Formation Prediction of Pre-Nosological Mental Disorders in Combatants

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Abstract
Clinically formed borderline mental disorders (BMD) in combatants have a lower prevalence in contrast to pre-nosological mental disorders. Blurred diagnostic criteria do not allow to classify short-term disorders of mental adaptation requiring therapy as BMD. In order to develop a model for predicting the formation of pre-clinical mental disorders (PMD) in combatants, the analysis of personal characteristics of 649 combatants was carried out. Among 311 people, in anamnesis, PMD with increased anxiety, diosomnia, instability of the emotional background were detected, in 338 people these states and other violations of mental adaptation were not recorded. Four years after participation in the fighting, according to Kotenev’s methodology and the Bass-Darky test, the combatants showed signs of maladaptation and a high level of physical aggression. On the basis of the obtained data, the model of forecasting the formation of PMD in combatants with the use of logistic regression by forced input of variables is calculated. It was found that the risk of PMD formation in combatants increases with a decrease in the indicator of the scale "symptoms of invasion" and with an increase in the parameters on the scales "symptoms of hyperactivity", "distress and maladaptation", "the presence of signs of post-traumatic stress disorder", "physical aggression" and "verbal aggression". This shows that PMD occurs more often in combatants with increased excitability in everyday life and a high level of physical aggression, while the symptoms of reliving a traumatic event are not a trigger factor for the formation of neurotic disorders. The use of this technique in medical and psychological combatant for the prevention of the formation of PMD is proposed. Formed borderline mental disorders (BMD) in combatants have a lower prevalence in contrast to disorders of the pre-nosological level [3]. The growth of adverse mental states, including pre-nosological mental disorders (PMD) in combatants is observed worldwide, which is probably associated with an increase in the number of local armed conflicts [8]. PMD have an uncertain prognosis, both in terms of recovery and in the formation of nosological forms [2]. This issue is often discussed in the medical literature, but vague diagnostic criteria do not allow to classify as formed BMD short-term disorders of mental adaptation that appear spontaneously - often against the background of the impact of trigger stimuli [4] At the same time, in the absence of therapy, they lead to a change in the personal structure and a violation of the quality of life of combatants [5, 6]. This puts before psychiatrists the task of developing new methodological and psycho-diagnostic approaches to both psycho-prophylactic examinations and treatment of this contingent [7].

Keywords: Combatants; Pre-nosological mental disorders; Prognosis model
The aim of the study is to develop a model for predicting the formation of PMD in combatants.

Materials and Methods

We analyzed the archival results of clinical examination (after the return of combatants from combat zones) and experimental psychological examination (four years after participation in hostilities) in 649 combatants. All respondents are divided into two groups by the presence of mental health disorders: Group I - 338 people – healthy individuals (average age of 35.3±1.2 y.o.), Group II - 311 people who had a history of PMD with increased anxiety, dissomnia, instability of the emotional background (average age 35.2±1.3 y.o.). Clinical examination was carried out using the Kotenev’s questionnaire of post-traumatic stress disorder (PTSD) - to identify symptoms of post-stress disorders and the Bass-Darky test - to identify the level and nature of aggressive behavior [1]. Statistical processing of the results of the study was carried out using the Mann-Whitney criterion and multiple logistic regression analysis with the method of forced input of variables.

Research Result

According to the results of the application of the Kotenev’s method, Group I respondents were more outspoken, but they showed a tendency to exaggerate the problems and dissimulation of the state than the representatives of the Group II (p<0.001). In the examined persons Group I compared with the Group II significantly lower was the relevance of psycho-traumatic events, but on the scale of "the presence of symptoms of avoidance" significant differences between the groups were not detected. Combatants Group I was emotionally unstable; on the scale of "distress and maladjustment" indicators were significantly lower, which reflected a good level of adaptation in civilian life, despite the high final indicator of the presence of symptoms characteristic of PTSD. Combatants Group II were prone to conceal problems, reduce their importance, they were characterized by the presence of symptoms of avoidance of traumatic events and high rates of maladjustment, which indicated the presence of problems and required additional clinical examination and therapy (Table 1).

In an intergroup comparison of forms of aggressive behavior by the Bass-Darky method, significant differences were determined only on the scale of "physical aggression", which was significantly higher in individuals of Group II (Table 2), with the representatives of Group I there were no signs of mental maladjustment, unlike those examined, who had a history of pre-nosological neurotic states.

To predict transient reactions in combatants on the basis of Kotenev’s method and the Bass-Darky method, we used multiple regression analysis. As predicted, a binary indicator was used-healthy and conditionally healthy combatants who had a history of PMD.

The method of step-by-step elimination was used in the regression analysis. As a result, the model was determined as statistically significant.

χ²=423.8 (p<0.001); -2 LL=465.1; Nagelkerke R²=0.645
Table 1: Features of signs of PTSD at combatants with PMD on Kotenev's method, Me (Q1-Q3), points.

| Variables                  | Combatants groups |   |   | p-level* |
|---------------------------|-------------------|---|---|----------|
|                           | Group I, n=338    | Group II, n=311 |   |         |
| Lie                       | 52.0 (29.0-56.0)  | 55.0 (41.7-59.0) | <0.001 |
| Aggravation               | 55.0 (41.0-59.0)  | 50.0 (37.0-57.0) | <0.001 |
| Dissimulation             | 45.0 (35.0-56.0)  | 40.0 (11.0-54.0) | <0.001 |
| The event of injury       | 10.0 (6.0-14.0)   | 13.0 (9.0-26.0)  | <0.001 |
| The symptoms of invasion  | 27.0 (22.0-34.0)  | 26.0 (21.0-36.0) | 0.053  |
| Symptoms of avoidance     | 27.0 (23.0-35.0)  | 31.5 (24.0-36.0) | 0.136  |
| Symptoms of hyperactivity | 34.0 (26.0-40.0)  | 27.0 (14.0-34.5) | <0.001 |
| Distress and maladjustment| 14.0 (11.0-24.0)  | 92.0 (21.0-112.0)| <0.001 |
| Signs of PTSD             | 85.0 (23.0-111.0) | 69.5 (49.0-121.0)| <0.001 |

Note: * - p was calculated using the Mann-Whitney test

Table 2: Features of aggressive behavior forms by Bass-Darky method in combatants with PMD, Me (Q1-Q3), points.

| Variables                  | Combatants groups |   |   | p-level* |
|---------------------------|-------------------|---|---|----------|
|                           | Group I, n=338    | Group II, n=311 |   |         |
| Physical aggression       | 7.0 (5.0-9.0)     | 8.0 (6.0-9.0)    | <0.001 |
| Indirect aggression       | 6.0 (4.0-7.0)     | 6.0 (5.0-7.0)    | 0.678  |
| Irritability              | 5.0 (3.0-7.0)     | 5.0 (3.0-7.0)    | 0.695  |
| Negativism                | 4.0 (3.0-5.0)     | 4.0 (3.0-5.0)    | 0.982  |
| Insult                    | 4.0 (2.0-5.0)     | 4.0 (2.0-5.0)    | 0.128  |
| Suspiciousness            | 4.0 (3.0-6.0)     | 4.0 (3.0-6.0)    | 0.838  |
| Verbal aggression         | 6.0 (4.0-8.0)     | 6.0 (4.0-8.0)    | 0.177  |
| Guilt                     | 4.0 (3.0-6.0)     | 4.0 (3.0-6.0)    | 0.785  |
| Remorse                   | 20.0 (16.0-26.0)  | 20.0 (16.0-25.0) | 0.944  |
| Hostility                 | 8.0 (5.0-9.0)     | 7.0 (5.0-9.0)    | 0.305  |

Note: * - p was calculated using the Mann-Whitney test

In Table 3, for each variable remaining in the model, the odds ratios (OR) are given, adjusted to take into account the influence of all other features included in the regression model.

Table 3: Independent prognostic signs of PMD formation in combatants.

| Variables remaining in the model | OR† | 95% DI         |
|----------------------------------|-----|----------------|
| The symptoms of invasion         | 0.937 | 0.908-0.966   |
| Symptoms of hyperactivity        | 1.040 | 1.013-1.068   |
| Distress and maladjustment       | 1.076 | 1.061-1.092   |
| Signs of PTSD                    | 1.101 | 1.006-1.016   |
| Physical aggression              | 1.265 | 1.139-1.406   |
| Verbal aggression                | 1.103 | 1.006-1.210   |

Note: † – OR adjusted for the influence of other variables in multiple logistic regression analysis.
The regression coefficients for each of the features and the level of their statistical significance are presented in Table 4.

| Variables                          | Code | $B^1$ | Wald statistic value | p-level |
|------------------------------------|------|-------|----------------------|---------|
| The symptoms of invasion           | X1   | -0.066| 16.9                 | <0.001  |
| Symptoms of hyperactivity          | X2   | 0.040 | 8.46                 | 0.004   |
| Distress and maladjustment         | X3   | 0.074 | 99.5                 | <0.001  |
| Signs of PTSD                      | X4   | 0.011 | 17.1                 | <0.001  |
| Physical aggression                | X5   | 0.235 | 19.1                 | <0.001  |
| Verbal aggression                  | X6   | 0.098 | 4.34                 | 0.037   |
| Constant                           |      | -5.140|                      |         |

Note: $^1$ – regression model coefficient

Discussion of Results

Our results indicate an increase in the risk of PMD formation in combatants with a decrease in the indicator of the scale "symptoms of invasion" and with an increase in the corresponding parameters on the scales "symptoms of hyperactivity", "distress and maladaptation", "presence of signs of PTSD", "physical aggression" and "verbal aggression". This suggests that PMD is more likely to occur in individuals with increased excitability in everyday life and high levels of physical aggression, while symptoms of reliving a traumatic event are not a trigger factor for the formation of PMD.

Based on regression coefficients and weighted OR values for each of the signs, it can be concluded that distress, maladjustment and physical aggression are the most significant factors responsible for the formation of PMD in combatants; next in importance are the presence of signs of PTSD, low indicators of the symptom of "invasion", high indicators of the symptom of hyperactivity and, finally, verbal aggression.

Thus, the received model of the forecast of formation of PMD at combatants has the following form:

$$ P(\hat{y}) = \frac{1}{1 + e^{-\hat{y}}} $$

where $\hat{y} = -5.140 - 0.066 \times X1 + 0.040 \times X2 + 0.074 \times X3 + 0.011 \times X4 + 0.235 \times X5 + 0.098 \times X6$; $P(\hat{y})$ – the probability of detection of transient reactions (0≤$\hat{y}$≤1); a value approaching "1" indicates a high probability of occurrence of this outcome, and to "0" - a small.

The distribution of 649 combatants depending on the presence of PMD in the history is predicted using a synthesized logistic model and a selected separation point of 0.5. The accuracy of the correct prediction of the probability of formation of PMD in combatants using the above methods was 82.9 %. Thus, the obtained model allows predicting the formation of PMD in combatants, and the proposed method can be used during psychoprophylactic examinations of persons of dangerous professions to predict the formation of PMD.

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