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THE USE OF MODS SCALE IN PROGNOSING LITHAL OUTCOME IN VICTIMS WITH MULTIPLE ORGAN DYSFUNCTION

ПОКАЗНИК АБДОМІНАЛЬНІЙ ПЕРФУЗІЇ ЯК ПРЕДИКТОР РОЗВИТКУ ПОЛІОРГАННОЇ ДИСФУНКЦІЇ У ПРОГНОЗУВАННІ ЛЕТАЛЬНОСТІ ЗА ШКАЛОЮ MODS

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Abstract: With the purpose to improve therapeutic-diagnostic measures at a hospital stage a multifactorial analysis of clinical-laboratory findings in 119 victims with abdominal multiple organ trauma was made on the basis of calculations by MODS scale. The value of abdominal perfusion pressure was detected as a predictor of functional complications in the development of traumatic process, and it was introduced with modification of MODS scale to prognosticate the term of lethal outcome. A strong correlation relation is noted according to defined by us experimental MODS (N) scale with the parameters of a bed-day in prognostication of the term of treatment in the group of victims who succeeded in their recovering (rP = 0,89), and those victims who died (rP = –0,69).
Key words: abdominal organ trauma, intra-abdominal perfusion pressure, prognostication.

Резюме. З метою удосконалення лікувально-діагностичних заходів на госпітальному етапі проведений багатофакторний аналіз клініко-лабораторних даних у 119 постраждалих з травмою органів черевної порожнини при політравмі на основі розрахунків за шкалою MODS. Визначено показник абдомінального перфузійного тиску як предиктор функціональних ускладнень в перебігу травматичного процесу і впроваджений з модифікацією шкали MODS для прогнозування терміну летальності. Згідно експериментальної шкалою MODS (N), відзначається сильний кореляційний зв'язок з показником ліжко-день в прогнозуванні терміну лікування як в групі пацієнтів, які видужали (Rp = 0,89), так і в групі померлих (Rp = -0,69).
Ключові слова: травма органів черевної порожнини, внутрішньочеревний перфузійний тиск, прогнозування.

Introduction. Treatment of the victims with a multiple trauma of the abdominal organs is an important problem of modern medicine. In spite of the fact that in the structure of traumatism a multiple trauma is found only in 8-30% of cases, in 70% it results in lethal outcomes [1, 351-353; 5, 12-27]. Leading clinics of the world give considerable attention to prognosticate the development of traumatic process in victims with a multiple trauma of the abdominal organs. Standardized systems of evaluation and prognostication of the lethal term are used in this purpose, and they should determine generally recognized stages of the therapeutic-diagnostic process [3, 1-16].

Multiple organ failure syndrome (MOFS), occurring at early stages, is one of the dangerous complications in a considerable part of the victims. A number of diagnostic scales are used at the hospital stage enabling to prognosticate MOFS development [2, 19-23; 4, 117-118]. The functional MODS scale is one of them [6, 1638-1652]. In addition to its advantages there is a disadvantage in that it detects only probable sequence of alethal outcome depending on an interval index measured in percentage.

Objective of the study was to find diagnostic value of intra-abdominal perfusion index in prognostication of lethal outcome risk in victims with abdominal trauma.

Materials and methods. The results of treatment of 119 victims with traumas of the abdominal organs in case of a multiple trauma were analyzed. All the victims were operated on and treated at the Department of a multiple trauma from 2010 to 2012 in Kyiv Municipal Clinical Emergency Rescue Hospital. All the victims were divided into two groups: I – the victims who recovered (n = 62); II – the victims who died (n = 57).

Qualimetric evaluation of the severity of victims' condition was made with the use of MODS scale. Among the indices included into MODS scale we used the index of abdominal perfusion pressure (APP) as a functionally valuable predictor of a complicated development of a traumatic process. It was determined as the difference between the index of an average arterial pressure (AP_{aver}) and intra-abdominal pressure (IAP).

To evaluate the degree of IAP the classification of D.R. Meldrum was used, according to which: I degree – 10–15 mm Mercury; II degree – 15–25 mm Mercury; III degree – 25–35 mm Mercury; IV degree – > 35 mm Mercury [7, 667-673]. IAP was measured by means of catheterization of the urinary bladder according to the standard method [8, 19-31].

The comparative analysis between the term of actual lethal outcome, the score according to MODS scale and the index of abdominal perfusion pressure was made on the basis of the following calculations: arithmetic mean value and standard error ($M \pm m$), CI 95 % of confidence interval with min-max values. To detect correlation dependence between the indices there was analysis made according to Pirson (r_P) with detection of bonding force according to Chertock.

Multiple-factor analysis of lethal outcome on the basis of calculations by the prognostic MODS scale with detection and introduction of complication predictors of a traumatic process was made by means of the multiple regression equation by Cramer formula. Statistical reliability of the multiple regression equation was estimated by Fisher F-criterion $F_{fact} > F_{crit}$; P < 0,01.

The data obtained were checked by means of the application package STATISTICA 8.0 (StatSoft Inc., USA, 2007).

Results and discussion. According to the data obtained an average index of the real lethal outcome term in the group of dead victims was (4,6 ± 1,2) days ($CI_{95\%}$ 3,2–6,1), calculated average index by MODS scale – (15 ± 1) ($CI_{95\%}$ 14 – 16) points, an average index of the abdominal perfusion pressure (APP) – (42 ± 3) mm Mercury ($CI_{95\%}$ 37 – 48) (Table 1).

Table 1. *Indices of early hospital stage in the victims who died (n = 57)*

Index	$M \pm m$	$CI_{95\%}$	r_P	P
AP_{aver}, mm Mercury	61 ± 3	55 – 67		
Term of lethal outcome	4,6 ± 1,2	3,2 – 6,1		
MODS	15 ± 1	14 – 16	–0,63*	< 0,05
IAP, mm Mercury	19 ± 1	17 – 21	–0,38*	< 0,05
APP, mm Mercury	42 ± 3	37–48	–0,59#	< 0,05
MODS (N)	17 ± 1	16–18	–0,69*	< 0,05
Term of predicted death	4,7 ± 1,0	3,8–5,7	0,71*	< 0,05

* *Correlation with the index of lethal outcome term.*
\# *Correlation with the index by MODS scale.*

The analysis demonstrated the correlation relation of an average force of the index of lethal outcome term with the index by MODS scale (r_P= –0,63) and a moderate relation with the index of IAP (r_P= –0,38). At the same time the correlation relation of an average force is found between the index of APP with the value by MODS scale (r_P= –0,59) (Fig. 1).

With the aim to introduce the index of APP into the pair correlation equation between the index by MODS scale and the term of lethal outcome the calculation method of multiple regression equation was used by Cramer formula:

$$Y = 23{,}02 - 0{,}97 \times X_1 - 0{,}087 \times X_2 \quad (1),$$

where:

- Y – prognosticated term of lethal outcome, days;
- X_1 – the value of the index by MODS scale, score;
- X_2 – the value of the index of APP, mm Mercury.

By both dependence trends of the term of lethal outcome and the index by MODS scale and the index of abdominal perfusion pressure (F_{fact} = 25,94, F_{crit} = 3,15 with P < 0,01) a statistical reliability of the multiple regression equation was detected.

To introduce the index of APP with calculation of the score by MODS scale we have elaborated its gradation from 0 to 3 points. These calculations were made on the basis of confidence interval of the minimal value of APP ($ДІ_{95\%\ min}$ – 37), IAP ($CI_{95\%\ min}$ – 17), which corresponds to II degree of severity considering the values of perfusion pressure of the kidney. Therefore, the score 0 corresponds to the index of APP 81 ≤ mm Mercury; the score 1 – 66–80 mm Mercury; the score 2 – 35–65 mm Mercury; the score 3 – ≤ 34 mm Mercury (Table 2).

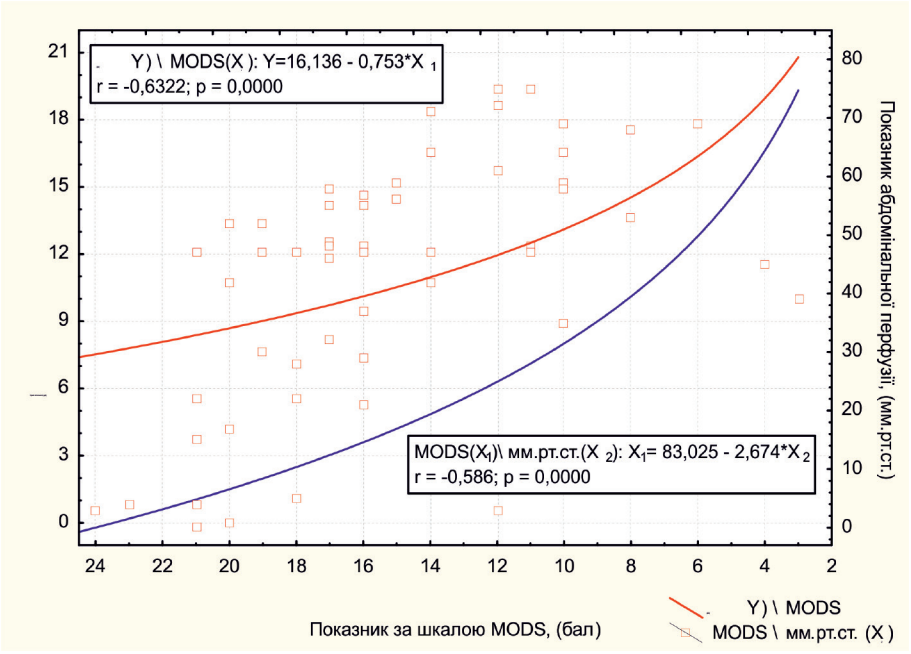

Fig. 1. *Multiple regression of the dependence between the term of lethal outcome and the index of the score by MODS scale and the index of the abdominal perfusion among victims who died (n = 57).*

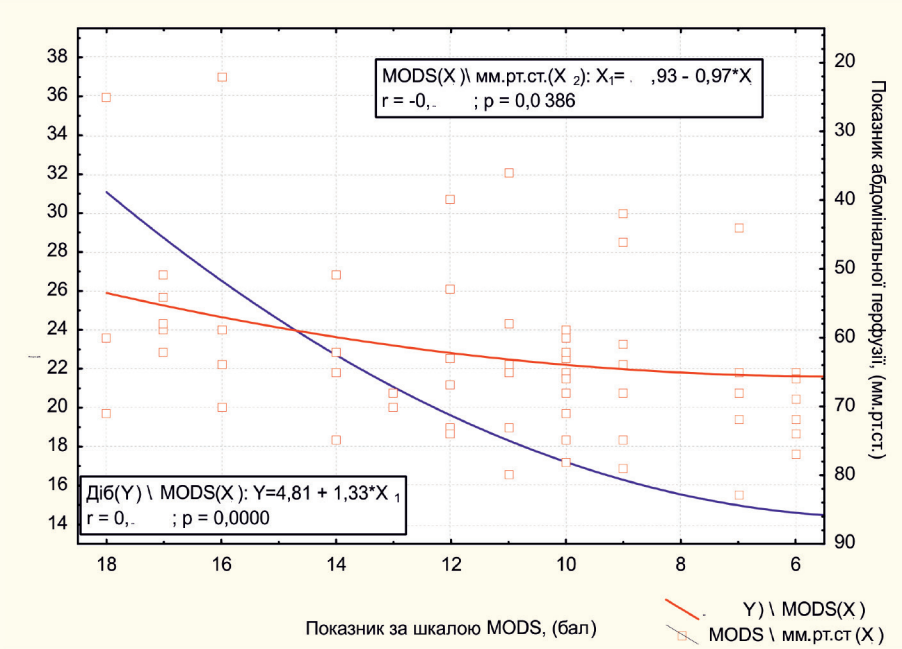

Fig. 2. *Multiple regression of the bed-day term dependence on the index by MODS scale and the index of abdominal perfusion pressure among victims who recovered (n = 62)*

Table 2. *Gradation of the index of abdominal perfusion pressure to introduce into MODS scale*

Score	The value of the index of APP, mm Mercury
0	81 ≤
1	66–80
2	35–65
3	≤ 34

Hereinafter, considering the index of APP by a numerical scale the values can be calculated by the experimental scale MODS (*N*).

According to our findings the correlation relation of an average force was found (r_P = –0,69) of the index by MODS scale (*N*) with the index of lethal outcome, which is better than a prognostic value of MODS scale (r_P = –0,63) in prognostication of reliability of lethal outcome. In addition, the use of the multiple regression equation the time of prognosticated death with a strong correlation relation (r_P = 0,71) with the index of the term of real lethal outcome proves its practical value.

In the group of victims who recovered an average index of a bed-day was (19,6 ± 0,7) days ($CI_{95\%}$ 18,3–21), calculated average index by MODS scale – (11 ± 1) ($CI_{95\%}$ 10 – 12), an average index of APP – (62 ± 2) mm Mercury ($CI_{95\%}$ 59 – 65) (Table 1).

Table 3. *Indices of early hospital stage in victims who recovered*

Index	M ± m	$CI_{95\%}$	r_P	P
$AP_{aver.}$, mm Mercury	76 ± 2	72–79		
Bed-day	19,6 ± 0,7	18,3–21		
MODS, score	11 ± 1	10–12	0,88*	< 0,05
IAP, mm Mercury	13 ± 1	12–14	0,85*	< 0,05
APP, mm Mercury	62 ± 2	59–65	0,28#	= 0,039
MODS-N, score	13 ± 1	12–14	0,89*	< 0,05
Prognosticated term of treatment	19,6 ± 0,6	18,3–20,7	0,89*	< 0,05

* Correlation with the index of bed-day.

\# Correlation with the index by MODS scale.

A strong correlation relation of the bed-day index with the value by MODS scale (r_P = 0,88) and the index of IAP (r_P = 0,85) was found. Introduction of APP index into MODS scale found a weak correlation relation of APP index with the value by MODS scale MODS (r_P = –0,28), although it was statistically reliable (P = 0,039) (Fig. 2).

By calculation method of the system of the three correlation dependence linear equations of the bed-day index from the index by MODS scale and APP by Cramer formula the formula of a multiple regression was obtained:

$$Y = 6.46 + 1,3 \times X_1 - 0,023 \times X_2 \ (2),$$

where:

- *Y* – prognosticated bed-day, days;
- X_1 – the value of the index by MODS scale, score;
- X_2 – the value of APP index, mm Mercury.

By both dependence trends of the term of bed-day and the index by MODS scale and the index of abdominal perfusion pressure (F_{fact} = 104,54, F_{crit} = 3,15 with P < 0,01) a statistical reliability of the multiple regression equation was detected.

In the group of victims who recovered by the experimental MODS scale (N) (see Table 3) a strong correlation relation (r_P = 0,89) with the index of bed-day in prognostication of the term of treatment was found.

Therefore, considering the index of APP during calculation of MODS scale better results were obtained, which is proved by a strong correlation relation both in the group of victims who died and those victims who recovered. It is indicative of the probability to use an improved scale in practical work and to carry out additional studies of the APP index influence on the choice of surgical tactics «damage control» among the victims with trauma of the abdominal organs in case of multiple organ trauma.

Conclusions.

1. Abdominal perfusion pressure should be considered as an important index stipulating development of functional complications in the course of traumatic process, and development of multiple organ failure syndrome in particular among the victims with abdominal trauma in case of a multiple trauma.

2. With calculation of the index of MODS scale in combination with the index of abdominal perfusion pressure a strong correlation relation between the index of the term of treatment and death risk is found both among those who died (r_P = –0,69) and those victims who survived (r_P = 0,89).

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