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PREDICTION OF MORTALITY IN PATIENTS WITH COMBINED CLOSED ABDOMINAL INJURIES

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ABSTRACT

On the basis of randomized concurrent retrospective study of treatment outcomes of 193 victims with combined closed abdominal trauma TRISS and MODS-II diagnostic scales were evaluated for prediction the mortality probability in the period of early hospital phase. Based on the clinical algorithm, in order to justify the choice of surgical treatment for damage control approach, it becomes possible to predict mortality in 24 hours period, as well as risk of death in the postoperative period.

Keywords: Combined closed abdominal trauma, Probable lethality, Scale TRISS, MODS-II.

INTRODUCTION

The main factors that determine the outcome of trauma of the victims are the severity of injuries and the multiple organ dysfunction syndrome [1, 4]. Combined injury with numerous variants of the traumatic process defines clinical analysis without the use of mathematical methods studies [2, 7]. Therefore, based on specific criteria developed by the evidence-based medicine in medical practice it was introduced by a number of standardized measurement systems (SMS) that allow to objectively assess the condition of the victim, the severity of the injury and to some extent to predict the future course of the traumatic process. For example, in United States analysis of work of hospitals is carried out using special statistical methods (Z and M-statistics) that are based on the TRISS or ASCOT indices [3, 6]. However, in Ukraine, the analyzing standards are based mainly on the very basic statistical methods and subjective identification of injuries.

Currently, the special role is played by the combined condition and the severity of injuries in the early hospital phase. TRISS (Trauma and Injury Severity Score), ASCOT (A Severity Characterization Of Trauma) are designed to dynamically assess the severity of organ dysfunction in the postoperative treatment similarly to SOFA, APACHE, SAPS, MODS [1, 5]. The disadvantages of these scales are that they don't help to identify possible mortality and length of hospital stay in the intensive care unit, or the probability of survival and the risk of hospital mortality. Objective: To determine the diagnostic applicability of TRISS and MODS-II scales in predicting of mortality under combined closed abdominal trauma, and also to justify the choice of surgical treatment for damage control approach.

MATERIAL AND METHODS

The current study fully conforms all domestic and international bioethical requirements as valid in Ukraine during study and approved by the Commission for Bioethics, Bukovinian State Medical University. Study included 193 victims with combined closed abdominal trauma who were treated in several trauma centers in Ukraine. All the victims were operated and were treated in the intensive care units. Results of the research were divided into two groups: research group RG 1 and RG 2.The first RG 1 (n=74) included patients with combined closed abdominal trauma with damage of the large intestine. Control group CG 1 divided into sub-groups: the victims, who recovered (n=26) and died (n=48). CG2 (n=119) – victims with combined closed abdominal trauma who were treated in the trauma department from 2010 to 2012. CG 2 was divided into subgroups of victims who recovered (n=62) and those who died (n=57). The victims of RG 1 participated diagnostic evaluation of the TRISS scale in order to justify surgical treatment in the intraoperative period. In RG 2 research results obtained in the CG 1 were used for the TRISS scale and the feasibility of using the MODS scale was studied in the early postoperative period. In the early hospital phase and qualitative intraoperative assessment of severity of injuries and the condition of the victims were analyzed using the RTS and NISS scales [6, 9, 13].

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The severity of injury was assessed byAIS-90 (Abbreviated Injury Scale). Predicted probability of survival (PS %) of the victims were calculated using logistic regression formula based on the TRISS scale and ASCOT method [1]. The data of prognostic scales were checked using TRISS and ASCOT-Calculator, and presented as the dependent variable (M) for different samples in studies of representative groups. These reference methods were used to assess the quality of treatment at the hospital stage. For comparison of data groups of patients were formed using randomized stratification for open and closed signs of trauma, as well as clinical and nosological forms of damage. The main feature for randomization was the damage to the colon. This is due to the fact that damage to the colon, as a component of combined injury is one of the worst prognostic factors and is measured at the maximum value of the SMS indicators.

The data of prognostic scales are presented as a percentage (%) for different samples and as the dependent variable (M±m), where the results of the data obeyed a normal distribution. The results cited as: M±m and CI95%. The test sample for normality was performed using Shapiro-Wilkcriterion. Assessing the degree of correlation between the data was performed by calculating the Pearson's linear correlation (Rp). Terms of mortality of victims were analyzed on the basis of calculations using multiple regression equations through Cramer's formula, and the definition of predictors of complications of trauma. Statistical significance of multiple regression equation by using the Fisher F-test when Ffact. >Fcrit. at p<0,01.To evaluate the computational capabilities of scales, regression analysis on the basis of calculations of binary logistic regression models (AUROC-analysis) was conducted, which simulated the performance characteristic curve (ROC – receiver operator curves) with estimation of the area under the curve – index – AUCMODS (AUC±SE, where SE – standard error). To assess the quality of prediction scales: predictive value correlation values scales, predictive value non-correlation values scales, diagnostic efficacy (E) and calculations depending on the sensitivity (Se) of specificity (Sp) scale. The data were calculated and checked using the application package Statistica 8.0 (StatSoftInc., USA, 2007).

RESULTS AND DISCUSSION

In the CG 1, a subgroup of patients who recovered, according to the TRISSscale average PS is 91.1±3.0. Subgroup of patients who died had predominantly cranio-thoraco-abdomino-skeletal (CTAS) injury (n=35), accounting for 47.3 %, among them a majority suffered an injury in road traffic accidents (n=29).

The total number of dead were divided into separate subgroups with mortality up to 72 hours (n=27) and mortality over 3 days (n=8). The high correlation (rP=0,76) according toTRISS was found on terms of mortality up to 72 hours. The observed correlation of average strength (Rp=-0.53) of TRISS was seen for hemoperitoneum volume (682-1198 ml, CI95%) (Fig.1).

Fig. 1. Approximation of probability of survival rate (TRISSscale), depending on the amount and duration of hemoperitoneum on actual fatal victims by using a second-order polynomial trend

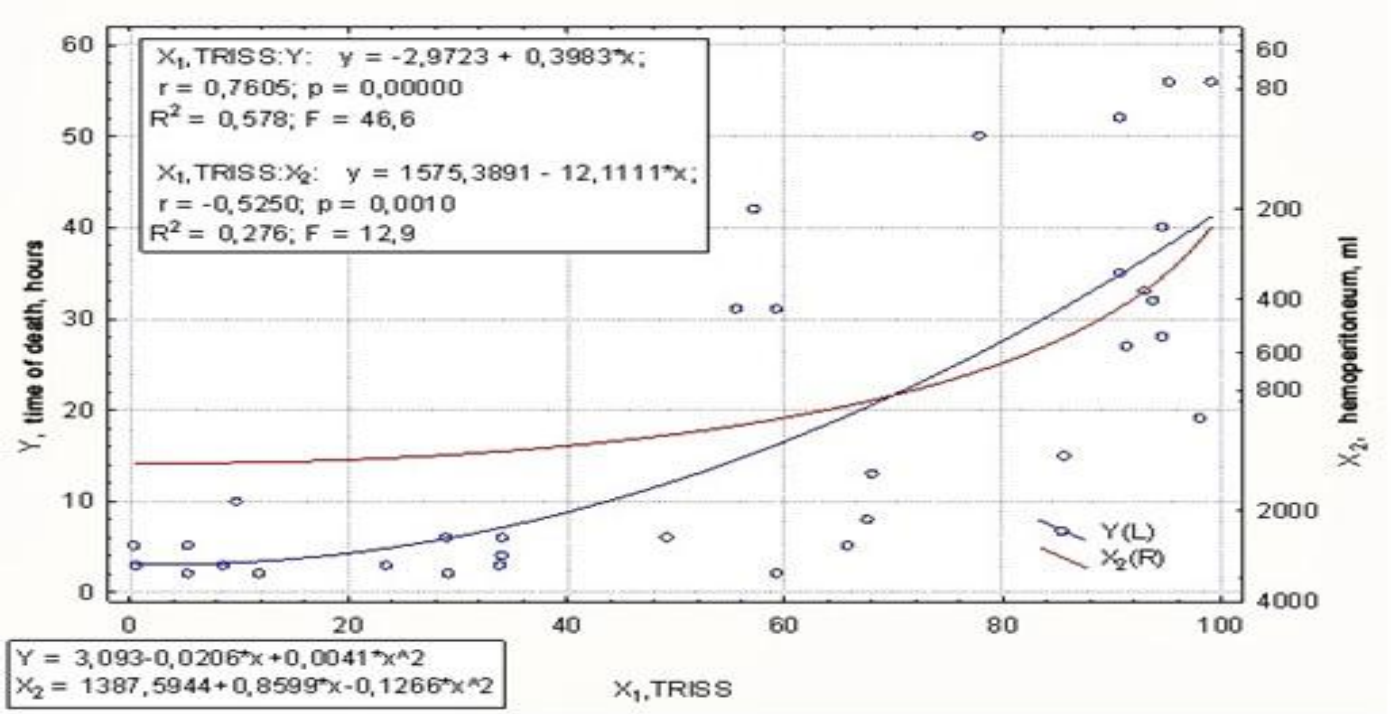
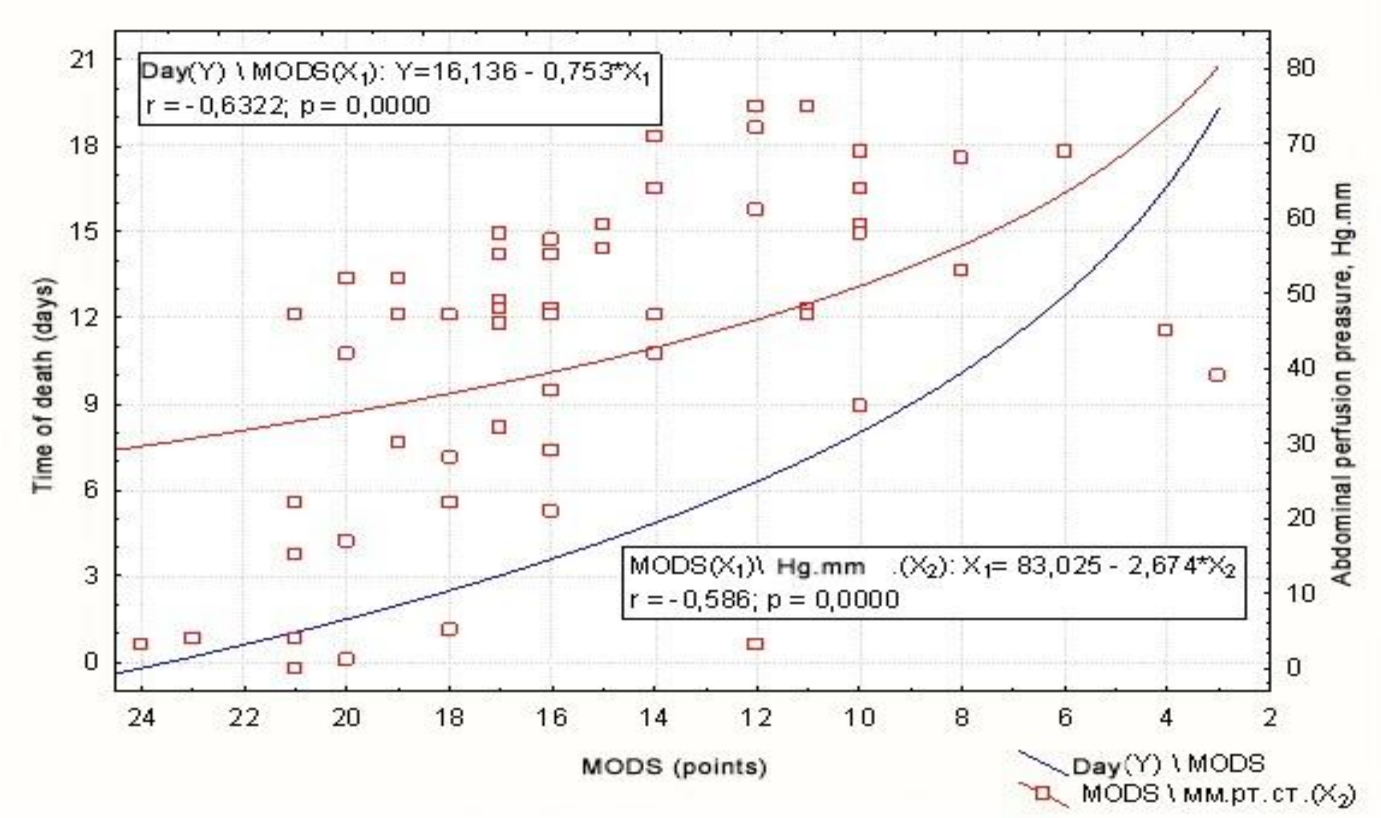


Fig. 2.The set of regression, depending on mortality rate term,MODS points and rate of abdominal perfusion among the victims who died (n=57)



For both periods, the actual mortality trends (Ffact.=46.64, Fcrit.=4.94, p <0,01) and hemoperitoneum volume (Ffact.=12.94, Fcrit.=9.56, p <0,01) reveal statistical significance and reliability of both pairs of equations of regression (Fig.1).

According to data, the expected fatality rate is 57.8% (R2=0.578) depends on the rate of variation on a TRISSscale, as indicated by a high degree of correlation (r=0,76) with terms of actual death of the victims. Other 42.2% – determined by the variation predictors of complications of trauma, of which 27.6% (R2=0,276) is dependent on the level of hemoperitoneum.

According to Dunn's formula with increased volume of hemoperitoneum (X2) per 200 ml, terms of deaths occur before 1.2 hours where Y – time of death of the victim, X1 – BB rate on a TRISS scale. Applying factor –0.00604×X2 in the regression equation predictive scale for TRISS, we get: b=b0+b1×(TS)+b2×(ISS)+b3×(A)+b4×(hem.), where b0-b4is significance of regression coefficients: b0=(-1.6465), b1=(0.5175), b2=(-0.0734), b3=(-1.9261), and the coefficient b4=(-0.0060), RTS– score for a functional RTS scale, ISS– the sum of the squares of anatomical points on a scale AIS-90, A – age of the victim in points, hem. – volume of hemoperitoneum calculated by our scale: 500 ml – 1 point, from 500 to 1500 ml – 2 points, from 1500 to 2500 ml – 3 points, over 2500 ml – 4 points. Prognostic value of the TRISS scale, where the area under the ROC-curve constituted 76,3% (AUC = 0.763±0,087; AUCC I95% = 0.591-0.934, with p=0.0027).

Qualitative assessment of the severity of the victims status was carried out from 1 to 6 days using scale MODS-II. According to information received, in a group of victims who died, the average actual mortality term is 4.6±1.2 (3.2-6.1% CI95%) days, calculated the average of the MODS-II – 15±1 (CI95%, 14-16%) and the average APP points 42±3 (CI95%, 37-48) mmHg. In the group of victims who recovered, the average hospitalization term is 19,6±0,7 (CI95%, 18.3-21.0) days, on MODS-II – 11±1 (CI95%, 10-12) points, and APP– 62±2 (59-65%,CI95%) Thus, it is possible to establish medium strength correlation index of APP indicator on MODS-II (rP=-0.59) and term of actual death (rP=-0.63), in group of victims who have died, and a strong correlation (rP=0.88) in group of victims who recovered (Fig.2).

victims with combined closed abdominal injury is relevant and rational.

2. Statistically reliable index of multiple determination (R2=0.578) characterizes hemoperitoneum volume of more than 682 ml, as an individual predictor of mortality in

CONCLUSIONS

1. Predicting the probable duration of mortality on the basis of the TRISSscale and rate of hemoperitoneumvolume as predictors of complications during the traumatic process in

victims with severe combined closed abdominal trauma during 24 hours.

3. The sensitivity of the experimental TRISS scale is 86.1%.The level of scale specificity – 33.3%, 66.7% may be overstated due to violations not related to hypovolemia, brain damage, or hypoxia.

4. Decrease of abdominal perfusion pressure below 80 mmHg should be considered as an important factor in the early development of organ dysfunction in the course of the traumatic process. Further decrease of abdominal perfusion pressure below 65 mmHg indicates the presence of the abdominal hypertension syndrome.

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