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Video Thoracoscopic Sanitation and Drainage of Hemothorax after Chest Injury

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Abstract: Today, the problem of choosing a treatment method for coagulated hemothorax remains undoubtedly relevant. There are still no clear indications for the use of one or another treatment method. Currently, the main factor for the use of a particular treatment method is the criterion of time elapsed since the disease. The medical records of 368 patients were analyzed. Using inclusion and exclusion criteria, the database was reduced. The groups were compared based on the presence or absence of differences. Using dependency analysis, we excluded variables that were not related to the grouping of patients. The parameters for assessing the patient's condition are described, which, one way or another, influence group differences. Among these parameters, both physical and laboratory parameters were identified.

Keywords: hemothorax; chest injury; videothoracoscopy; minor surgery techniques ;pre - dictions ; multivariate statistical modeling.

Relevance of the problem

Despite the high level of development of medical technologies and knowledge, the issue of choosing a treatment method for patients with coagulated hemothorax has not yet been resolved. Getting acquainted with the literature on this topic, the conclusion arises that in the Russian and world thoracic community there are no clear criteria for the use of this or that method. Some authors, when identifying or admitting a patient with such a pathology, suggest immediately starting with thoracoscopic methods [11]. Others suggest always starting with "minor" surgery methods (puncture or drainage), and if the latter are ineffective, moving on to video-assisted thoracoscopy or thoracotomy [14]. Currently, the starting points for using a particular treatment method are, as a rule, the time criterion and the personal experience of the surgeon. Domestic authors consider it possible to perform videothoracoscopy in patients with coagulated hemothorax 2-3 weeks after its formation (disease or injury) [1, 2]. There is also no uniform approach among foreign authors: the time for successful treatment of patients using videothoracoscopy varies from 5 to 13 days [6, 7, 9, 10, 12, 13, 15]. In some studies, the exact timing for successful use of video-assisted thoracoscopy is considered unknown [8]. This became the reason for conducting an independent study of the issue, through a retrospective study of patients treated at the Yaroslavl Regional Clinical Hospital (YAO) and treatment and preventive institutions of the Yaroslavl Region (MPI YaO) from 2000 to 2011.

Target. To evaluate the possibility of creating an algorithm for treatment tactics for patients with coagulated hemothorax.

Tasks:

1. Based on the collected material, assess the representativeness of the sample.
2. Identify significant variables that reliably differentiate groups from each other.
3. Assess the degree of participation of the selected parameters in the possibility of constructing the algorithm.

Materials and methods

Taking into account the goals and objectives of the study, as well as the characteristics of the studied category of patients, the minimum necessary and sufficient representative sample was formed. The study included 368 patients who were treated at the thoracic department of the Yaroslavl Regional Clinical Hospital from 2000 to 2011, who could be admitted either initially to the thoracic department of the regional clinical hospital or previously treated in the medical facilities of the Yaroslavl Regional Clinical Hospital. The exclusion criteria from the study were: ongoing intrapleural bleeding, use of anticoagulants at the time of the onset of pathology, and the presence of oncological pathology . Observations that were missing key data for the purpose of analysis were also excluded. As a result, 108 observations remained. Patients were divided into groups based on treatment options. Three treatment methods were taken into account, namely “minor surgery methods” - puncture treatment and drainage of the pleural cavity (1st group of patients), video-thoracoscopic sanitation of hemothorax with possible pleurectomy and decortication of the lung (2nd group) and treatment using thoracotomy with sanitation of hemothorax with possible pleurectomy and decortication of the lung (group 3). All patients had stable vital signs, which did not require hospitalization in the ICU. The clinical diagnosis was made based on the analysis of anamnestic and clinical data and according to polyposition radiography of the chest organs.

Among the patients there were 93 (86%) men, 15 (14%) women. 81 (75%) patients with closed chest trauma, 17 (16%) with open trauma, 3 (3%) with spontaneous hemothorax, 1 (1%) with spontaneous hemopneumothorax , 6 (6%) with infected hemopneumothorax . 83 (77%) patients had no concomitant diagnosis, 25 (23%) were burdened with concomitant pathology. The average age was 46/37.5/55.5/ years. The distribution of patients within groups by gender and age is presented in Table 1.

Table 1 Distribution of patients within groups by gender, age

Type of treatment	Floor		Age		
	Man	Woman	Up to 30 years old	31-55 years old	over 55 years
Minor surgery	90 %	10 %	14	59	27
Videothoracoscopy	87 %	13 %	13	67	20
Thoracotomy	67 %	33 %	13	54	33
Confidence level, p	<0.05		>0.05		

The patient's condition was assessed using 148 criteria. The analysis was carried out using exploratory methods of multivariate statistics, taking into account the objectives of the study. The signs in the groups were both quantitative and qualitative in nature. Qualitative data were described through absolute and relative frequencies, followed by their comparison using $\chi 2$, x 2 tests with Yates' correction, or Fisher's exact two-tailed test. Qualitative data included the following parameters for assessing the condition - chest X-ray data on admission, the presence or type of previous treatment, time from the onset of the disease, gender, the presence or absence of a concomitant diagnosis. Quantitative data were first tested for normal distribution using the Shapiro- Wilk test . After which they are described accordingly . The significance of differences between groups in quantitative data was carried out using the Kruskal-Wallis method . As in the previous case, differences were considered significant when p was less than or equal to 0.05.

Given the purpose of the study, parameters that could not be determined upon patient admission were excluded from further analysis. This left 44 variables. In order to test the hypothesis about whether there is a connection between the primary grouping of the formed sample and the variables that were taken into account as a result of copying the primary data, a dependency analysis was carried out. It made it possible to carry out an initial sorting of available observations and exclude variables that have no connection with the phenomenon being studied. As a result, the following variables remained - time of illness, previous treatment, chest X-ray results on admission, presence or absence of a concomitant diagnosis, body temperature on admission, the value of red blood cells in a general blood test on admission, hemoglobin, platelets, ESR, urea, bilirubin , total protein and albumin in a biochemical blood test. Significant correlation coefficients ranged from 0.21 to 0.5, with positive and negative values.

Results. Based on the Zacks scores, the variables taken into account were assessed for compliance with the intended procedures of one-way analysis of variance. Calculations with this method are based on an estimate of the permissible error. They take into account that the finer the difference that needs to be detected between treatment approaches, the more widely dispersed the options (indicators), the more material needs to be accumulated for evidence [5]. The test results revealed an acceptable set of observations in the first and second groups. At the same time, the volume of the third group was at the level of borderline values. Taking this into account, it was decided to establish the required number of observations during the study itself using sequential sequential analysis. Such decisions are based on a comparison of competing hypotheses.

The assessment of significant differences in the considered qualitative variables was carried out using the %2 test, either with Yates' correction, or Fisher's exact two-sided test (Table 2).

Table 2 Statistically significant differences in anamnestic and instrumental data

Evaluation parameter	State significance level, p
Time of illness	0.0000
Previous treatment	0.0001
Chest X-ray data upon admission	0.0001
Concomitant diagnosis	0.0117

To identify significant differences in the quantitative variables taken into account, the Kruskal-Wallis nonparametric analysis of variance (ANOVA) procedure was used . State assessment parameters for which statistically significant differences were identified as a result of this analysis are presented in Table 3. No statistically significant differences were found for other parameters.

Table 3 Statistically significant differences in physical and laboratory data

State evaluation parameter	The exact meaning of the Kruskal –Wallace H statistic	Number of observations N	Significance level P
Body temperature upon admission	24.14	108	0.0000
Red blood cells	8.82	108	0.0121
Hemoglobin	17.58	108	0.0002
Platelets	13.61	63	0.0011
ESR	36.85	103	0.0000
Urea	11.6	82	0.0030
Total bilirubin	6.13	95	0.0467
Albumen	9.12	32	0.0105

No statistically significant differences were found in other parameters. At the next stage, to identify the relationship between the state assessment parameters and group differences, a dependency analysis was performed. It made it possible to exclude parameters for assessing the state of connection with the phenomenon under study that do not have (Tables 4, 5).

Table 4 Analysis of the relationship between anamnestic and instrumental data and the treatment method

State evaluation parameter	Number of observations	Correlation coefficient	Exact Statistic Meaning	Significance level
Time of illness	108	0.50	5.39	0.000000
Previous treatment	108	0.49	5.41	0.000000
Rg of chest organs upon admission	107	-0.38	-4.31	0.000016
Concomitant diagnosis	108	0.34	2.60	0.009089

Table 5 Analysis of the relationship between physical and laboratory data and treatment method Kendall Correlation Test Statistics

State assessment parameter	Number of observations	Correlation coefficient	Exact Statistic Meaning	Significance level
Body Ton admission	108	0.38	5.93	0.000000
Red blood cells	108	-0.21	-3.39	0.000839
Hemoglobin	108	-0.31	-4.84	0.000001
Platelets	63	0.36	4.18	0.000029
ESR	103	0.47	7.04	0.000000
Urea	82	-0.30	-4.05	0.000052
Total bilirubin	95	-0.21	-3.05	0.002314
Albumen	32	-0.44	-3.57	0.000361

The discussion of the results

The reliability of the differences in the parameters taken into account indicates that the correct approaches to the treatment of this category of patients were applied. Statistically significant differences were revealed between the groups of treatment methods according to anamnestic and instrumental data.

These are indicators such as chest x-ray data upon admission, type of previous treatment or lack thereof, time of illness, and burden of concomitant pathology. Statistical differences in physical and laboratory data were also revealed. These are the following indicators: body temperature upon admission, results of a clinical blood test, namely red blood cells, hemoglobin, platelets, ESR, and a number of values of a biochemical blood test - urea, total bilirubin, albumin. However, as is known, statistically significant differences may not always be clinically significant, which requires further verification. The condition assessment parameters obtained in this study, in which the groups differ from each other, represent a set of examinations that can be performed in any medical institution. However, in central district hospitals, especially when the patient is hospitalized in the evening, the diagnostic potential of the institution may be limited only by a general blood test, although this examination is not always feasible. Please note that differences between the groups were also obtained in terms of parameters that are determined by interviewing the patient, measuring body temperature and performing chest x-rays, which is always easy to do.

To determine the relationship between the identified parameters of state assessment and group differences, a dependency analysis was performed. For parameters that were represented in the database by qualitative data , gamma (y) statistics were used, and for parameters that were represented by quantitative data, Kendall's Tau (t) statistics were used to obtain the corresponding correlation coefficients. Thus, among the physical and anamnestic data, a moderate reliable correlation was observed (correlation coefficients varied from 0.34 to 0.5 with group differences. The strongest reliable correlation (0.5) is observed for the parameter time of illness.

Among physical and laboratory data, with correlation coefficients ranging from 0.21 to 0.44. The indicator of a general blood test - red blood cells, and a biochemical blood test - total bilirubin showed a low correlation, the correlation coefficient was 0.21, with a negative value. That is, the higher the level of red blood cells and bilirubin (all values rarely exceeded 25 µmol /l), the more “light” the treatment method was used for the patient. The identified correlation in total bilirubin values is difficult to consider clinically important. For other indicators, a moderate significant correlation was revealed. Hemoglobin, urea and albumin also had a negative sign in front of the correlation coefficient.

If the hemoglobin and albumin values are easy to interpret and appear to be clinically important, then the higher the hemoglobin and albumin values, that is, the patients are more somatically stable, then they will receive a less severe treatment method, namely, they will most likely fall into the group of methods " minor" surgery. Then, when urea values decrease, patients are likely to be operated on, either using video thoracoscopy or thoracotomy.

Conclusions

1. The work done to copy the primary material made it possible to generate data that meets the principles of both randomization and representativeness, anticipating further actions to assess the possibilities of creating an algorithm.
2. Among the many data taken into account during the initial copying , a set of characteristics of the patient’s condition was identified, including both laboratory and instrumental, as well as anamnestic and physical data that reliably distinguished the groups from each other.
3. All components of the identified set of parameters for assessing the condition turned out to be significantly correlated with the treatment options.

Considering the differences we identified between the groups both in some physical and anamnestic data, as well as in laboratory data, we can talk about the influence of these parameters for assessing the patient’s condition on the choice of treatment method. The differences found significantly exceed the number of generally known factors. Given the large set of parameters for assessing the condition, in order to determine the combinatorics of the influence of these parameters on group differences, that is, on the choice of treatment method, and the limits of values characteristic of each treatment group, it is necessary to use mathematical modeling methods. And the possible creation of an algorithm for treatment tactics for patients with coagulated hemothorax.

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