Austin Emergency Medicine

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Perspective

Transcranial Ultrasound in Neurocritical Patient (TUSiNP Protocol): A Proposal

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Received: May 08, 2019; **Accepted:** June 04, 2019; **Published:** June 11, 2019

Perspective

The use of multimodal monitoring in neurocritical patients meant a milestone in neurocritical care [1]. Invasive measurement of intracranial pressure is still the gold standard method for evaluating cerebral hemodynamic [2]. However, there is a group of clinical situations or care settings in which the use of non-invasive methods of neuromonitoring would be ideal.

At the end of the 80s, color-coded transcranial duplex ultrasound (CCTD) began to be introduced into the adult population, a technique that combines the acquisition of color and spectral images by transcranial Doppler together with two-dimensional images [3]. Its generalization in medical practice has not been parallel to the point of care ultrasound (POCUS). There is a group of authors who try to make the transcranial ultrasound part of POCUS.

The method requires a learning curve not different from that required by critical ultrasound and an approach based on pathophysiological knowledge of the normal and damaged brain. In POCUS the use of some basic protocols such as RUSH, FAST, e-FAST, among others has facilitated their learning and generalization [4,5].

Perhaps the proposal of a protocol for the use of transcranial ultrasound in neurocritical patient (TUSiNP) could help the implementation of the method. At this point it is mandatory to highlight its use together with clinical examination and judgment.

The same ultrasound used in the evaluation of critical patients is used, with the same sectoral transducer used for echocardiography (1-5 MHz). Through the transtemporal window the views of the diencephalic, mesencephalic and ventricular planes will be obtained. Once the third ventricle has been identified and the distance from it measured from each side, it will be possible to assess whether there is a deviation from the midline [6].

In the bi-dimensional images, the presence of intracranial hematomas can be evaluated [7]. In a transtemporal window in the mesencephalic and diencephalic planes, the blood vessels that make up the polygon of Willis can be visualized. By identifying the vessels by color Doppler and placing the pulsed Doppler sample volume in them, Doppler spectra of flow velocities are obtained (Figure 1). The evaluation of mean velocity, final diastolic velocity and pulsatility index allow an approximation to the pattern cerebral hemodynamics [6,8]. Five patterns can be diagnosed: low flow, high resistance, hyperemic, vasospasm and circulatory arrest. The identification allows to initiate personalized behaviors and to have differential diagnoses in each pattern. There are described formulas for the non-invasive estimation of intracranial pressure (ICP) and cerebral perfusion pressure [9]. Acceptance is controversial but trends can be followed.

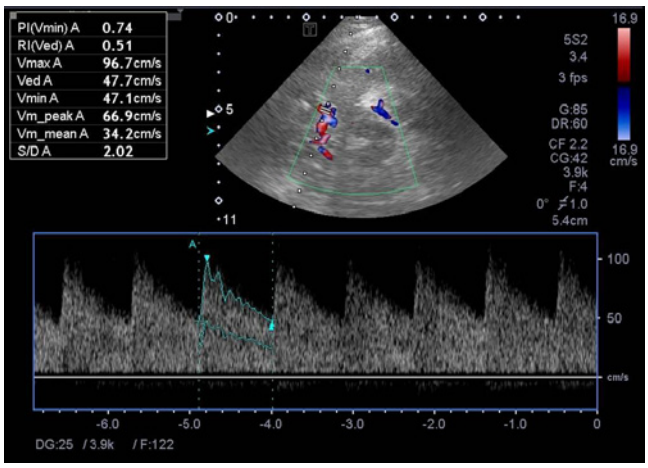

Figure 1: Color and spectral Doppler. Insonation of middle cerebral artery by transtemporal window.

With a 3-8 MHz linear transducer through the transorbital window, the diameter of the optic nerve sheath can be determined [10]. An increase above parameters that must be established corresponds to an increase in ICP.

In summary, color-coded transcranial duplex ultrasound can have an important value for the non-invasive evaluation of cerebral hemodynamics, by following an established protocol: TUSiNP protocol.

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Citation: Abdo-Cuza A. Transcranial Ultrasound in Neurocritical Patient (TUSiNP Protocol): A Proposal. Austin Emerg Med. 2019; 5(1): 1061.

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Austin Emerg Med - Volume 5 Issue 1 - 2019
ISSN : 2473-0653 | www.austinpublishinggroup.com

Citation: Abdo-Cuza A. Transcranial Ultrasound in Neurocritical Patient (TUSiNP Protocol): A Proposal. Austin Emerg Med. 2019; 5(1): 1061.