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CASE REPORT

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Identification of Intracranial Hypertension by Ultrasound Measurement of Optic Nerve Sheath Diameter: About a Case

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Abstract

The ultrasound measurement of optic nerve sheath diameter (ONSD) as a screening test for intracranial hypertension (ICH) has demonstrated to be useful. Especially patients with traumatic brain injury (TBI), however, it could be a valuable tool if a patient presents with intracranial hypertension from non-traumatic origin. We report the case of a patient with acute neurological deficit from non-traumatic origin in which the ultrasound measurement of ONSD helped changing the therapeutic approach. Initially, the neurological deficit was thought to be secondary to an ischemic stroke but the finding of an increased size of ONSD contributed to final diagnosis of a bacterial brain abscess.

Keywords: Point of Care Ultrasound; Optic Nerve Sheath Diameter; Intracranial Hypertension; Brain Abscess

Abbreviations: ONSD: Optic Nerve Sheath Diameter; TBI: Traumatic Brain Injury; ICH: Intracranial Hypertension; ED: Emergency Department; ICP: Intracranial Pressure; CSF: Cerebrospinal Fluid

Introduction

A patient with altered mental status as main symptom represents a great challenge on emergency department (ED). Particularly taking into account the broad spectrum of etiologies potentially involved, the altered mental status as an alarm sign on ED could be the only presentation of a life-threatening condition. CNS conditions can acute elevate the intracranial pressure (ICP), which is a common emergency condition with poor clinical outcomes and high rates of mortality [1]. Next, we report the case of a young female with altered mental status as presentation sign where ONSD sonography evaluation contributed to diagnosis and change initial therapeutic plan.

Case

39 years old female with history of insomnia, hypothyroidism, depression and anxiety disorder who came to the emergency department (ED) with complaint of occipital headache, nausea and emesis. The clinical picture included dysesthesia in left side of her face, consciousness fluctuation and dysarthria. Vital signs on arrival Blood arterial pressure: 126/75 mmHg, Pulse: 93, afebrile and without requirement of supplemental oxygen, Drowsy but interacts with evaluator, follow simple commands and could answer simple questions with dysarthria. Physical examination normal pupils with spontaneous and continuous rotational nystagmus towards right side, the funduscopic evaluation was normal, she had no facial asymmetric aspect and no motor or sensitivity deficits on limbs, any meningeal signs or pyramidal tract involvement. Brain CT scan was evaluated as normal by a radiologist (Figure 1). The previous information raised concern of a neuro-vascular syndrome, the treating group wanted to check for the presence of a vertebral-basilar vascular dissection or a possible CNS vasculitis and the patient was admitted for inpatient management, brain MRI was ordered and management for stroke was initiated.

Laboratory ancillary tests showed elevated transaminases above 200 UI/L and arterial blood gas analysis revealed a metabolic acidosis without academia. We made a measurement of the optic nerve sheath diameter by ultrasound because patient arousal kept fluctuating and we wanted to rule out the possibility of an intracranial hypertension point of care ultrasound with Sonosite micromaxx device, a linear - high resolution probe finding a ONSD of 5.4 mm (normal diameter: less than 5.0 mm) on right side and 5.5 mm on left side (Figure 2). Due to normal findings in the CT scan and the abnormal ONSD findings, a lumbar puncture was carried out to confirm elevated intracranial pressure. Cerebrospinal fluid (CSF) opening pressure was 51 cmH_2O, CSF differential analysis showed 32 leucocytes, 100% of these were monocytes, glucose and protein levels were normal, molecular panel was negative to bacterial infection, after blood cultures, antibiotics were initiated. Once MRI scan was obtained (Figure 3), cerebellar peduncle abscess was suggested, blood cultures were positive for listeria monocytogenes and the patient received 21 days of antibiotics treatment leading to improvement, she was discharged to home without complications.

Figure 1: CT Scan with normal findings

Figure 2: Increased optic nerve sheath diameter suggesting elevated intracranial pressure

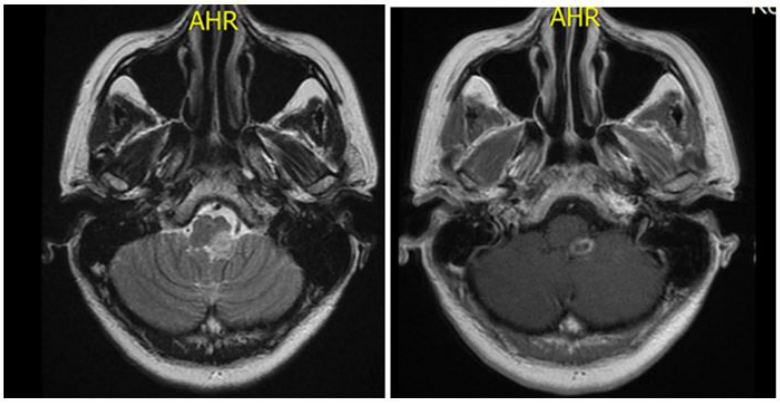

Figure 3: Brain MRI: Image with anular enhancement and restriction to the diffusion left brain stem. Suggest abscess

Discussion

Identification of ED patients with intracranial hypertension without trauma history could represent a challenge. The clinical picture of raised intracranial pressure (ICP) is variable and physicians could see patients with normal arousal status presenting with mild or non-specific symptoms like headache, nausea or emesis, but in some cases pathological changes in alertness or focal findings from unknown origin. In most cases, patients with acute raised ICP have not a remarkable physical examination, and the presence of intracranial hypertension is associated with adverse outcomes including mortality [1,2]. Since establishment of Monroe and Kellie's doctrine we understood a rising ICP as a dysfunction of intracranial compliance regulatory mechanisms that could lead to a drop of perfusion, ischemia and brain herniation. Normal ICP is considered inferior to 20 mmHg [3]. Direct measurement of that variable is complex on ED where devices to invasively measure frequently are not available, that is why non-invasive estimation of ICP is interesting. Ultrasound ONSD measurement offers some advantages: Procedure is non-expensive, not expose patient to radiation, time of performance is relatively short (4 minutes) and the learning curve of technique is relatively easy to achieve (25 measurements) [4].

ONSD measurement has an anatomic basis. Optic nerve is enveloped by arachnoids and there is subarachnoid space between these two structures. Then, ICP changes should generate diametral changes between the sheath that cover the optic nerve from side to side and that could be measured by ultrasound techniques [5]. Ultrasound ONSD measurement is a potentially useful tool to identificate adult patients with rising ICP. To date, it's not clearly defined the cut point of ONSD to stablish an accurate diagnosis of ICH and proposed cut-off points can range from 5 to 6 mm on literature [6,7]. We have accepted the lower point of this measurement to indicate abnormality [8,9]. In a study conducted by Afshin et al, the sensitivity increased from 38.9% to 100% with an increase in cut-off point from 4.5 to 5.5 mm [6]. This allows the sonographic technique to be used as a reliable technique to identify patients at risk for increased ICP in emergency wards. The reported specificity is between 74 - 100% when compared to invasive measurements [7-10]. In our case, utilization of ONSD ultrasound measurement led to an effective change in the diagnostic and therapeutic approach. From current evidence we can conclude that ultrasound ONSD measurement could be used as a noninvasive screening tool to identify ICH in ED patients with suggestive clinical findings and a diameter of optic nerve sheath larger than 5 mm.

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