Prediction of Infectious-Toxic Shock And Disseminated Intravascular Coagulation in Patients With Pneumonia in the Disease Onset

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SUMMARY

Objective: Development of diagnostic algorithms for prediction of infectious-toxic shock and disseminated intravascular coagulation (DIC) patients with pneumonia at the onset of the disease.

Materials and methods. Examination and treatment of patients with pneumonia was conducted in pulmonary department of the military hospital in the period from 1998 to 2008 in the study included 2000 patients with pneumonia, men, military, military service by conscription, aged 18 to 22 years (19, 2 ± 0,19).

In order to evaluate the effectiveness of forecasting algorithms of infectious-toxic shock and DIC with pneumonia, a comparative analysis of the two groups of patients. In the comparison group (n = 782) forecasting of infectious-toxic shock and DIC was conducted based on the individual views and personal experiences of doctors, without the use of forecasting algorithms in the period from 1998 to 2003, and in the study group (n = 1218) – between 2003 to 2008 - on the basis of diagnostic algorithms forecasting of infectious-toxic shock and DIC pneumonia developed by us.

Results. It is shown that the proposed diagnostic algorithms for the prediction of the infectious-toxic shock and DIC help practitioners, including at the stage of primary health care in the early stages of development to suspect the possibility of a patient with pneumonia potentially fatal complications, which allows to adjust medical and diagnostic tactics, more accurately resolve transportation issues the patient to determine the indications for hospitalization, including in the emergency department and intensive care.

Keywords: pneumonia, toxic shock, DIC, predicting complications of pneumonia, algorithms.

Introduction. Despite the continuous improvement of diagnostic methods and the availability of highly antibiotics, pneumonia, as before, is a leader in the structure of morbidity and mortality from infectious diseases in developed countries [1, 8]. Mortality for pneumonia in adults up to 50 years without comorbidity is 2 - 3%, and among patients requiring hospitalization in intensive care units, reaches up to 22% [1, 7]. Remains a high incidence of pneumonia in the Armed Forces of the Russian Federation among soldiers performing military service [3, 5]. Risk factors for poor outcome of pneumonia, including in the military, is the development of complications such as toxic shock and disseminated intravascular coagulation (DIC). Due to this fact remains urgent task is the development of diagnostic algorithms for forecasting, which would allow a doctor at an earlier date to reveal indirect signs indicating the possibility of the above complications of pneumonia.

The purpose of the work. Development of diagnostic algorithms for the prediction of infectious-toxic shock and disseminated intravascular coagulation in patients with pneumonia at the onset of the disease

Materials and methods. Examination and treatment of patients with pneumonia was conducted in pulmonologiche-Soviet department of the military hospital in the period from 1998 to 2008. Were enrolled 2,000 patients with pneumonia, men, soldiers performing military service at the age of 18 to 22 years (19 2 ± 0,19).

In order to evaluate the efficiency of algorithms for forecasting the development of

infectious-toxic shock and disseminated intravascular coagulation with pneumonia, a comparative analysis of the two groups of patients. In the comparison group (n = 782) to predict the development of infectious-toxic shock and disseminated intravascular coagulation was carried out according to individual views and personal experiences of doctors, without the use of algorithms to predict the period from 1998 to 2003, and in the study group (n = 1218) - in the period from 2003 to 2008 - on the basis of diagnostic algorithms for predicting the development of infectious-toxic shock and disseminated intravascular coagulation in pneumonia, developed by us.

In the course of the study were used, and general clinical and instrumental diagnostic methods in accordance to the guidelines of the Main Military Medical Directorate of the Ministry of Defense of Russia in 2003, as well as the standard for the diagnosis and treatment of patients with non-specific lung diseases, approved by the Ministry of Health of the Russian 9. 10. 1998 № 300 [2, 6].

In patients who were treated in the department of anesthesiology and intensive care unit (193 people). Additionally monitored some of the functions of the body, including blood pressure, central venous pressure, urine output. Determined by blood gas, electrolytes (potassium, sodium, serum), the use of protein composition, blood coagulation and renal excretory function.

Patients received etiopathogenic and symptomatic therapy According to current standards of treatment of disease. According to the testimony appointed as mucolytics, fever and cold preparations, as well as complex physical therapy and physiotherapy.

Statistical processing of the results of the study were performed using software package Microsoft Office Excel 2007 and Statistica 6.0 (StatSoft, Inc. 2001). For the processing of the data used assessment of the credibility of intergroup differences with the Student t-test for independent samples. Between-group differences were considered significant at $p < 0, 05$.

Calculation of the diagnostic value of forecasting algorithms performed using the following formulas: diagnostic sensitivity (DF) = = a / (a + c), in %, diagnostic specificity (DS) = d / (d + b), in% diagnostic accuracy (DA) = (a + d) / (a + d + c + b), in%, diagnostic efficiency (DE) = (DF + DS) / 2, and wherein a- the number of true positive results of the study, b - number of false positive results, b - the number of false negatives, d - the number of true negative results [4].

Results and discussion. The principle of constructing an algorithm to predict the development of infectious and toxic shock [ID for rationalization proposal number 4454 "Irkutsk State Medical University" 10. 04. 2009] was as follows. On admission to the hospital the patient was evaluated the clinical picture of the disease, including the identification of clinical markers of verification of infectious-toxic shock. Further analysis was conducted signs indirectly indicate the possibility of this complication and its degree. In the proposed algorithm took into account the following well-known to medical practitioners clinical signs of pneumonia character's debut, the state of consciousness of the patient, the presence or absence of shortness of breath, skin color, blood pressure. An analysis of the above symptoms are gradually determined the likelihood of infectious-toxic shock (Figure 1).

Another complication is inevitable or very often associated infectious-toxic shock, the patient's life-threatening pneumonia, contributing to the accession of other complications of the disease and increasing the duration of treatment, including the favorable outcome is DIC. This is a complex disorder of hemostasis that develops as a result of an imbalance between the factors of the cellular elements of blood, plasma and vessel wall. Systemic activation of the coagulation system with multiple promotes the formation of blood flow in micro-and makrosgustkov and blood clots, blockage of the microcirculation in the "target organs" with the development of their failure, leading to activation, intensive consumption and depletion of coagulation factors physiologic anticoagulants (antithrombin III, protein C) and components of fibrinolytic system

(plasminogen and its activators).

In order to predict the possibility of DIC in pneumonia we have developed a diagnostic algorithm [ID for rationalization proposal number 4458 "Irkutsk State Medical University", 10.04.2009], according to which the patient on admission to the hospital evaluated the clinical picture of the disease and identified clinical signs, indicating a high probability of this complication in the short term. Later identified and analyzed markers, indicating the possibility of the occurrence of DIC and its degree. The algorithm took into account the following signs: respiratory rate, color of skin, hemodynamic parameters, the presence and extent of acute respiratory failure, the presence of infectious-toxic shock and anti-shock performance measures.

Depending on the presence or absence of any of the features listed above, the extent of their manifestations determined not only by the risk of disseminated intravascular coagulation, but also predicted the degree of severity (Figure 2).

Diagnostic algorithm for predicting the development of DIC is used to determine the risk of its occurrence in a patient with pneumonia, and depending on the degree of treatment to correct violations, avoiding thus the adverse effects and improve treatment outcome.

The introduction to the work of the receiver, infectious and pulmonary department of the hospital developed algorithms for predicting the development of infectious-toxic shock and disseminated intravascular coagulation in patients with pneumonia has significantly reduced the number of these complications of the disease. As a result, toxic shock was diagnosed in 8 patients, 8% of patients in the comparison group and 3, 7% of the study group ($p < 0, 05$). DIC was diagnosed only in the comparison group (2, 8%), while among the patients of the group this complication have been identified through the effective prediction of shock and taken preventive measures (Table 1).

The effectiveness prediction algorithm infectious toxic shock of 97, 7 % sensitivity at 95, 6%, specificity of 99, 7 % and accuracy 99 5%. The effectiveness of the algorithm prediction of DIC was 100%.

Conclusion. The proposed diagnostic algorithms to help the practitioner, including at the stage of primary health care in the early stages suspect the possibility of a patient with pneumonia potentially fatal complications. It will help to correct the medical and diagnostic tactics, more accurately solve transportation issues the patient, to determine the indications for hospitalization, including the intensive care unit and intensive care, and thus improve the results of treatment of pneumonia.

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