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SCIENCE OF XXI CENTURY:
DEVELOPMENT, MAIN
THEORIES AND
ACHIEVEMENTS

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HOW INFORMATIVE IS THE CALCULATOR «ABC SCORE FOR MASSIVE TRANSFUSION»?

Background. The problem of massive blood loss due to injuries and the associated problem of massive blood transfusions are extremely relevant in surgery, anesthesiology and intensive care. Massive transfusion involves administering 10 or more units of whole blood or packed red blood cells (pRBCs) within 24 hours. [1]. To quickly predict the need for massive blood transfusions, medical professionals are now widely used the calculator, which takes into account information on the mechanics of traumatic injury (blunt or penetrating), systolic blood pressure levels, heart rate and FAST Ultrasound results at the time the patient arrives in the emergency department [2-4]. The ABC Score in Trauma had developed to assist clinicians in discerning when massive transfusion would be required to resuscitate trauma patients. The original retrospective study (Nunez et al. 2009) examined a trauma registry of 596 patients and isolated variables predictive for massive transfusion in the 76 patients that required ≥ 10 units of pRBCs during the first 24 hours of fluid resuscitation. The ABC score assesses four clinical variables and a score of ≥ 2 as had founded to have a sensitivity of 75% and a specificity of 86% for predicting the need for massive transfusion. A validation study (Cotton et al. 2010) applied the ABC score to three trauma cohort registries retrospectively involving 1604 patients and found a Negative Predictive Value (NPV) of 97% and a Positive Predictive Value (PPV) of 55% using the rule. The rule had derived and validated using retrospective data and the authors support its use in predicting the need to active massive transfusion protocols within early phases of resuscitation in trauma. Advantages of this study include that it applies non-laboratory variables to assist in rapidly identifying patients requiring more blood products [4]. The purpose of our work was to assess the informativeness of the «ABC Score for massive transfusion» scale in the rendering of specialized anesthesiological care at an early hospital stage in patients with polytrauma, the main component of which was thoracic injury.

Materials and methods. The scale for predicting the need for massive blood transfusion includes such an assessment of its following components. Specialists in trauma only four components have assessed. Variable & associated points: 1) penetrating mechanism (Yes = 1, No = 0); 2) systolic blood pressure ≤ 90 mm Hg in the emergency department (Yes = 1, No = 0); 3) heart rate ≥ 120 in the emergency department (Yes = 1, No = 0); 4) positive FAST Ultrasound (Yes = 1, No = 0). Score 0 or 1: patient is less likely to require massive transfusion, defined as ≥ 10 units of pRBCs in the first 24 hours resuscitation. Score 2, 3 or 4: patient is likely to require massive transfusion, defined as ≥ 10 units of pRBCs in the first 24 hours of fluid resuscitation [4].

We included 100 patients with polytrauma in our study. The main component of polytrauma in these patients was thoracic trauma. The study included patients with an injury severity rating on the ISS (Injury Severity Score) of at least 17 points. In all 100 patients, surgeons from the polytrauma department performed urgent surgical intervention involving drainage of the pleural cavity according to Bulau. Surgeons from the polytrauma department performed this operation first. After drainage of the pleural cavity, surgeons performed other operations on these patients. We assessed the mechanics of injury in all patients, as well as elementary, most accessible hemodynamic parameters upon admission to the emergency department of a multidisciplinary city hospital. We also assessed data from urgent ultrasound examinations upon patient admission to the clinic. We counted the number of pRBCs transfusions in the first 24 hours from patients' admission to the clinic. Next, we compared the scores on the «ABC Score for massive transfusion» with the number of pRBCs transfusions in the first 24 hours from the patients' admission to the clinic. For assess we used PPV and NPV tests. The positive predictive value of a test is the probability that the patient/subject has the disease/condition when restricted to those patients/subjects who test positive. This term is sometimes abbreviated as PPV. You can compute the positive predictive value as $PPV = TP / (TP + FP)$ where TP and FP are the number of true positive and false positive results, respectively. Notice that the denominator for positive predictive value is the number of patients/subjects who test positive. Negative predictive value is the proportion of the cases giving negative test results, who, for example, are already healthy. It is the ratio of subjects truly diagnosed as negative to all those who had negative test results (including patients, who, for example, were incorrectly diagnosed as healthy). This characteristic can predict how likely it is for someone to truly be healthy, in case of a negative test result. In our case, we used as a positive result the number of red blood cell transfusions actually performed in the first 24 hours from the patients' admission to the clinic, the number of which corresponded to the definition of «massive blood transfusion» [5].

Research results. Massive transfusions of pRBCs we had performed in 3 out of 100 patients (3%). All of these patients had a penetrating mechanism of injury. All three of these patients had a score of 4 points. The remaining patients did not require massive blood transfusion. 71% of patients had a score of 1 point. 19% of patients had a score of 2 points. 6% of patients had a score of 3 points. 4% of patients had a score of 4 points. Penetrating trauma occurred in 7% of cases. Accordingly, blunt trauma occurred in 93% of cases. A decrease in systolic blood pressure to 90 mm Hg or lower occurred in 15% of patients. Heart rates that reached or exceeded 120 beats per minute occurred in 17% of cases. The results of urgent ultrasound examination were positive in 100% of cases. Hemopneumothorax had combined with hemoperitoneum in 6% of cases. Massive transfusion of pRBCs was required when hemothorax had combined with hemoperitoneum in 2 out of 6 cases (33.33%).

Thus, only patients who had a maximum score of 4 points on the ABC Score for Massive Transfusion required massive blood transfusion. However, we did not limit red blood cell transfusions in our patients. The target endpoint was a blood hemoglobin concentration of 10 g/dL. The PPV for patients with a score of 4 points on the ABC Score for Massive Transfusion on the scale was 75%. Accordingly, the NPV value for such patients was 25%. Calculating these indicators for patients who had a score of 2 and 3 points does not make any sense.

Conclusion. Based on the results of our study, we can state that the prognostic expectation of the need for massive red blood cell transfusion in the first 24 hours from the admission of patients with polytrauma to the clinic according to the ABC Score for Massive Transfusion may be significantly overestimated. In fact, there is no need for as many massive blood transfusions as predicted by the authors of the ABC Score for Massive Transfusion. Without a doubt, working with the ABC Score for Massive Transfusion calculator can be very useful for emergency department specialists, anesthesiologists and intensive care specialists, as these calculations increase the alertness of medical workers and increase attention to the patient who has suffered from an injury. We must also consider the effects of medications because, for example, the administration of atropine or rapid fluid resuscitation that continues in the emergency department can seriously influence the score and changes in hemostasis. In addition, the results of FAST Ultrasound are a very important point, and not all ultrasound endoscopists are equally good at it. The intensive care program (protocol) adopted in the hospital may also influence the need for massive blood transfusion. Very rapid massive use of crystalloids and colloid plasma substitutes temporarily improves hemodynamic parameters, but then this leads to the formation of hemodilution coagulopathy, and the need for transfusion of blood components increases. Also not all surgeons have equally good surgical technique. This also affects the amount of blood loss. Thus, the results of using the ABC Score for Massive Transfusion may have different prognostic value in each individual clinic.

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