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DIAGNOSTICS AND TREATMENT OF PATIENTS WITH ABDOMINAL SEPSIS

Introduction

The most important and difficult problem of the modern surgery is the treatment of patients with severe abdominal infections include a wide variety of infectious processes. As usual the processes develop in the abdomen with the influence of microorganisms which colonizing the gastrointestinal tract. The problem actuality is caused by: substantial increase of patients quantity (the tendency in developing countries); increasing the number of patients with fatal complications (in Western Europe more than 500 thousand patients of intensive care wards have sepsis complications between 2% and 18%, and septic shock – about 3-4%); presence of multiple or residual nidus of infection (main: abdominal cavity, retroperitoneal space, gastrointestinal tract, additional: the pulmonary nidus, as a result of pulmonary ventilation, urinary tract, main venous catheters), polymicrobial infection and other factors. Considering the general laws of systemic inflammatory development response (SIRS) to this category of pathological processes, like other authors, refer three types of infections, joint by general term: «abdominal sepsis» (AS). Introduce: widespread purulent peritonitis arising due to destruction of the organ or perforation, and neglected acute intestinal obstruction, postoperative peritonitis due to abscess formation, and the failure zone of previously imposed anastomosis sutures, purulent-necrotic pancreatitis due to infection of pancreatic necrosis or development septic retroperitoneal phlegmon. The problem actuality consists, that the quantity of patients with AS now has sharply increased, and the disease often complicated by multiple organ dysfunction (MODS) and accompanied by high mortality (30-80%), which show the most reputable clinics [1, 4]. The main content of the disease in these patients is the uncontrolled release of mediators of inflammation and the subsequent development of massive system damage in organs distant from the primary nidus [2]. According to recent studies just Toll-like receptors are key structures that bind to different components of microbial origin and trigger the expression of nonspecific resistance factors and SIRS.

A new view at the pathogenesis of sepsis, including the AS, led to the other diagnostic criteria, and most support in this regard was the R.Bone et al. classification (1992), based on the simplicity of the diagnostic criteria and clinical signs of SIRS, sepsis, severe sepsis and septic shock [1].

Materials and methods

Investigated 169 patients aged 21 to 78 years at AS is carried out and noted the following peculiarities of the main disease: the presence of at least two clinical and laboratory signs of SIRS on classification R. Bone et al. (1992), the presence of nidus of infection and enteric insufficiency. All the patients were operated in 2010-2013. On the development of MODS was tried in the presence of a clinical and laboratory signs of organ dysfunction: acute respiratory distress syndrome: $RaO_2 < 70$ mm Hg, $RaO_2/FiO_2 < 175$; dysfunction of the cardiovascular system: the syndrome of «small cardiac output», need for inotropic support; liver dysfunction: total bilirubin levels > 30 μ mol/l, increase in transaminases and alkaline phosphatase in a 2 or more times upper limit of normal; kidney dysfunction: urine output < 30 ml/h, creatinine levels $> 0,15$ mmol/l; dysfunction of the hemostatic system: prothrombin index $< 70\%$, platelets $< 150 \times 10^9/l$, fibrinogen < 2 g/l; of CNS dysfunction: < 15 points on a scale of Glasgow [5]. On the day of surgical operation received assessment of the physical condition and state of health by integrated systems APACHE II [3] for determine the risk of developing MODS.

In tests of arterial and mixed venous blood were determined indicators of acid-base status, using acid-base analyzer FAA -1 «Radiometer» (Denmark), and rates of transport and oxygen consumption were calculated by standard formulas. Laboratory studies included a clinical blood tests assessment and biochemical blood tests, hemostasis system by standardized methods and indicators specific and nonspecific resistance of body. Acute phase of patients response assessed by C-reactive protein (CRP) of blood serum by test system of CARMAY (Switzerland) company, for semiquantitative analysis (56 patients). The level of IL-2, IL-6, IL-8 in serum were determined by ELISA (developer «Protein Contour», Russia, 40 patients), and the dynamics of changes in anti-LPS-IgA, IgM, IgG by ELISA with enzyme immunodetection (39 patients). Abdominal pressure monitored indirectly by using the urinary catheter by Kron I.L., et al. (1984). Bacteriological studies were performed by standardized methods.

Statistical analysis by computer programs of «Biostatistics, Russia» was done.

All the patients before surgery was performed «starting» infusion therapy by hypertonic solution (7.5% or 10%) of sodium chloride at a rate of 3.5 ml/kh/30 min in a 1:1 ratio with colloidal solutions and subsequent infusion therapy included crystalloid solutions. If necessary, for correcting disorders of hemostasis used frozen plasma, albumin was not used due to increased permeability of cell membranes in shock. In 31 patients used inotropic support by dopamine (5 – 15 mcg/kg/min), 12 – was applied intravenous nitroglycerin (5 – 15 mcg/kg/min.). Correction of the oxygen-transport function of blood was done by erythrocytic mass, wash washing RBC, with hemoglobin (below 70 g/l). Antibiotic therapy in all patients was performed in 2 phases: phase 1 – the introduction of empirical broad-spectrum antibiotics in combination with antianaerobe; phase 2 – continuation or change of antibiotic treatment based on the sensitivity of microflora. Usually appointed fluoroquinolones in combi-

nation with ornidazol, cephalosporins of III-IV generation in combination with an aminoglycoside and ornidazol, or carbapenems with severe condition of the patients.

Philosophy of surgical intervention in all patients included two main components: 1) source infection control (the removal or exteriorisation, drainage) and 2) the function control of damage organ. Intubation of the small intestine was performed ante- or retrograde (depending on the clinical situation) using a probe that has two slits for the implementation of early enteral feeding. Control of the source of infection was based on the following principles: the source of infection, and the intake of bacteria involved in the inflammatory process products (bile, blood, fecal matter) should be eliminated. Selection procedure depends on the anatomy of the source of infection, the degree of inflammation of the peritoneum, the severity of the syndrome of systemic inflammation reactions (SIRS) and multiple organ dysfunction (MODS), and physiological reserves patient. Antibiotic therapy was carried out taking into account the possible causative agents of abdominal infection, morbidity and other factors.

Among the principles of control of functional damage is isolated by conventional measures and activities that have no advantages over the existing ones. Conventional measures: remediation of the abdomen and/or necrotic lesions with crystalloid solution (5-10 L); bowel intubation; drainage of the abdominal cavity; relaparotomy (on-demand or planned). Events that do not have the advantages of: remediation of the abdominal cavity with the use of antibiotics and antiseptics due to violation of antibacterial drugs in inflammation of the peritoneum, and because of the high risk of occurrence of local and general toxicity; radical removal of fibrin film tightly fixed on loops of intestines.

Results and discussion

All patients were identified as disturbances of blood gas transport system, the severity of which was dependent on the severity of the disease. Also, vicious activation of the immune system and production of mediators, that is characterized by acute phase of inflammation (occurrence Immune reactions, increased cytokine, the proteins of acute phase, oxygen radicals and so on). The patients with AC, most often observed reducing IL-2 (about 70% of patients), hypersecretion of CPB (90% of patients), IL-6 and IL-8 in all 40 examined patients.

The most heavy condition was in patients with grade III of intraperitoneal pressure (>2,45 kPa) and development of abdominal compartment syndrome (ACS). Reduced anti-LPS-Ig classes in all these patients indicated the most massive arrival lipopolysaccharide complexes in the systemic blood circulation due to the most pronounced processes in the abdominal cavity, the loss of barrier function of the intestines and other reasons. Proof of this was proportional dependence to the reduction of the anti-LPS-Ig in the blood, that indicating the binding of its specific immunoglobulins.

After stabilization of hemodynamic parameters in all patients of another group, along with a saline infusion therapy to ensure iso-osmotic condition of the water sector, used a system of low-calorie food, which was a mixed or enteral (enteral and par-

- enteral) nutrition. This method was used in 12-24 hours after surgical operations, followed by enteral tube feeding (with enzymes and probiotics) in combination (with or without) parenteral amino acid solution 500 ml/day. At the end of the fifth day in uncomplicated cases full enteral feeding was carried out with a gradual increase calorie diet to the level of the basal metabolism.

The basis for the proposed treatment technology for patients with AS the analysis of published data and data obtained during the treatment of patients of first group. As a rule, the normal barrier function of the intestine due to the following components: 1) the normal microflora; 2) mechanical factors; 3) an intact immune system; 4) the axis «gut-liver» [2, 3-8,9,11].

Relaparotomy on – demand strategy was carried out in an emergency (hollow organ perforation or bleeding into the abdominal cavity) and urgency (postoperative bowel obstruction, intra-abdominal opened abscess). These interventions were performed in 16 patients of 169 patients. The fault of the surgical treatment of peritonitis by on – demand strategy include the following:

- the risk of incomplete elimination of the source of peritonitis during a single operation;
- the late diagnosis of complications;
- the late decision about relaparotomy.

It is were the basis for the active development of various techniques and introduction into clinical practice of combined surgical treatment.

Planned relaparotomy were performed in 23 patients of 169 patients with AS. The intervention programs included «semi-open» approach were performed in 9 patients. The main arguments for this approach were: perforation of the colon, which can not be securely sewn or withdraw beyond the abdomen cavity; unstable hemodynamics, which requires minimization of primary interventions; abdominal tamponade due to bleeding. The main arguments for the use of the open method (laparotomy – 14 patients) were follows: diffuse infected pancreatic necrosis; large tension of the abdominal wall due to edema or fascia damage, which can lead to the development of abdominal compartment syndrome; severe injury to the loss of tissue abdominal; retroperitoneal perforation of a hollow organ; fascia poor state after multiple laparotomy. Typically, the immediate closure of the abdominal cavity technique used «sandwich». The intervention programs included open abdomen (OA) approach, conducted in 14 patients. In 1988, M. Schein et al. reported vacuum-assisted management of OA by intra-abdominal infection using a «sandwich» technique [4]. In our study, the method of temporary abdominal closure using the technique «sandwich» was used in 8 patients. In 6 patients we have chosen, with some modifications, the configuration of the vacuum pack system (VPS) made by W.B. Brock (1995) because of its simplicity and low cost [4]. The procedure that is applied in our hospital as described below shares most of its original principles. After the initial laparotomy, a sterile 40×40 sheet of polyethylene folded over its self-adhesive side and multiperforated was placed over the peritoneal viscera (from the right paracolic sliding valve to the left) and below the parietal peritoneum of the anteriolateral abdominal wall (Figure 1-2).

In this way the formation of adhesions was decreased that hamper the mobility and subsequent closure of the abdominal wall, as well as inadvertent bowel injuries during changes in VPS. Subsequently, we placed a humid dressing of 0.9% saline in order for it to mold itself to the configuration of the wound between the polyethylene sheet and the parietal peritoneum. Two catheters (French ~ 24-26) with additional perforations were fixed to this first dressing, which were not placed in contact with the abdominal wall to prevent obstruction during aspiration. The catheters were exteriorized from the surgical wound from its superior vertex. A second dressing, dry on this occasion, was placed over the catheters, which were joined by a «Y»- connector to a latex tube. In turn this is connected to a wall system to provide continuing negative pressure of 25-100 mmHg.

This technique is a temporary closure of more than just the decision of containment internal organs. A layer of polyethylene, tucked between the bowel and abdominal wall, is a physical barrier preventing the formation of adhesions between the bowel and abdominal wall. In other words, while maintaining the peritoneal cavity and the delayed development of the «frozen» abdomen. Bowel loops tightly soldered together with granulation, but the space between the intestine and abdominal wall remains free and the abdominal wall is moving, expanding the time interval for the possibility of permanent closure of the abdominal cavity from a week to a month after primary surgery.

The interval between surgical interventions after the 1st surgery is usually one day, after a 2-4 interval remedial interventions specifically extend to 48 hours with the possibility of peritoneal lavage between the operational period (patients with U-shaped drainage and eliminate the source of peritonitis), or in cases of extreme gravity condition of the patient (APACHE II > 16 points). Increasing the interval of more than 48 hours is often associated with the deterioration of the abdominal cavity – the progression of peritonitis. Except in the case of tertiary peritonitis or unliquidated its source, should be considered the best a 3-4-step relaparotomy, in the subsequent risk of adverse effects increases the method of intervention and treatment effect is stabilized or regressed.

The indication for the completion of active methods of surgical treatment is the relief of inflammatory processes in the abdominal cavity. This provision is based on the intraoperative assessment of the abdominal cavity by morphological criteria. The main criteria for the end of the regime of programmable relaparotomy are: removal or locating the source of peritonitis; the absence of necrosis, or may be permanently delineated multiple purulent foci; clear serous exudate; delimitation of the loops of the small intestine from the free abdominal cavity overlays are organized in the form of fibrin shell; the presence of stimulated or spontaneous motility of the small intestine; lack of widespread purulent necrotic lesions of the wound or abdominal wall, precluding the possibility of one-stage surgical correction.

Our data indicate, that between the number of reoperation on the abdomen, complications rate (group 1) and mortality (group 2) after relaparotomy established a positive relationship (Figure 3). In our study, complications occurred in 36,8% (62

patients). Major complications of reoperation: postoperative multiple organ failure, intestinal fistula, bleeding, lateral retraction of wound and formation of large defect. Mortality was 22.4% (38 patients).

Conclusion

Treatment of AS patients is a serious problem of modern surgery. The using of surgical control tactics of severe intra-abdominal infections – relaparotomy on – demand strategy and planned, has its advantages and disadvantages. It remains unclear how impact of the surgical trauma to the progression of systemic inflammation and organ disorders in patients with AS, is it possible to study the mechanisms of these disorders, depending on the number of surgical interventions, and thereby optimize treatment?. Answers to questions are identified only in single studies often are experimental in nature, which does not allow them to fully extrapolated to clinical practice. Our experience shows that planned relaparotomy need only part of this category of patients:

- 1) patients with sepsis and MODS, when the source of infection in them has been adequately removed during the first operation;
- 2) patients who wound suturing can lead to the development of abdominal compartment syndrome;
- 3) patients with severe combined trauma and massive intraperitoneal bleeding, to stop that requires tight tamponade with surgical swabs and towels.

References

1. Bone B.C. Difinitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. / Bone B.C., Balk R.A., Cerra F.B. // *Crit. Care Med.*- 1992. № 20. – P. 864-874.
2. Heidecke C.D. Immune paralysis of T-lymphocytes and monocytes in postoperative abdominal sepsis. Correlathion of immune function with survival. / Heidecke C.D., Weighardt H., Hensler T. et al. // *Chirurg.* – 2000. – № 71 (2). – P. 159-165.
3. Knaus W.A. APACHE II: a severity of disease classification system. / Knaus W.A., Draper E.A., Wagner D.P. et al. // *Crit Care Med.* – 1985. – № 13. – P. 818-825.
4. Leobaldo López-Quintero. Treatment of open abdomen in patients with abdominal sepsis using the vacuum pack system// Leobaldo López-Quintero, Gerardo Evaristo-Méndez, Freddy Fuentes-Flores, Félix Ventura-González, and Ricardo Sepúlveda-Castro// *Cir. Cir.* – 2010. – Vol.78. – P.317-321.
5. Zimmerman J.E. Severity stratification and outcome prediction for multi-system organ failure and dysfunction. / Zimmerman J.E., Knaus W.A., Sun X., Wagner D.P. // *World J. Surg.* -1996. – № 20 (4). – P. 401-405.



Figure 1. Placing the first multiperforated polyethylene sheet.



Figure 2. Second polyethylene sheet placed with the system under negative pressure.

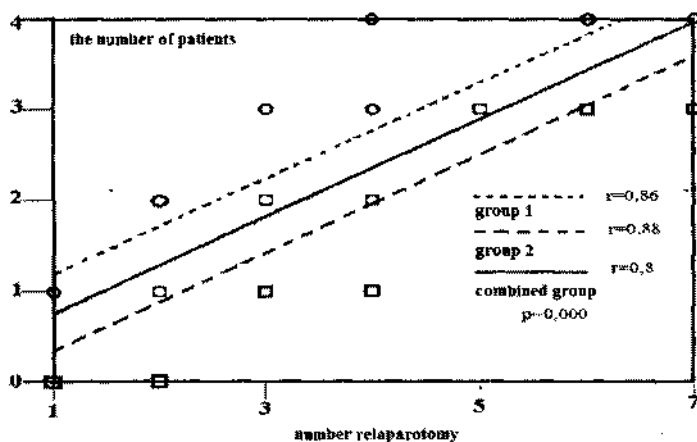


Figure 3. Relaparotomy - an independent risk factor for complications.