Mini Review

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Crucial applications of ultrasound in emergency toxicology

Abstract

Ultrasonography has a recognized and accepted role in helping diagnose diseases in the clinic and especially in emergency situations. But little attention has been paid to the effective and practical role of this technique in emergency toxicology. This article is intended to introduce ultrasound applications in poisoning emergencies such as, hypotension management, snake bite, gastric lavage, lead poisoning and rhabdomyolysis

Keywords: Ultrasonography, emergency toxicology, hypotension, rhabdomyolysis

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Introduction

Ultrasound is used in various emergency and non-emergency medicinal situations, for example: identify traumatic joint effusions; pathological placental conditions, dermatologic anatomy; for detection of Esophageal foreign body; and many other conditions. Emergency sonography brings about a number of targeted sonographic study techniques, which allow a quick response to frequently critical situations arising in intensive care and emergency medicine. Use of emergency ultrasound (EUS) in medical poisoning setting has not been previously studied. In this article we will discuss applications of ultrasound in emergency poisoning department.

Ultrasound in hypotensive toxic patients and in shock state

Hypotension is one of the most important causes of mortality in emergency toxicology department.[1] Physician Along with physical examination and ultrasound can makes more and faster right decision to treatment and adequate volume repletion in hypotensive patient, so tissue perfusion and renal function improved leading to better poison excretion.[2] Imaging the IVC with ultrasound can provide a window to evaluate the patient hydration and volume status.[3] Bedside measurements of caval index could be a useful noninvasive tool to determine central venous pressure during the initial evaluation of the ED patient.[4] TUSH Exam (an ultrasound exam for poisoned patient) is bedside point- of- care ultrasound (POCUS) in critically ill toxic patients, with the potential to change clinical management and improve patient outcomes.[5]

Focused cardiac ultrasonography (FOUS), is principally used to assess the presence of in the pericard, volume if intra-cardiac cavities, overall cardia coperation, and intravascular volume status. The next step in pericardial effusion is evaluation of right ventricular function for cardiac tamponade, and evaluation of left ventricular contractility based on the left ventricular contractibility.[6] Therefore, performing the diagnostic procedures along with appropriate treatment is very critical for the patients with hypotension of unknown causes. If the diagnostic tests that used for evaluation of these patients are inexpensive, rapid, and be relevant at bedside, this will assist the clinicians who engaged in critical situations.[7, 8]

Ultrasound in assessment need for gastric lavage

Ultrasound can play a useful role in the need for gastric lavage in poisoned patients. The American and European Association of Poison Centers and Clinical Toxicologists (EAPCCT) distributed a united declaration that Gastric Lavage (GL) should not be used regularly in the treatment of intoxicated patients.[9,10]

Although the records to strengthen Gastric Lavage is inefficient, the American Academy of Clinical Toxicology(AAPCCT)persists to mentioned take into account of Gastric Lavage in possibly massive intoxications when the process should be done within first hours postingestion.[11] In adequatedata are accessible to direct conclusions on this minor but important intervention in the management of severe and fatal poisoning.

In emergent conditions information often incomplete and unreliable therefore evaluations of acute poisoned patients is complicated. In these situations where time of ingestion is indefinite, the diagnostic imaging tools can be partly helpful in making the appropriate decision.[10, 11]

A clinical trial showed that point of care ultrasound (POCUS) has a responsibility in helping emergency physicians deal with intoxicated cases. For carrying out POCUS via a linear array transducer (10-5MHz), applicants fill a questionnaire about presence or absence of drugs and the probable number of drugs.[12]

Ultrasound is an available equipment to assist in the prompt assessment of intoxicated patients without the need for a patient to move the emergency department. Based on the patient's history of life threatening ingestion and shortly after the arrival the patient decision on doing or not doing gastric lavage by ultrasound tool was made.

And the decision was made to initiate GL based on the patient's history of potentially life-threatening ingestion of a large amount of pills, the bedside ultrasound, deteriorating clinical status, and a relatively short time from ingestion to ED presentation.

Ultrasound role in snake bite

According to the species of snake the proteins in snake venom may be has cytotoxic, proteolytic, and/or neurotoxic enzymes activities. That's why local or systemic symptoms following the bite differs based on the type of snake.[13] Detailed care of patients with repeated examination and measurement of its circumferential in order to judge the need for surgical intervention is feasible.[13,14]

Ultrasonography of the affected limb was depend able with

physical examination of the extremity. Subcutaneous tissue edema is the most common finding in sonography. In some cases necrosis and edema rapidly progress and leg swelling spared via fascial planes through deeper muscle layers. In cases with fingers involvement, swelling and tendon injury were willingly visualized using with a water-bath procedure (place of the limb in a pool of water, letting more comprehensive examination of the soft tissue).

Ultrasonography may benefit for a more overall understanding of the local impacts of snakebite. Ultrasonography is able to prove normal deeper muscle consistent in cases with diffuse leg edema.[14] Therefore ultrasonography has a significant task as a diagnostic aide in snake bite evaluation.

Ultrasound role in lead poisoning

Ultrasonography utilized in the diagnosis of lead poisoning. Trans cranial sonography can be used to examine congenital lead poisoning in infant with lead encephalopathy.[15] Zou et al investigated the consequences of lead exposure effect on sys/dia blood pressure, the echocardiographic findings proposed that systolic cardiac function augmented in the exposed group as a compensatory result to the effect of lead cardiomyopathy.[16] Pulsed Doppler imaging displayed that time-concerned fact or were similar among all cases but that blood flow velocity across the mitral valve and Doppler area fractions altered meaning fully in lead-exposed groups.

The decrease in diastolic cardiac operation was considerable in the lead-intoxication group than in the non-exposed group.[15, 16]

Ultrasound role in rhabdomyolysis

Rhabdomyolysis is described as massive acute straited muscle necrosis, which may be caused by toxic agents and drugs, crush damage, infections, physical activity, and neuromuscular disorder. Rhabdomyolysis may result from exposures to toxins other than medications.[17,18] It may leads to acute kidney injury too. These include: Metabolic poisons, such as carbon monoxide, Snake venoms, bee stings, Mushroom poisoning, an unidentified toxin found in certain types of fish, Rhabdomyolysis may cause further life-threatening complications.

Early diagnosis and prompt treatment are mandatory. The sonographic images showed decreased echogenicity and increased thickness and disorganization of muscular structure without local defect over the muscle. The sonographic images indicated muscle necrosis rather than muscle strain or tear.[18]

Discussion

Physicians are progressively more utilizing ultrasound for make a diagnosis in many conditions, mainly in serious patients as it characterizes reason ably simple and instantaneously accessible device. They also utilized it in lots of concomitant pathological situations such as soft tissue irregularities, tendon rupture and organ anomalies.

In toxic patient, ultrasound can have an important and beneficial function in the diagnosis and treatment several conditions like evaluation of gastric lavage indication, fasting in diagnosis in snake bites and lead poisoning. Moreover, it can be an alternative to invasive procedures like central venous catheter arrangement in refractory hypotensive patients, early diagnosis of rhabdomyolysis as a complication of many toxins. Ultrasonography can be used at the bedside simply, securely, and repeatedly and Working in Emergency department, medical wards and ICUs only following sufficient instructing.

Authors' contribution

FGH and SHSSH contributed to the search of the data and preparing of manuscript equally. All authors read and signed the final paper.

Disclosure of potential conflicts of interest

The authors declare that they have no conflict of interest.

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