

Methods of Evaluation of the Pneumonia Severity and their Comparative Analysis in the Servicemen

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ABSTRACT

Objective. Comparative analysis of two-step (non-severe, severe) and three-step (mild, moderate, severe) assessment of the severity of community-acquired pneumonia in the military men.

Materials and Methods. The study included 1177 patients with pneumonia, men, and soldiers performing military service at the age of 18 to 22 years (19.2 ± 0.19).

Results. It is shown that a three-stage evaluation of the severity of pneumonia allows more adequately assess the degree of severity of the disease and thus provide not only more accurate triage on site selection of treatment, but convincingly decide on the hospitalization need and determine the most rational treatment of the disease.

Keywords: community-acquired pneumonia, assessment of severity of pneumonia.

INTRODUCTION

The problem of diagnosis and treatment of community-acquired pneumonia (CAP) continues to be one of the most relevant in the modern health care. The paradox in this case is that, on the one hand, achieved impressive results in understanding the pathogenesis of infection, to improve diagnostic methods, to improve the effectiveness of chemotherapy, the availability of modern highly effective antibacterial drugs, and on the other - is stored a large number of patients with severe disease and relatively high mortality due to pneumonia than, as before, is a leader in the structure of morbidity and mortality from infectious diseases in developed countries [15].

In Russia, the incidence of community-acquired pneumonia in 2006 was 4, 1 ‰ [3]. However, the incidence of community-acquired pneumonia in the Armed Forces of Russian soldiers performing military service, is substantially higher for the past 15 years, 30 - 45 ‰ [3, 4, 7]. Mortality in community-acquired pneumonia in adults up to 50 years without concomitant diseases in Russia is 1 - 3% of patients requiring hospitalization in the intensive care unit (ICU), it comes to 30% [3]. In the European Union, North America and Japan, the death rate from pneumonia in 2003 - 2006 years. was 50 - 60 to 100 thousand people per year [15], in Russia - 30 cases per 100 thousand population [3, 4].

M.J. Fine et al. examined risk factors for a possible death of pneumonia, with a total point

value of these parameters, such as age, sex, laboratory findings, clinical examination of the patient on admission, presence of comorbidities [11, 14]. In accordance with the greater or lesser likelihood of death were identified five risk categories (I - V). The authors concluded that patients with I and II risk category, that is, the minimum probability of a fatal outcome, can be treated as outpatients. Patients with category III need a short hospital stay. When the amount of points corresponding to the IV and V categories of risk, requires unconditional admission [11, 14]. Were formulated new approaches to the management of patients with pneumonia, in which a significant number (80%) were invited and treated without hospitalization [3, 13].

The cost of outpatient treatment, of course, much lower than fixed. For example, if the treatment of hospitalized patients in the United States in 2007 was worth an average of 5700 dollars, the patient - only \$ 300. [8]. The economic benefits are more than obvious. Especially since the cost of treating patients with pneumonia in the United States in 2006 totaled \$ 10 billion, with more than 92% of them came from hospitals [12].

Thus choice of treatment of CAP (outpatient or inpatient) is very important, including economic value. As a result, there was a replacement concept actually assess the severity of the EP on the definition of criteria (or reading) to the formulation of criteria for hospitalization and severe course of the EP with the criteria of flow, requiring hospitalization in the ICU.

CAP moderate course with low risk of adverse outcome on the merits of the question. Meanwhile, it is not heavy for the CAP, which included the mild and moderate course of the disease is about 96% of all cases of CAP. Patients who make up this major part of all cases have different clinical manifestations, the evaluation of which is of great importance when choosing the type and amount of antibiotic, detoxifying and symptomatic therapy. Adequate assessment of the severity of pneumonia is of practical importance and is not limited to sorting on site selection criteria and treatment of heavy flow.

The purpose of the study. Comparative analysis of two-stage (non-severe, severe) and three-stage (mild, moderate, severe) assessment of the severity of community-acquired pneumonia in the military men.

Materials and methods. To fulfill this goal, a comparative analysis of the results of examination and treatment of patients with pneumonia in a pulmonary department of the military hospital in the period from 2004 to 2010. In the study included 1,177 patients with pneumonia, men, soldiers performing military service at the age of 18 to 22 years ($19, 2 \pm 0,19$).

The severity of pneumonia in all patients who participated in the study, determined sequentially: first, by a two-stage criteria (non-severe and severe), and then - according to the criteria of the three-stage (mild, moderate, severe) scales. The results were called, respectively,

two-and three-stage assessment of the severity assessment of the severity of pneumonia.

For two-step evaluation of the severity were used the criteria set out in the relevant methodological guidelines of the Main Military Medical Directorate of the Russian Defense Ministry on the diagnosis, treatment and prevention of community-acquired pneumonia in the military (2003 and 2009), and practical recommendations for the diagnosis, treatment and prevention of community-acquired pneumonia in adults (2003 and 2006) [2, 3, 4, 7]. The criteria for severe pneumonia, according to the methodological guidelines for the diagnosis, treatment and prevention of pneumonia in troops in 2003 [7] were: the plight of the patient (cyanosis, confusion, delirium, fever above 39,0 C); respiratory failure (respiratory rate >30 per minute, $\text{Pa O}_2 < 60 \text{ mm Hg}$, $\text{Pa CO}_2 > 50 \text{ mm Hg}$), arterial hypotension - systolic blood pressure < of 90 mm Hg. and (or) diastolic blood pressure of 60 mm Hg; marked tachycardia (heart rate per minute > 125); leukocytosis ($> 25 \cdot 10^9 / \text{L}$) or leukopenia ($< 4 \cdot 10^9 / \text{L}$) hemoglobin < 100 g / l; hematocrit < 30 %; common extensive pneumonia or bilateral pneumonic infiltration; progressive course of pneumonia, massive pleural effusion; cavity (s) of the collapse of the lung tissue; diuresis < 80 ml for 4 h, and (or) blood urea nitrogen > 7, 0 mmol / l (or) creatinine > 176, 7 mmol / l; secondary bacteremia, meningitis, pericarditis, hematogenous infection screenings. Extras were isolated and signs dire, life-threatening pneumonia flow presented in Table. 1.

According to the guidelines of the Main Military Medical Directorate of the Russian Defense Ministry on the diagnosis, treatment and prevention of community-acquired pneumonia in the Russian Defense Ministry troops in 2009 [4], the above criteria for severe pneumonia extremely became known as the criteria for severe (Table 2).

The criteria for severe in the methodological guidance of the Main Military Medical Directorate of the Russian Defense Ministry on the diagnostics, treatment and prevention of community-acquired pneumonia among military personnel of the Ministry of Defense of Russia in 2009 [4], were similar to the criteria for severe pneumonia recommendations for diagnosis, treatment and prevention of community-acquired pneumonia in adults in 2003 and 2006) [2, 3], with the exception of hemoglobin, and hematocrit values of azotemia.

The guidelines for the treatment and diagnosis of pneumonia as the Main Military Medical Directorate of the Ministry of Defence of Russia (2003, 2009) and in adult civilian patients (2003 and 2006) emphasized that the estimates for pneumonia heavy enough as one of the following criteria [2, 3, 4, 7].

In order to determine the severity of pneumonia for three-criterion evaluation of the severity we used the criteria developed by us [5]. They are presented in Table. 3.

In contrast to the recommendations of the methodological guidelines of the Main Military

Medical Directorate of the Ministry of Defense of Russia in 2003, 2009 and in civilian medicine in adults in 2003, 2006 [2, 3, 4, 7], according to the three-stage evaluation criteria it was proposed to determine the severity of CAP on the aggregation of all the available evidence and developed criteria for mild, moderate and severe disease.

Confirmed case of pneumonia was considered the presence of specific clinical and radiographic evidence of disease. Besides of physical signs there were analyzed electrocardiogram data, parameters of common peripheral blood, urine, biochemical studies, electrolyte (potassium, sodium, serum), protein composition, the coagulation system, renal excretory function and blood gas. All patients received antibiotic and symptomatic treatment in accordance with accepted standards and clinical guidelines [2, 3, 4, 6, 7].

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 comparison of quantitative indicators used Student's t test.

Results and discussion. According to the criteria for the diagnosis of acute respiratory failure (ARF) (respiratory rate > 30 min; $\text{SaO}_2 < 90\%$, $\text{PO}_2 < 60$ mm Hg), the number of patients with severe pneumonia for two-and three-stage assessment was essentially the same: two-stage assessment of severity - 4, 8% (56 people) and a three-stage assessment of severity - 4, 6% (54 people). By hypotension when using a two-stage assessment (systolic blood pressure < 90 mm Hg., Diastolic blood pressure < 60 mm Hg) The number of patients with severe pneumonia was 4, 2% (50 persons), on a scale three-stage assessment (systolic blood pressure ≤ 90 mm Hg diastolic pressure ≤ 50 mm Hg) - 4, 6% (54 patients). Thus, the criteria for acute respiratory failure and hypotension both systems rated severity of pneumonia showed similar results .

According to X-ray examination of the chest cavity, most of the patients (999 men; 84, 9%) in the inflammatory process involved only one segment, two and three segments - respectively in 164 people (13, 9%) and 14 (1, 2%) .

Pneumonic infiltrates were found in the lower lobe of the lower lobes of both lungs - 45 patients (3, 8%) in the upper lobe of the left and light in the middle right lung lobe - in 22 persons (1, 9%), the upper lobe of the left lung and the lower lobe of the right lung - in 27 persons (2, 3%), in the lower lobe of the left lung and the right middle lobe lung – in 14 patients (1, 2%).

Share a lot of lung damage among patients studied were found. The two share loss was observed in 108 people (9, 2%). If the criterion of "Two and a lot of equity of interstitial lung disease" on a scale of two-stage evaluation of the severity of patients with severe pneumonia was 108 people (9, 2%), then the scale of the three-stage assessment of the severity of these patients

were distributed as follows: mild course was in 69 people (63, 9%), moderate - in 36 people (33, 3%) and severe - in 3 people (2, 8%). Thus, by destruction of lung tissue of patients with severe when using the three-step evaluation of the severity scale was significantly less (54 pers.; 4, 6%) and corresponded to the number of patients with severe pneumonia criteria for acute respiratory failure and hypotension.

The correlation between the volume of infiltrative changes in the lungs according to radiography and the severity of the patient's condition is often absent. Thus, the practical experience so far shows that even minor radiological manifestations at the onset of pneumonia in the future may develop severe illness. Therefore, if properly assess the severity of pneumonia at the onset of the disease, focusing only on a small area of destruction of lung tissue in the future may develop life-threatening complications of the disease - infectious-toxic shock and acute respiratory failure due to incorrectly chosen tactic of the patient. At the same time, extensive inflammatory infiltration of the patient's condition may not significantly suffer, not objectively detect signs of severe pneumonia and not cause risk of developing complications, which confirmed the results of the use of a three-stage evaluation of the severity scale.

Leukopenia ($<4 \times 10^9 / L$) in the primary results of the study of peripheral blood was diagnosed only three people (0, 3%). These patients were admitted to hospital in a satisfactory condition, complaining of a rare unproductive cough without fever and other symptoms of infectious intoxication, with no signs of acute respiratory and circulatory failure and criteria of the scale three-stage evaluation of the severity of pneumonia among them was defined as mild, but on the scale of a two-stage assessment of severity as severe. However, no other criteria for severe pneumonia in these patients were found and white blood cell count returned to normal within the first 2 days after admission. Therefore, in view of the clinical picture, data, physical examination, and results of instrumental studies of the disease in the final version were considered easy. Leukocytosis as pneumonia severity criterion is not considered two-stage assessment of the severity [2, 3, 4], while the scale three-rated severity of [5], this figure, in most cases correlated well with disease severity. So, on a scale three-stage assessment of the severity of leukocytosis to $10 \times 10^9 / L$ was detected in 792 people (67, 3%), 10 to $20 \times 10^9 / L$ with a shift to the left leukocyte counts - in 337 people (28, 6%) and over $20 \times 10^9 / L$ toxic grit – 48 (4, 1%). Thus, to evaluate how severe pneumonia only one of the criteria, as required by a two-stage range [2, 3, 4] apparently impractical. There was an obvious need for a set of criteria to determine the severity of community-acquired pneumonia.

For an objective assessment of the patient's consciousness on a scale of severity we used a two-stage evaluation process recommended in the methodological guidelines of the Main

Military Medical Directorate of the Russian Defense Ministry on the diagnosis, treatment and prevention of pneumonia in military personnel (2003) [7]. To this end, we use the special scale H. Quereshi, H. Hodgkinson (1974), as amended by Stratchounski L.S. (2002), which includes 10 questions, the correct answer to each of which was estimated at 1 point. Amount of ≤ 8 points indicates a violation of consciousness. Questions asked by the patient, according to this scale: 1) age, 2) date of birth, and 3) the time (within hours), and 4) a year, and 5) the name of the hospital, and 6) the ability to recognize two people (eg, doctor, nurse) 7) address; 8) the date of the beginning of the Great Patriotic war, 9) the name of the President of the Russian Federation, 10) countdown from 20 to 1.

In our study, almost one-third of the patients (345 people, 29, 3%) scored less than 8 points, and, therefore, should be attributed to the group of patients with severe disease, as found signs of "disturbance of consciousness" [2, 3, 4]. Most often, patients, due to their low educational level, and made mistakes in questions 3, 5, 8, 9 and 10. However, during the observation and treatment, with a comprehensive evaluation of data and objective examination of the results of instrumental studies treat for pneumonia in 291 (24, 7%) patients had a severe extremely difficult. Severity of intoxication was defined as a minimum, acute respiratory and cardiovascular failure were absent, complications of the disease was not. When using a three-step scale assessing the severity of mild euphoria in patients was observed only in 10.7% of cases (126 pers.), and the confusion of all diagnosed in 14 people (1, 2%). Thus, the criterion of "disturbance of consciousness" is used as the sole criterion for assessing the severity of PE and defined in points on a special scale, may also contribute to an erroneous evaluation of the severity of CAP.

Patients with extrapulmonary foci of infection (meningitis, brain abscess, etc.), acute renal failure (anuria, blood creatinine > 0.176 mmol / L, urea nitrogen > 7.0 mmol / L) and anemia (hemoglobin < 100 d/l, hematocrit < 30 %) of the patients included in the study, was not.

When using a three-stage evaluation of the severity scale, based on a comprehensive analysis of all the criteria of severity of pneumonia at the time of admission to hospital for lung diseases were reported in significantly more patients (712 people, 60, 5%) than moderate and severe (respectively at 411 people., 34, 9 % and 54 people, 4, 6 %, $p < 0.01$ (χ^2). Using a two-stage evaluation of the severity scale, with a recommendation to regard the disease as severe if at least one criterion, showed different results: the so-, severe pneumonia was found in 427 people. (36, 3%). Due to the fact that the criteria for non-severe pneumonia flow on a scale two-stage assessment of severity are not differentiated, then it must be assumed that they are all left outside the heavy currents, the is – 750 people) (63, 7 %).

Feature of our study was the participation of patients with pneumonia, soldiers performing

military service. For this category of people is a mandatory hospitalization in case of pneumonia, and this gave us the opportunity to analyze the course of the disease including those patients who are on the scale of a two-stage evaluation of the severity of medicine in the civilian sector may be treated as outpatients. As a result of 712 people (60, 5%), who at the time of admission were recorded for lung pneumonia on a scale assessing the severity of a three-stage, 17 patients (1.4%) diagnostic views on the severity of the disease during the follow-up of the first two days have changed and the disease has been disease interpreted as moderately. On the contrary, for pneumonia in 13 patients (1, 1%), with the primary inspection deterministic as moderately, in the future, during the first day of observation, was seen as a slight. Of the 411 people (34, 9%), whose admission to hospital for pneumonia was diagnosed moderate scale three-stage assessment of severity, the next day the state has been revised as severe in 11 people (0, 9%), which required the translation of these patients in the intensive care unit. Therefore, if you do not differentiate between mild and moderate of pneumonia, assess disease only as "non-severe" and advise patients to outpatient treatment without proper medical supervision, not taking into account the possibility of adequate care and treatment in an outpatient setting, there are cases with exacerbation of pneumonia, which is equivalent in importance late admission. According to our data [1], during the first two days of the onset of the disease in the hospital received up to 3, 6% of patients with severe pneumonia, then on the third day the percentage of such patients increased to 8, 6 % and 4-th it has already reached 11, 8%. It is established that the hospital on the third and on the fourth day of onset of pneumonia during the weigh down 5% and 8, 2%, respectively, $p < 0, 05 (\chi^2)$ [1].

Conclusion. One of the reasons that the mortality from pneumonia still is one of the first places a leading cause of death from infectious diseases has traditionally holds the 1st place [15], and this is despite the availability of highly effective antibiotics, may be in the among other things, an inadequate system of assessing the severity of pneumonia. The desire to preferential treatment of pneumonia in an outpatient setting, with the aim of reducing insurance premiums, delaying hospitalization, lack of adequate medical supervision of the patient may also contribute to weighting of the patient, the development of life-threatening complications with the consequent fatal.

Patients, the severity of the pneumonia which qualifies under the three-stage system as a mid-weight, two-step on the scale is usually assessed as non-severe, and patients are encouraged to outpatient treatment. But after a while, after failure of outpatient, but significantly cheaper treatment, these patients swell group of patients with severe, complicated course of the disease and that they tend to require ICU admission and increase the percentage of deaths in pneumonia.

This circumstance is connected and the highest mortality from pneumonia among men of working age [3]: severe illness is diagnosed, the patient is not hospitalized, is assigned to outpatient treatment, and the patient often continues working as long as the disease does not acquire a severe course.

Most importantly, what convinces clinical experience in the diagnostic process need to be defined disease severity. Moreover, a more detailed examination of any pathology, including the CAP, and promotes a more accurate assessment of its clinical manifestations. Any simplification, including the separation of pneumonia only a mild and severe, leading to the erosion of the task of evaluating the severity of the disease and the inevitable, in view of this, errors.

If many authors [9, 11, 14] recommend distinguish three groups of patients with pneumonia (ambulatory patients requiring hospital treatment and indications for hospitalization in intensive care units), the stratification of the severity of the disease involves yet only two options - either heavy or non-severe. Obviously, using the three-stage assessment of the severity of pneumonia would eliminate this drawback. In this case, patients with mild pneumonia could be recommended outpatient treatment, patients with moderate course - admission to the therapeutic (pulmonology) department, and patients with severe disease were sent to the ICU.

Conclusions.

1. Sorting pneumonia severity considering only one criterion, a two-stage scale according to the recommendations are insufficient and could lead to an incorrect evaluation of the severity of the disease, indicating the need for comprehensive analysis of all clinical criteria.

2. Using a three-step scale provides a more accurate triage site selection treatment.

References

1. Borisov I.M. Shapovalova T.G. Pnevmonia u vakcinirovannich pnevmococcovoy vaccinoj [Pneumonia in vaccinated with pneumococcal vaccine]. Saratov, 2012. 190 p.
2. Chuchalin A.G., Sinopalnikov A.I., Jakovlev S.V. Vnebolnichnaja pnevmonia u vzroslich: prakticheskie rekomendacii po diagnostike, lecheniu I profilaktike [Community-acquired pneumonia in adults: guidelines for diagnosis, treatment and prevention] Clin. Mikrobiologija I antimicrobnaja chimioterapija [Clin. Microbiology and antimicrobial. Chemotherapy]. 2003, № 5, pp. 198 - 224.
3. Chuchalin A.G i dr. Vnebolnichnaja pnevmonia u vzroslich: prakticheskie rekomendacii po diagnostike, lecheniu I profilaktike [Community-acquired pneumonia in adults: Practical guidelines for the diagnosis, treatment and prevention]. Moscow: Izdatelskiy dom M-Vesti [Publishing house M-News], 2006, 76 p.
4. Diagnostika, lechenie I profilaktika Vnebolnichnoy pnevmonii u

voennosluzaschich MO RF: metodicheskie rekomendacii GVMU MO RF [Diagnosis, treatment and prevention of community-acquired pneumonia in servicemen of the Russian Federation Ministry of Defense: Defense guidelines Main Military Medical Management of the Russian Federation Ministry of Defense]. Moscow, 2009, 53 p.

5. Borisov I.M., Kraynyuk P.E., Shapovalov T.G., Borisova M.S. Patent 2458626 RU, (51) IPC A61V 5/0205 (2006.01) Sposob otsenki stepeni tajzesti pnevmonii [A method for assessing the severity of pneumonia]. № 2011109430/14; Zajavleno [Stated] 11.03.2011, Opubl. [Publ]. 20.08.2012, Bull. № 23.

6. Standarti (protokoli) diagnostiki i lechenija bolnich s nespecificheskimi zabolevaniami legkich: prikaz MZ RF 9.10/1998 № 300 [Standards (protocols) diagnosis and treatment of patients with nonspecific lung diseases: an order from the Russian Ministry of Health] 9.10.1998 № 300 Biblioteka jurnala kachestvo medicinskoy pomoshi [Library Journal, Quality of care] № 1. Moscow: Grant, 1999, 40 p.

7. Ukazania po diagnostike, lecheniu i profilaktike vnebolnichnoy pnevmonii u voennosluzaschich: metodicheskie ukazaniya GVMU MO RF [Guidelines for the diagnosis, treatment and prevention of community-acquired pneumonia in the military: Defense guidelines Main Military Medical Management of the Russian Federation Ministry of Defense]. Moscow, 2003, 79 p.

8. Ambrose P. G. Bhavnani S.M. Owens R.S. Antimicrobial Pharmacodynamics in Theory and Clinical Practice. New York, NY: Informa Healthcare, 2007. - pp.177-188.

9. American Thoracic Society. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. Am J Respir Crit Care Med, 2001, pp. 1730 – 1754.

10. Dambrava P.G. Torres A. Valles X. Adherence to guidelines empirical antibiotic recommendations and community-acquired pneumonia outcome. Eur. Respir. J., 2008; pp. 892 – 901.

11. Fine M. J. Auble T.E. Yealy D.M. A prediction rule to identify low- risk patients with community-acquired pneumonia. N. Engl. J. Med., 1997. Vol. 336. pp. 243 – 250.

12. Mandell L.A. Wunderink R.G. Anzueto A. Infectious Diseases Society of America/ American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis., 2007. Vol.44. pp. 27-72.

13. Metersky M. L. Community-acquired pneumonia: process of care studies. Curr Opin Infect Dis, 2002, № 15, pp. 169-174.

14. Metlay J P. Fine M. J. Testing strategies in the initial management of patient with



community-acquired pneumonia. An Intern Med, 2003; № 138, pp. 109-118

15. National Vital Statistics Report. Vol. 57, Number 14, April 2009. Deaths: Final Date for 2006. Centers for Disease Control and Prevention.

Available at www.cdc.gov/nchs/data/nver/nver57/nver57_14pdf

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