

Assessment of the Effectiveness of Treatment for Extensive Peritonitis

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Abstract: The aim of this study was the early detection of ineffective treatment for extensive peritonitis. Trend analysis of points of the multiple organ failure allows us to determine its stage and the effectiveness of treatment. As a result, we can determine the indications for relaparotomy in less time than when using a prognostic index of relaparotomy. 132 patients with extensive peritonitis were examined. It was found that the predicted mortality in the studied group coincided with the real mortality (27.3%). In the control group the actual number of deaths (85.7%) was higher than the expected number (72%). The sensitivity and specificity of the method for determining the indications for relaparotomy was 0.9 and 0.8, respectively. Thus, the determination of the stage of multiple organ failure allows to evaluate the effectiveness of treatment and to identify the indications for relaparotomy.

Key words: Peritonitis % Multiple organ failure % Relaparotomy % Effectiveness of treatment

INTRODUCTION

Extensive peritonitis (EP) in severe cases is accompanied by abdominal sepsis and multiple organ failure [1]. The progression of multiple organ failure by EP leads to death, the frequency of which is up to 70% [2, 3].

The ability to correct the treatment in early stages is a prerequisite for the successful treatment of a patient. When we don't have the expected effect of the therapy is extremely important to justify the need for relaparotomy or the correction of conservative therapy. The correct sequence of actions will increase the patient's chances of recovery [4, 5].

Currently, the indications for relaparotomy on demand are determined by a prognostic index of relaparotomy (PIR). However, this method contains a subjective evaluation criteria (abdominal pain in 48 hours after the operation, evaluated by the patient himself). In addition, a reliable assessment made by PIR requires a time period of 96 hours (4 days) after the surgery, but the relaparotomy may have to be performed earlier [6, 7].

Hans Selye pointed to the need for close monitoring of patients with any infectious process, including patients

with peritonitis. In his opinion, the prognosis of clinical outcome is determined in the first three days of the onset of the disease [8].

Thus, the ability to determine the effectiveness of treatment at the stage of prognoses will allow us to make correction of the therapy much earlier [9].

The Aim of the Study: The aim of the study was to develop methods to improve the evaluation of the effectiveness of treatment of patient with EP, in particular - the identification of the need for relaparotomy to make a sanitation of the abdomen.

MATERIALS AND METHODS

In order to determine multiple organ failure in EP a "scale of the dynamic assessment of organ dysfunction" (SDAOD) was used. 7-points or more on this scale reliably indicates that there is a multiple organ failure syndrome (MOFS). The scale allows to evaluate the patient's condition on 6 systems and organs, it has a maximum amount of 24 points (certificate for intellectual product number 73200600055 from November 13, 2006).

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The amount of points in the 1's, 2's and third days after surgery had a trend analysis using the program Microsoft Office Excel. Such an analysis allowed us to estimate individual prognosis for the patient's life, suffering from EP, as well as to determine the level of predicted mortality in the group.

To determine the effectiveness of treatment we used the assessment of SDAOD point's growth towards the previous days' (patent number 2013120450 from 30.04.2013). When we receive a 7 or more SDAOD points in the first day after surgery, combined with an increase growth of SDAOD points of the third day, compared with the growth of points of the second day less than 100% treatment was assessed as effective.

To determine whether relaparotomy is needed (in randomly selected three contiguous days after surgery) we also assessed the SDAOD point's growth and compared it with the previous day's growth, in combination with the definition of the amount of stab neutrophils (patent number 2013120439 from 30.04.2013). If the absolute growth of SDAOD points of the third day was more than 100% higher than the absolute growth of points of the second day and we found 20% or more of stab forms of leukocytes in the blood on the third day – relaparotomy is needed.

Thus, in case of EP an algorithm that allows us to detect inefficiency of treatment and to identify indications for relaparotomy.

In Gaus PC City Clinical Hospital number 4 in Perm from 2008 to 2013, 132 EP patients with various acute abdominal surgical pathology (as perforated gastric ulcer, duodenal ulcer, acute appendicitis, bowel obstruction of various etiologies, abdominal trauma, etc.) were examined.

A prospective and retrospective analysis of EP cases were made. We studied 40 case histories retrospectively: 20 people made up the main group (mean age $57,2 \pm 6,2$ years) and 20 people - the comparison group (mean age $56,4 \pm 8,8$ years).

When working with the case histories of patients of the main group, we used the proposed method to evaluate the indications for a sanitation of the abdominal cavity, to determine the need of relaparotomy in patients with EP. In the comparison group the need of relaparotomy is detected by PIR, suggested by J. F. Pusajo in 1993.

On the 1st day after the surgery the severity of the patients' condition was comparable to the points of SAPS scale ($p = 0,93$, $r = 0$), to the points of SDAOD ($p = 0,77$, $r = 0,00007$), to the points of Mannheim index ($p = 0,99$, $r = 0$) and SIRS criteria ($p = 0,67$, $r = 0,001327$).

Prospectively we studied 92 patients. Patients were divided into a main group - 46 people (mean age $48,93 \pm 5,81$ years) and a comparison group - 46 people (mean age $46,28 \pm 5,66$ years).

The difference between groups was in the method of choosing the amount of infusion therapy. In the main group we used the thoracic fluid volume index (TFVI) for this purpose, in the comparison group - central venous pressure (CVP), daily urine output volume, the number of erythrocytes, hemoglobin and hematocrit.

The assessment of the effectiveness of treatment was conducted by studying the dynamics of multiple organ failure, the number of complications and deaths. On the 1st day after surgery the severity of the patients' condition was comparable to the points of SAPS ($p = 0$, $r = 0,97$), to the points of SDAOD ($p = 0$, $r = 0,97$), SIRS criteria ($p = 0$, $r = 0,8$) and separately took points of hemodynamic derangements of the SOFA scale ($p = 0$, $r = 0,77$).

RESULTS AND DISCUSSION

While making a trend analysis of SDAOD points of all patients with EP, we detected curve of polynomial type, which characterizes the process of multiple organ failure syndrome (MOFS) in time (Fig. 1).

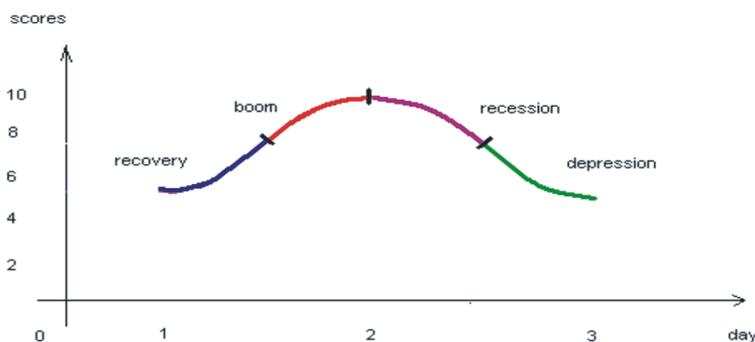


Fig. 1: Curve of polynomial type

In economics, the curve of polynomial type is described as a cycle of economic development (Kondratieff cycle), which contains 4 stages: recovery, boom, recession and depression [10].

"Stage of recovery" reflects the progression of multiple organ failure with acceleration. In this stage we see a growth of SDAOD points compared to the previous day in more than 100%. The term "recovery" does not reflect the clinical meaning of this condition. This stage is appropriate to be called "the stage of the origin and development of multiple organ failure".

Stage of "boom" describes how the body begins to respond to organs' and systems' damage and retardation of multiple organ failure syndrome (MOFS). The growth of SDAOD points compared to previous day - less than 100%. This stage is appropriate to be called "the stage of retarding of the development of multiple organ failure".

Stage of "recession" reveals the beginning of the healing process and a progressive decrease in multiple organ failure. The decrease of SDAOD points compared to the previous day - more than 100%. This step is appropriate to be called "the stage of regression of multiple organ failure".

Stage of "depression" reflects the deceleration of regression of multiple organ failure, associated either with the restoration of the organs' functions, or the preparation for a second wave of multiple organ failure syndrome (MOFS). The decrease of SDAOD points compared to the previous day - less than 100%. This step is appropriate to be called "the final stage of multiple organ failure".

Approximation coefficient (R^2), close to 1.0, indicates the reliability of the distribution of the analyzed variables.

Thus, the speed of the dynamics of MOFS in time is heterogeneous. A positive life prognosis of EP patients was determined in patients who had "the stage of regression" or "the final stage" of MOFS, which was detected in the first three days after surgery. A negative prognosis -was determined when "the stage of the origin and development of multiple organ failure" or "the stage of retarding of the development of multiple organ failure" was detected.

All 20 patients of the main group of retrospective analysis had a relaparotomy at different times after the surgery (of 3 days). The patients of the comparison group did not have a relaparotomy, but had initially a comparable severity of the condition to the patients of the main group. All 40 patients had MOFS.

Indications for relaparotomy in the main group of PIR were identified in 11 (55%) of patients, according to the proposed method - 18 (90%). In the comparison group of

PIR - in 2 (10%) and by the proposed method - in 4 (20%) patients, respectively. Fishers' criterion of reliable differences in the state of patients in both groups of PIR ($F = 1, 3958, p = 0.1035$) and the proposed method of determining the indications for relaparotomy ($F = 1, 0421, p = 0.4903$) were not found.

As a result, the sensitivity of PIR was 0.55 and the sensitivity of the proposed method for determining relaparotomy - 0.9. The specificity was higher in PIR - 0.9, however in the proposed method it was also sufficient - 0.8.

Thus, the proposed method of determining the need to relaparotomy is objective, a reliable and useful tool and allows us to detect the indications for relaparotomy earlier (on the third day). Note that PIR should be evaluated within 96 hours (4 days) and contains a large proportion of subjectivity.

In a prospective assessment of 92 patients with EP, it was revealed that the sensitivity is (0.89) and the specificity is (1,0), thoracic fluid volume index (TFVI) in identifying hypovolemia was substantially higher than in the CVP, daily urine output volume, hematocrit, hemoglobin and red blood cells. Therefore, it is reasonable that the volume of fluid therapy is oriented on TFVI.

When we made a prospective comparison of the two methods of conservative therapy after surgery, differing only in the way of choice of the fluid therapy volume, the best results were obtained in the main group. Among 46 patients of the main group, 11 (23.9%) had MOFS. Negative life prognosis is defined in 3 (27.3%) patients with MOFS of 11. In the comparison group MOFS was detected in 7 (15.2%) of 46 patients. Negative prognosis for life is defined in 5 (72%) of 7 patients. A correlation of life prognoses was noticed by Spearman method, with mortality ($p = 0,014536, r = 0,565099$) and a number of complications ($p = 0,030065, r = 0,511404$).

Mortality among patients with MOFS in the main group was 3 (27.3%), in the comparison group - 6 (85.7%) patients. The number of complication - 5 (45.5%) and 6 (85.7%), respectively.

Thus, the predicted results and the actual level of mortality in the main group matched, in the comparison group the mortality is 13.7% higher than predicted. These data, as well as the lower levels of mortality and complications, confirm the effectiveness of the treatment in the main group. That is making up for hypovolemia in EP patients using thoracic fluid volume index (TFVI) was the most effective.

CONCLUSION

Thus, the assessment of the SDAOD points dynamic using trend analysis allows us to determine the stage of multiple organ failure, which in turn helps to quickly identify the ineffectiveness of the treatment and correct it.

An algorithm for estimating the effectiveness of treatment of EP is formed.

- C We should determine the SDAOD points in the 1-3 days after surgery and conduct a trend analysis of the received points.
- C If we count 7 or more SDAOD points and if we detect "the stage of the origin and development of multiple organ failure" the treatment should be corrected and we should continue the control.
- C If we using the trend analysis detect "the stage of the origin and development of multiple organ failure" in aggregate with 20% or more of stab leukocytes, a relaparotomy is needed. If the stab shift is less than 20% - a correction of the treatment without surgery.

Findings:

- C The course of multiple organ failure in extensive peritonitis within adjacent three days subjects to the laws of polynomial function and it has heterogeneous speed of development and regression. It has 4 stages: "the stage of the origin and development of multiple organ failure", "the stage of retarding of the development of multiple organ failure", "the stage of regression" and "the final stage".
- C Life prognosis in extensive peritonitis depends on the stage of multiple organ failure. If we detect "the stage of the origin and development of multiple organ failure" or "the stage of retarding of the development of multiple organ failure" in the first three the prognosis is bad, if we have "the stage of regression" or "the final stage"- the prognosis is favorable.
- C The effectiveness of treatment for EP in the postoperative period should be assessed using trend analysis of multiple organ failure points. When we have a combination of signs of intoxications' growth (the level of stab leukocytes more than 20%) and the detection of "the stage of the origin and development of multiple organ failure" a relaparotomy and a sanitation of the abdominal cavity is needed. If the stab shift is less than 20% and we detected "the

stage of the origin and development of multiple organ failure" we should correct the conservative therapy.

- C A trend analysis of the scale of dynamic assessment of organ dysfunction points in 1-3 days after surgery allows us to compare two different methods of treatment of extensive peritonitis at the stage of forecast. The most effective is the method in which minimal number of patients have "the stage of the origin and development of multiple organ failure".

Thus, the generated algorithm for estimating the treatment of patients with EP using the trend analysis allows to identify the inefficiencies of the treatment and to determine indications for relaparotomy.

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