Ultrasonography Of The Optic Nerve Sheath Suggested Elevated Intracranial Pressure In Epilepsy: Case Report

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Citation

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Abstract

Undiagnosed elevated intracranial pressure could lead to brain damage in Intensive Care Unit patients. Recently, ultrasound diagnostic has been proved to be a sure and cost-effective way to get data otherwise difficult to obtain during primary evaluation in Emergency and Critical Care Medicine settings. The optic nerve sheath diameter is enlarged in patients with intracranial hypertension and its increase correlates with data of non-invasive and invasive measurements of intracranial pressure and head computed tomography scan findings. Thus, the optic nerve sonography can serve as an additional non-invasive diagnostic tool of elevated intracranial pressure preceding the emergency computed tomography or the decision to start the invasive monitoring of intracranial pressure.

BACKGROUND

Elevated intracranial pressure (EICP) could be found in critically ill patients and lead to severe brain damage, if not diagnosed promptly. At the same time EICP diagnosis is a challenge during physical examination of a critical patient because of the limitations posed by the unconscious state of patient, paralysis or intubation. Moreover, it is not conceivable to perform emergency head computed tomography scan in all intensive care unit (ICU) patients and direct measurement of intracranial pressure is not recommended as routine procedure because of its invasive character. Fundoscopic examination could be helpful, but its accuracy in acute setting is limited and visualization of the optic disc may be difficult. The optic nerve is an evagination of the brain surrounded by meninges. Consequently, in the case of raised pressure of the cerebrospinal fluid, the retrobulbar optic nerve sheath will inflate. [1,2]

In recent years, Emergency Medicine and Critical Care Medicine have seen the expansion of emergency ultrasound, both in the form of ultrasound technology proliferation and the expansion of different ultrasound applications [3]. Bedside ultrasonographic measurement of optic nerve sheath diameter (ONSD) has been proposed as a reliable means to detect raised intracranial pressure [4,5] . We believe that routine use of ultrasound diagnostic in ICU can provide data otherwise difficult or even impossible to obtain from anamnesis, physical examination, laboratory, and radiography. At Maria Vittoria Hospital all ICU physicians are trained in ultrasonography according to the guidelines of the Society for Academic Emergency Medicine [6]. Since 2007, within six hours from admittance, an “head-to-toe” ultrasonographic examination is performed to resolve specific diagnostic challenges in critically ill patients. Further ultrasonographic evaluation is performed on the basis of clinical data.

CASE REPORT

A 73 year-old male patient with a history of severe heart failure as a consequence of atherosclerotic coronary artery disease, diabetes mellitus, and hypertension was admitted to ICU after episode of sudden death in medical ward of our hospital, followed by successful cardiopulmonary resuscitation. At admittance, with the patient sedated and intubated, ECG and chest X-ray examination were without new pathological findings and troponin I was 0,9 ng/ml (n.v. 0,0-0,6 ng/ml). Ultrasonographic evaluation showed that optic nerve sheath had diameter 6,459 mm (Figure 1.).

Figure 1

Figure 1. The calliper of the optic nerve sheath is enlarged to 6,459 mm. Also papilla bulges in the lumen of the eyeball. The scan was performed with an high frequency linear probe.

At heart examination left ventricular function was severely impaired (ejection fraction ≤ 35%) with no evidence of segmental wall motion abnormalities; ultrasonography showed no other pathological finding. Because the ONSD enlargement suggested the presence of EICP, brain computerized tomography was performed immediately and big arteriovenous malformation with cerebral oedema was diagnosed (Fig. 2). The following EEG revealed the presence of status epilepticus as well. The patient was immediately transferred to a neurological ICU were he died seven days later.

Figure 2

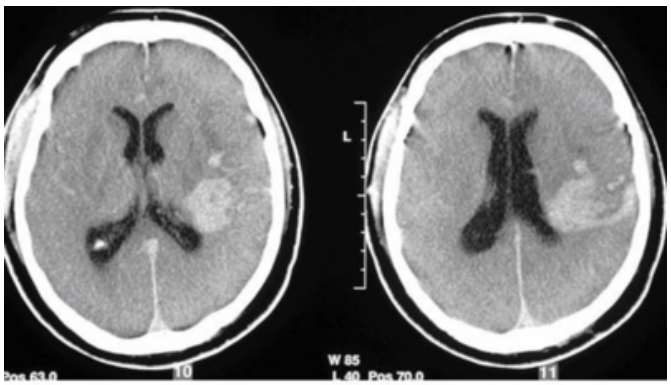

Figure 2. Brain computerized tomography evidences the AVM and cerebral oedema.

DISCUSSION

In 2002 Lichtenstein et al. [7] suggested to measure the ONSD to diagnose EICP in Critical Care setting. In his study, cerebral oedema was diagnosed in 80% of patients who had had ONSD larger than 4,5 mm and this number was proposed as the best cut-off one. In recent studies, conducted in Emergency Department and in neurological ICU settings the measurement of ONSD proved its high sensitivity (100%) and specificity (95%) for detection of increased intracranial pressure [8,9]. In two other studies performed in the neurological critical care unit settings, the ONSD measurement correlated with invasive measurement of intracranial pressure, they both recognised the same ONSD of 5,7 mm as the best cut-off value to diagnose EICP [10,11]. It is worth to remember that the ultrasonography is highly operator-dependent investigation and with respect to measurement of ONSD there is a subjective judgment in establishing the boundary of the optic nerve sheath and every effort should be done to ensure that the nerve is centred and measurement is made 3 mm posterior to globe [9,12].

CONCLUSION

In ICU patients early identification of EICP is of great importance to initiate its prompt treatment [13]. This case underlines the importance of optic nerve sheath sonography integrated into an “head-to-toe” primary ultrasonographic assessment of critically ill patient, it provides important information on intracranial pressure and can be used for early EICP detection. In practice, the ONSD more than 5,0 mm should lead us to take under serious consideration the options to perform brain computerized tomography or to start invasive monitoring of intracranial pressure.

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