

Possibilities of Computer Prediction of the Relative Risk of Lethal Outcome in Septic Patients

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ABSTRACT

The algorithms of actions for the definition of the condition severity and choice of the medical-diagnostic measures in the patients with the biliary sepsis are presented. We take into account the traumatic factor of the operation, the kind of narcosis (endotracheal, local anesthesia) and severity level of the initial condition of the patients. We suggest using this program of the actions in the form of the computer program for the diagnostics of the severity level of a condition of the septic patients, creation of the database and electron archives of results of treatment, and also continuous monitoring of the condition of the patients.

Keywords: sepsis, severity level, program of the actions.

INTRODUCTION

Nowadays, the role of predicting the outcome of surgery in the optimization of therapeutic tactics is very important. The prediction of the outcome of any treatment and diagnostic measures is **operational risk** that includes postoperative complications, including death, caused by an underlying medical condition and accompanying pathology [1-3, 6]. Operational risk consists of the anesthetic and surgical risks; the objective assessment of the severity of patients allows predicting the mortality risk and evaluation of the effectiveness of the treatment [2]. **The purpose** of our research was the creation of a program to determine the degree of severity of patient's condition and the choice of algorithms of treatment and diagnostic measures in patients with surgical sepsis.

THE EXPERIMENTAL PART

In the current study, the authors studied the immediate results of integrated clinical and laboratory examination and treatment for 60 patients with surgical sepsis from age 21 to 93 years (mean age 53 ± 0.7 years), out of which 25 men (35%) and 50 women (65%). All patients were divided into three groups by age: the first consisted of 35 patients from age 21 to 59 years, the second - 25 patients from age 60 to 74 years old, and the third, with 15 patients from age 75 to 93 years old. Causes of surgical sepsis by localization of primary infection: 1) purulent forms of pyelonephritis with urolithiasis (20 patients); 2) spilled purulent-inflammatory diseases of abdominal cavity (30 patients: perforated gangrenous appendicitis - 10, pancreatic necrosis - 10, acute ileus-10); 3) acute purulent cholangitis in benign lesions of biliary ducts - (10 patients).



All patients conducted intensive care and surgical treatment, according to current recommendations for treatment of sepsis. The following surgical interventions were performed: 1) laparotomy, the elimination of infection, sanitation and drainage of abdominal cavity (30 patients), with marsupialisation stuffing bags and cholecystostomy (10 patients); 2) laparoscopic cholecystectomy with choledocholithotomy and common bile duct drainage for A.V. Vishnevsky, Kehr (10 patients); 3) endoscopic papillosphincterotomy or suprapapillary choledochoduodenotomy with mechanical lithoextraction and laparoscopic or laparotomic cholecystostomy. (10 patients); 4) Tool kidneys cavity drainage (ureteral stenting, catheterization, percutaneous puncture nephrostomy) for the intensive care of pyelonephritis and sepsis; kidney's decapsulation, excision of the carbuncles, nephrostomy with removing stones from ureter and without that, nephrectomy (20 patients).

All the patients were similar in accompanying pathology (coronary heart disease), the severity of the disease and the prevalence of the disease process (a severe surgical sepsis, confirmed bacteriemia, multiple organ dysfunctions, the presence of primary inflammatory focus). Criteria of organ dysfunction [1] in severe biliary sepsis were: 1) cardiovascular system (systolic BP ≥ 90 mmHg or mean BP ≤ 70 mmHg during 1 hour and more, despite the correction of hypovolemia), 2) urinary system (diuresis < 0.5 ml/kg/h with adequate volemic filling or increasing creatinine to 2 times the normal value), 3) respiratory system ($p_aO_2/FiO_2 \leq 250$ or bilateral infiltrates on x-ray, or the need for respiratory care), 4) liver (increased bilirubin content above $20 \mu\text{mol/l}$ within 2 days or increase in transaminases in 2 times and more), 5) coagulative system (the number of platelets less than $100 \times 10^9/\text{l}$, or a reduction of 50% relative to the highest value for 3 days), 6) metabolic dysfunction ($\text{pH} \leq 7.3$, lactate plasma in 1.5 times more than normal), 7) Central nervous system is less than 15 points on a scale of Glasgow. Bacteremia was confirmed in 20 patients: *S. epidermidis* in 4 patients, *Pseudomonas aeruginosa* in 10 patients, *Klebsiella Pneumoniae* - in 6 patients.

All indicators were tested for normality, according to criteria of Kolmogorov-Smirnov, Lilliefors, Shapiro-Wilkes. All data does not obey normal distribution law of Gauss. We conducted analysis of variance by rank Kruskal - Wallis test and the median, as well as the correlation analysis using Spearman rank correlation coefficient. The relative risk of death as the ratio of the number of patients who have died to the number of survivors was determined [5]. Statistical processing was performed using the program STATISTICA 6.0 for Windows. The level of significance was set at $P 0.05$.

RESULTS AND DISCUSSION

According to the statistical analysis of correlative factor proportion traumatic operations, the degree of severity and frequency of recovery or death in patients with surgical sepsis with



different versions of the infection in the abdominal cavity and retroperitoneal space, we have developed a programme of action to determine the severity of the condition and the selection of treatment in patients with surgical sepsis. We took into account the traumatic level of surgery, the type of anesthesia (local anesthesia, endotracheal), and severity of patient's condition. It should be noted that the relative risk of death, in the proposed prediction method, calculated taking into account the patient perform a laparotomy or lumbotomy and eliminate the source of infection in the abdomen and / or retroperitoneal space under endotracheal anesthesia.

To save time, the diagnosis of the severity of septic patients, establishing a database and electronic archives results treat, and continuous monitoring of patients, we offer the use of the programme of action in the form of a computer program [4]. The program is designed to determine the risk of death according to the results of surveys of patients with surgical sepsis. The program performs the following functions: maintenance of charts of patients, conducting the survey maps for each patient, plotting changes survey results and probabilities of death for each patient, getting statistics on patients.

The Program works as follows.

On admission the patient with suspected surgical sepsis, we estimate the severity of the patient's condition on the basis of clinical, laboratory and instrumental data and correlated with the risk of death or recovery. The degree of severity of the patient is determined automatically by the program on the basis of the proposed method of determining the degree of severity of patients with surgical sepsis [5].

According to a degree of severity the practical doctor recommended specific action algorithm based on valid traumatic operations.

This computer program facilitates continuous monitoring of the condition of patients with surgical sepsis based charting: 1) the results of laboratory and instrumental diagnostics; 2) the risk of death at any time of observation; 3) statistical data.

Thus, the optimal choice of algorithms of treatment and diagnostic measures in patients with surgical sepsis with different versions of the infection in the abdominal cavity and retroperitoneal space based on reliable prognostic assessment of operational risk (relative mortality risk) helped reduce the average number of deaths from 60% to 30%.

REFERENCES

1. Abdominalnaya hirurgicheskaya infekciya: klinika, diagnostic, antimicrobnaya terapiya [Abdominal surgical infection: clinical features, diagnosis, antimicrobial therapy] Prakticheskoe rukovodstvo [Practical Guide] Rossiyskaya associaciya specialistov po hirurgicheskim infekciyam: pod redakciey V.S. Savelyev, B.R. Gelfand [Russian



- association of specialists in surgical infections: Edited by V.S. Savelyev, B.R. Gelfand]. Moscow: Publishing House "Littera", 2006, p.168.
2. Bokeria L.A., Arakelyan V.S., Shirinbek O.Sh. Prognozirovanie operacionnogo riska v chirurgii [Prediction of operational risk in surgery] Annaly cchirurgii [Annals of Surgery] 2007, N5, p.5 – 10.
 3. Vinokurov M.M. Ostriy holecistit: puti uluchsheniya rezultatov hirurgicheskogo lecheniya [Acute cholecystitis: methods of results improvement of surgical treatment] Novosibirsk: Nauka, 2002, p.168.
 4. Grebenuk V.V. Olejnikov D.A., Nazarov A.A., Chumatchenko I.V. Programma ocenki tyagesti sostoyaniya i vibora lechebnykh meropriyatiy u bolnykh s hirurgicheskim sepsisom [Program evaluation severity and choice of therapeutic interventions in patients with surgical sepsis] Svidetelstvo o gosudarstvennoy registracii programmi dlya EVM [Certificate of state registration of the computer] №2013610108, 01.09.2013, Bul. №2.
 5. Grebenuk V.V. Chumatchenko I.V. Sposob opredeleniya stepeni tyagesti sostoyaniya bolnykh s hirurgicheskim sepsisom [Method of determining the degree of severity of patients with surgical sepsis] Patent RF na izobretenie [RF patent for invention] № 2479251, 04.20.2013, Bull. №11.
 6. Sergienko V.I., Bondarev I.B. Matematicheskaya statistika v klinicheskikh issledovaniyakh [Mathematical Statistics in clinical research] Moscow: GEOTAR "Medicina", 2000, p.256.

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