

"Blind spots" of emergency abdominal ultrasound during mass admission of wounded with hostilities. Experience of armed conflict in Ukraine.

Oksana Popova, Employee of Ukrainian Armed Forces, Surgeon, PhD Student, Military Medical Clinical Center of the Eastern Region, Dnipro, Ukraine

Konstantyn Gumeniuk, Colonel, Surgeon General of Ukrainian Armed Forces, PhD, Medical Forces Command of Ukrainian Armed Forces, Kyiv, Ukraine

Summary. Ultrasound diagnostics (USD) has confidently taken a leading place in the provision of emergency care. The "gold standard" of emergency ultrasound for abdominal trauma has long been recognized FAST (Focused Assessment with Sonography in Trauma), which is enshrined in almost all standards and guidelines for emergency and military medicine, including ATLS (Advanced Trauma Life Support), BATLS (Battlefield Advanced Trauma Life Support), NATO STANDARD AJP-4.10 (ALLIED JOINT DOCTRINE FOR MEDICAL SUPPORT) and NATO STANDARD AMedP-1.8 (Skills Matrix). However, in the experience of the armed conflict in Ukraine in 2014-2022, we had the opportunity to see that the FAST has a few "blind spots", in particular, regarding the diagnosis of colon damage and retroperitoneal hematomas. We tried to eliminate them based on the development of universal, simple and repetitive probe positions and evaluation criteria.

Methods-Results. We had added a few criteria and positions to the standard FAST procedure for assisting wounded with combat abdominal trauma:

- examination of the iliac regions with assessment of the diameter of the cecum and the diameter of the sigmoid colon;
- assessment of retroperitoneal hematoma was added to examination in the standard positions of the FAST procedure, the as a phenomenon of ultrasonic density rarefaction with an uneven edge and a clear border in the relevant areas, the thickness of which has been also measured.

As we found earlier in a case series, a decrease in the diameter of the cecum of less than 40 mm and the diameter of the sigmoid colon less than 20 mm is a specific sonographic sign of colon damage. We decided to use this criterion to detect colon damage in wounded with combat gunshot abdominal trauma. This problem is less urgent for non-military medicine, where the incidence of colon injuries does not exceed 1% among the injured and 5% among patients with abdominal trauma. Whereas in the case of combat trauma, the frequency of colon damage can reach 14% in the overall structure of injuries and up to 45% among the wounded with abdominal trauma, which leads to high mortality and increased incidence of complications.

The risks of retroperitoneal hematoma for abdominal combat trauma are also underestimated. Along with intra-abdominal bleeding, it is often a source of

significant blood loss and is the cause of death and complications that are not routinely diagnosed.

Verification of the effectiveness of proposed additions to the standard FAST procedure was carried out in 2 stages:

1. Comparison of retrospective data on the use of the standard FAST procedure during the Joint Forces Operation (JFO) 2014-2021 (2012 wounded with abdominal injuries) and the improved procedure, which we began to apply separately in January 2022 and systematically - after start the war in Ukraine 24 February 2022 (1179 wounded with abdominal injuries).
2. Comparison of the effectiveness of the standard FAST procedure with and without additional criteria in the experience of wounded with abdominal injuries received after the start of the war in Ukraine on February 24, 2022 (1179 wounded with abdominal injuries).

The criteria of effectiveness were: a) the proportion of damage to the abdominal organs and retroperitoneal space, which were detected during the implementation of the FAST procedure to those that were diagnosed intraoperatively; b) early mortality among the wounded with abdominal trauma; c) the overall percentage of early complications among the injured with abdominal trauma.

Results are shown in Table 1 (see below).

The major part of the detected injuries was isolated colon lesions and large retroperitoneal hematomas.

Conclusions.

1. Improving the protocol of emergency abdominal ultrasound in accordance with the requirements of military medicine is a necessary measure that reduces early mortality and the level of complications among the wounded with abdominal injuries.
2. Proposed changes are easy-to-implement additions to the standard FAST procedure that allow additional detection of colon damage and assessment of retroperitoneal hematoma, are sensitive enough to use in clinical practice (increased sensibility to abdominal injuries by 9.8%; p-value <0.05).
3. The introduction of an improved protocol has a positive effect on the treatment of wounded with abdominal trauma, reducing early mortality (by 1.6%; p-value <0.05) and the frequency of early complications (by 6%; p-value <0.05).
4. Delayed complications and mortality need further assessment, which will be possible later, after the final synthesis of the data that we began to collect after February 24, 2022.
5. This protocol can be implemented not only for the wounded with gunshot wounds to the abdomen, but also to improve the rapid diagnosis of any injuries of the abdominal cavity, regardless of their mechanism of development and causes.