

Editorial

Ultrasonic Evaluation of Shock in Emergency Department

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EDITORIAL

A prompt and accurate diagnosis of shock in the Emergency Department (ED) could improve the outcome of patients. Ultrasound is fundamental to guide an early diagnosis and therapy [1] for several reasons: ultrasound equipment has become more available because more compact, higher quality and less expensive; it allows a very rapid assessment of the hemodynamic state of the patient, giving a rapid help to found the main causes of shock; it guides therapeutic interventions (eg fluid therapy, pericardiocentesis) and can be used serially to assess response to interventions in a "real-time" manner. For these reasons many Emergency and Intensive scientific societies have suggested to spread an early use of Ultrasound exam for the evaluation of critical patients in the ED [2-4] and have defined the competence and training standards for critical care ultrasonography [2,4-6].

However the Ultrasonography is a user-dependent technology and this could be a great limit in the management of the patient in shock.

For this reason, in the last years several authors proposed ultrasound protocols to improve the standardization of the methodology in patients with undifferentiated hypotension and shock in ED [1,4-5,7-12].

All the ultrasound protocols actually in use are complex because they include the evaluation of many organs: heart, thorax, vessels, abdomen. However they have common characteristics: the evaluation of heart with cardiac function, pericardial, chamber size (although the valvular assessment remains absent from most protocols); the volume assessment.

The mayor ultrasound protocols for medical shock assessment in Emergency Department are shown in the Table 1.

The ultrasound (US) management of critical patients based on a US protocol has many advantages: it is rapid, objective and complete.

Ideally before using an US protocol it should be tested for the major quality indexes: validity, reliability and feasibility.

But to our knowledge there are not reports on this topic and few studies tested the impact of this protocols on clinical practice [13,14].

In particular Jones et al in 2004 looked at the effect of a

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Table 1: Comparison of major Ultrasound protocols for shock.

	Views	Goal
⁴ FOCUS	Not specify	Pericardial effusion Global cardiac function Enlargement of right and left ventricular chamber Intravascular volume assessment
⁸ RACE	Parasternal long and short axis Apical four and two chamber Subcostal	Left Ventricular function Right Ventricular function Pericardial effusion Fluid status
¹ GDE	Parasternal long and short axis Apical four and two chamber Subcostal Color Doppler	Left and Right Ventricular function Pericardial effusion Septal dynamics Valvular morphology Fluid responsiveness
⁹ ACES	Parasternal long Apical four chamber Subcostal FAST	Left and Right Ventricular size and contractility Pericardial Inferior Vena Cava max. diameter and caval index Abdominal aorta Free peritoneal, pleural and pelvic fluid
¹⁰ RUSH	Parasternal long and short Apical four chamber Subcostal FAST and Thoracic US	PUMP Pericardial effusion and Cardiac Tamponade Left ventricular contractility Right ventricular size TANK: Volume status Inferior vena cava and Internal Jugular vein FAST and Thoracic US PIPES: Aorta and Femoral-Popliteal veins
¹¹ EGLS	Thoracic Subcostal Parasternal long and short Apical	Pneumothorax ? Tamponade ? Hypovolemic ? Hypotension for poor Left ventricular function ? Signs of Right Ventricular strain ?
¹² FAST and RELIABLE	Parasternal long and short Apical four chamber Subcostal FAST and Thoracic US	FAST Right ventricular strain Pericardial effusion Left Ventricular function Inferior Vena Cava, aorta, Venous for deep venous thrombosis Pneumothorax Ectopic pregnancy

goal-directed US protocol in the management of patients with undifferentiated hypotension in ED. The authors concluded that the incorporation of a US protocol results in a more accurate physician impression of final diagnosis.

Manno et al in 2012 determined whether a US protocol can change therapy, induce further testing or interventions and confirm or modify diagnosis in one Intensive Care Unit (ICU). The researchers concluded that the US exam revealed unsuspected clinical abnormalities, modified many admitting diagnosis (26%) and confirmed it in a lot of patients (58,4%); it prompted further testing in 18% of patients, led to changes in medical therapy in 18% of cases. For these reasons it could be included as a tool of rapid global assessment of the patient on admission to improve healthcare quality. But this study has been conducted in an ICU so it could be difficult to apply its conclusions at the ED.

In fact there are not randomized controlled trials which investigate the US protocols validity in improving management of hypotensive or shock patient in ED.

Moreover there are not studies on the impact of US protocols on outcomes neither reports on the reliability among users. In our opinion this gap in the research could influence the clinical use of the previous protocols.

In particular the reliability should be test in further research because the user-dependent feature of ultrasonography. It could be interesting to check the inter-rater reliability in the centers who apply the international statements on the US training in critical care setting [2, 4-6].

Finally are the US protocols feasible in the setting of crowded ED when the Emergency Physician should visit a very large number of critical patients very rapidly? Further research should answer this question. Although there is a study on the time needed to perform FOCUS by ultrasonographers of variable expertise [15] to our knowledge other US protocols have not been tested for this outcome.

In conclusion, in our opinion, it is the time to stop developing US protocols and to plan research on those which actually in use.

Point-of-care echocardiography using portable machines is an exciting development in emergency medicine and recent improvements in ultrasound quality mean that emergency physicians are finding echocardiography useful in a variety of clinical settings but further research should be published on the validation of the main US protocols proposed for the shock and hypotensive patient.

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