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CASE REPORT

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Use of point-of-care ultrasound (POCUS) in the diagnosis of abdominal trauma performed by a paramedic in EMS: a case report

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ABSTRACT

Ambulance Service in Poland, in their daily work, are obliged to make appropriate diagnoses already at the pre-hospital level. Effective diagnostics is the key to proper diagnosis, treatment and decision-making by the emergency medical service (EMS) leader paramedic. In particular, the history and physical examination are the key to solving the mystery regarding the patient's health condition, predicting and avoiding death. Nevertheless, not every emergency presents, at the time of examination, suspicious symptoms that do not give any clear symptoms, and without using a specific imaging method at the scene of the incident, we limit the proper assessment of the patient's condition and future prognosis, which may be dramatic or even fatal, especially given the scant history the patient presents. We would like to present a case of the appropriateness of using ultrasound at the pre-hospital level, which turned out to be crucial for the management of the patient in accordance with medical art, even if he does not consent to transport to the hospital and no symptoms suggest that the current condition is a threat not only to health, but even to life. We would like to prove that a simple pre-hospital ultrasound scan can help make a very advanced diagnosis, complementing the patient's scant interview and pointing to the circumstances that occurred at the scene of the incident. After losing consciousness, a young woman with an accidental abdominal injury, without typical symptoms, was correctly diagnosed by a paramedic, which allowed for the diagnosis of a life-threatening condition at the scene of the incident.

KEY WORDS: Ultrasonography, USG, eFAST, POCUS, emergency medical service, paramedic

INTRODUCTION

Ultrasonography (USG) - is a safe, non-invasive imaging diagnostic method that uses ultrasonic waves of high frequency, inaudible to humans, to image internal organs and blood flow in real time. It does not produce ionizing radiation, so it can be repeated many times in patients of different ages, especially in patients with a life-threatening emergency [1]. Ultrasonography is used in emergency medical services/ambulance servie to improve the diagnosis of the disease at the scene of the incident, which facilitates making effective diagnoses and implementing appropriate treatment, and improves the patient's further prognosis [1,2]

In paramedics' practice, this test is used mainly in POCUS protocols; FAST; EFAST, RUSH, RADIUS, BLUE. Each of them corresponds to a different position of the head and is used in precisely defined clinical cases. The task of a paramedic is to effectively detect the so-called "red flags" that cannot be captured effectively in the history and physical examination without imaging (lack of specific symptoms) and constitute an important addition to the interview that the patient may not remember [1-3]. Traumatic conditions, cardiac arrest, shortness of breath, identification of the causes of shock, cardiological assessment or an isolated disease should be taken into account, especially when the history is incomplete.

CASE REPORT

PATIENT INFORMATION: Call code 2 (departure time - up to 3 minutes, no signals), for a 26-year-old patient. From the interview, we know that the EMS is being called by a grandmother to her granddaughter, who lost consciousness in the bathroom while doing laundry. After locating the address using the GPS system, we know that we will reach the scene of the incident in about 13 minutes. In order to determine the context of the situation, we take a CO detector with us and inform you that electric shock should also be taken into account - as the two main external causes of the above-mentioned condition. Upon arrival, the patient's grandmother opens the door, and the patient herself awaits the visit in the living room of the house.

CLINICAL FINDINGS: Interview according to the medical acronym SAMPLE:

S - no significant disturbing symptoms, overall impression is very good

A - negation

M - none

P - none, the patient is menstruating

L - about 2 hours ago

E - grandmother's interview: she heard a bang in the bathroom, saw her unconscious granddaughter, couldn't wake her up, so she called the emergency medical services;

The patient's history: she often has painful periods, after which she feels weak, hence the possibility of fainting. The only thing she felt was severe pain in the left subcostal area. Currently pain free. Negates electric shock. EMS activities at the scene of the incident: the rooms were thoroughly examined for the presence of CO - negative results. The place of loss of consciousness was examined again - the bathroom. The only thing that remains disturbing is the open cabinet door, located directly behind the place where the patient fell.

DIAGNOSTIC ASSESSMENT: Patient's diagnosis according to CABCDE acromine:

C - no active bleeding;

A- nasal passage, no symptoms of shortness of breath;

B - symmetrical vesicular murmur, overt symmetrical bulge, chest compact, no crepitation or pain on examination, SpO_2 = 99%;

C - CRT<2s, skin is pink, heart sounds are clear and loud: s1+s2+0, no signs of PRELOAD, ECG shows regular sinus rhythm, around 75/min, no signs of ACS. BP = 145/80 mmHg;

D - Alert, GCS = 15, RTS = 12, neurological examination FAST negative, tympanometry temperature 36.5 °C on the eardrum; Glycemia = 80 mg%, cranial nerves innervate symmetrically, no meningeal symptoms, symmetrical specific strength in 4 limbs, normal coordination, no dizziness, proper vision (PERRLA eye assessment), no head injuries;

E - The patient has a slim build. The abdomen is soft, painless, not tense, slightly tender in the lower abdomen, the peristaltic wave is live, without pathological pulsations, the assessment of the pulse in the iliac arteries is correct and symmetrical. Urine and stool without stasis.

The patient reports that she felt pain in the left subcostal region, on the dorsal side, before losing consciousness, we examine this place. The area is slightly tender, with no signs of crepitation, and a visible area of linear abrasion of the epidermis. We tap the left subcostal area from the chest. The patient reports a strange stinging sensation in her left collarbone. Tapping forces a defensive movement - protection of this place with the other hand. We extend the examination with ultrasound in the FAST protocol - we locate a small amount of free fluid in the vaginal vestibule - corresponding to the period of menstruation; while in the Keller's recess we see a hypoechoic structure modeling the space between the posterior part of the tail of the spleen and the left kidney (Figure 1).

Morrison's recess is clearly visible and normal, parasternal apposition in the short axis shows no signs of free fluid in the pericardial sac. The bladder is properly filled, trapezoidal with oval edges.

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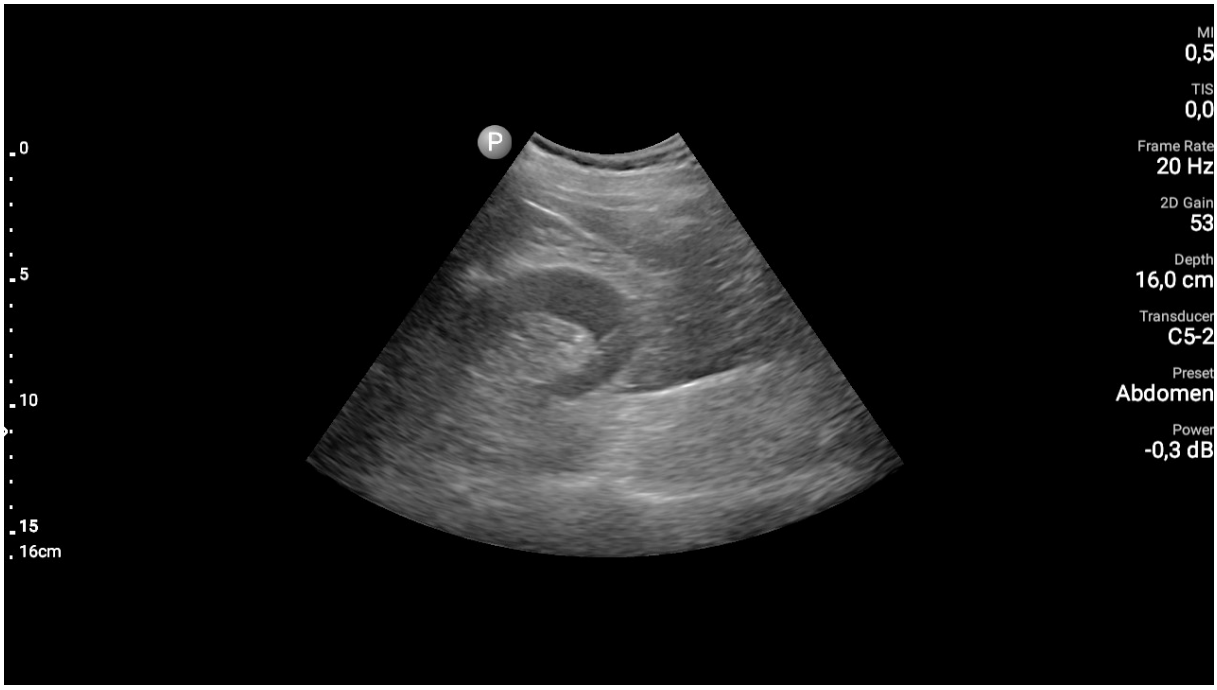

Figure 1. View of Keller's recess - visible hypoechoic structure surrounding a fragment of the tail of the spleen, resting on the upper edge of the left kidney.

Key technical features ultrasound available at EMS:

- Imaging modes: 2D, Color Doppler, M-mode, Power Doppler (on selected models).
- Connectivity: USB-C or Micro-USB; Apple devices require a power module (Lumify Power Module).
- Power: Battery-free design (draws power from the display device).
- Uptime: Depends on tablet/phone, average 2 to over 6 hours of continuous scanning.
- Data security: HIPAA compliance and data encryption. A compatible account (email) with the ability to send the image remotely (to the Emergency Department).

THERAPEUTIC INTERVENTION: The patient initially does not agree to transport to the hospital. She claims that it was because of her menstrual period that she could have fainted, and her grandmother unnecessarily called the emergency medical services. We make a diagnosis of splenic injury, probably in a two-time mechanism. We transport the patient with appropriate parameters and very good general condition to the hospital.

FOLLOW UP AND OUTCOME: The patient additionally underwent CT with contrast, and was diagnosed with a splenic hematoma and a hemothorax (for conservative treatment); but the patient was qualified for splenectomy. After about 3 weeks, she was discharged home with recommendations.

DISCUSSION

The interview is a key element in making a diagnosis by paramedics. The most accurate and well-known is the interview using the acronym SAMPLE and the patient examination using the acronym CABCDE. Even such an extensive examination method, without diagnostic imaging, may in many cases be insufficient to make the correct diagnosis. In this case, the history and circumstances pointed to relatively external causes (CO, electric shock), and the patient's general condition did not present any symptoms known to medicine as a life-threatening condition. In this case, there are two diagnostic traps:

1. Injury to the tail of the spleen, which does not cause peritoneal symptoms
2. Formation of a pathological capsule limiting the hematoma - no hemorrhage

Without effective ultrasound imaging at the scene of the incident, the therapeutic decision could have taken a different form and due to the normal vital parameters and the decision of the patient herself, there were no absolute grounds for forcing her to hospitalize. Ultrasonography in the FAST protocol not only provided an answer to the circumstances of the event - the dorsal part hit the edge of an open cabinet, which, given active menstruation and spleen injury in such a slim person, could have temporarily led to hypotension and fainting. An additional aspect could be the pain impulse. In such situations, short-term retrograde amnesia may occur, hence the interview was very limited.

POCUS plays a significant role in decision-making in the prehospital setting. In a cohort study, Niek J. Vianen et al. found that ultrasound is most frequently used (62.7%) in trauma patients, but its impact on important rescue decisions was demonstrated in 65.4% of non-traumatic patients [4]. In most emergency medical systems, a physician supplements basic rescue procedures, performing, among other things, on-site ultrasound [5]. In Poland, paramedics have been certified to perform ultrasound in emergency protocols only since 2024. The devices used for this examination have not yet been standardized. A mobile version of the probe is typically used with a tablet for imaging. Educational programs regarding POCUS for paramedics vary widely worldwide and should be standardized [6]. In the authors' opinion, a paramedic can acquire this skill during a multi-day course to perform the FAST or eFAST protocol. The case described is just one example of a trained paramedic using ultrasound in an EMS setting. This above-standard examination enabled the diagnosis of a life-threatening symptom in a patient who, under other circumstances, could have remained at home. Therefore, it is recommended that POCUS training begin during the undergraduate program. This will allow paramedics to gain greater experience in conducting the examination.

CONCLUSIONS

Ultrasonography in the FAST protocol, in this case, absolutely helped to correctly diagnose the patient, in whom the complexity of the interview and the lack of deviations in the examined parameters could suggest incorrect differentiation of the case. This could have put the young woman at risk not only of her health, but above all of her life. Efforts should be made to recognize POCUS examination performed by EMS paramedics as standard on-scene treatment for trauma patients.

SUPPLEMENTARY INFORMATION

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Informed Consent Statement: *Informed consent was obtained from all subjects involved in the study.*
Data Availability Statement: *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*
Conflicts of Interest: *The authors declare no conflicts of interest.*

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