imaging studies, increased ONSD values contribute to a comprehensive diagnostic assessment.
- The inclusion of ONSD assessment within the diagnostic algorithm proves valuable for the early identification of IIH. This addition becomes particularly pertinent in scenarios where invasive procedures carry a heightened risk, emphasising the importance of non-invasive measures for timely diagnosis and appropriate management.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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