



Original article

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CURRENT SURGICAL THERAPY OF SECONDARY PERITONITIS

SUMMARY

The aim of the study was to use a comparative analysis to evaluate the efficiency of therapy and the importance of different methods of surgical treatment of the most severe cases of secondary peritonitis (the classic "on demand" approach, continuous postoperative lavage-CPL and STAR-method) and to show our experience and results by applying new, more "aggressive" therapeutic approaches.

A cohort of 1485 patients with SP who were surgically treated at the Surgical Clinic of the Clinical Center of Niš within the period between June 1st, 1994 to June 1st, 2003 were analyzed retrospectively and classified into three groups according to severity of secondary peritonitis using MPI scoring system. These groups were further classified into subgroups of patients who underwent different methods of surgical treatment (the common "on-demand" approach, CPL-Continuous postoperative lavage and STAR). The efficiency of the therapy of the applied methods was evaluated by analyzing and comparing clinical parameters (duration of hospitalization, incidence of local and systemic complications, number of relaparotomies, mortality rate) using the χ^2 test.

Comparing the results obtained by applying the aforementioned testing methods of surgical treatment, better therapeutic efficiency of the new, more "aggressive" approach has been shown (according to all parameters), which, with the lack of more efficient ones, today does represent the most powerful weapon of the surgical treatment of severe intra-abdominal infections.

Key words: severe secondary peritonitis, surgical treatment

INTRODUCTION

Secondary (perforative) peritonitis (SP) represents the most common and most difficult form of generalized inflammation of peritoneum caused by pathologic or traumatic perforations of the hollow organs of the digestive and/or genitourinary tract or post-surgery dehiscence of their anastomosis and suture (1). SP is a specific and complex intra-abdominal infection of polymicrobial origin, where the kinds of microorganisms which can be

isolated from peritoneal fluid match the damaged segments of the digestive tract (2). The bacterial causes of SP are mixed aerobe-anaerobe intestinal flora with synergistic pathogenic effect, and the most common are *Escherichia coli* among aerobe and *Bacteroides* among anaerobe (1,2).

Even with the noticeable development of diagnostics of SP and application of modern complex therapy (surgical, antibiotic, immunotherapy), safe anesthesia and efficient reanimation measures, SP is

still very difficult and relevant problem in modern abdominal surgery (1). SP represents the most severe form of intra-abdominal infection and is the second most common cause of SIRS (Systemic inflammatory response syndrome), sepsis, septic shock and MOF syndrome (Multiorgan failure syndrome) and is still characterized by high mortality rate (10–20%, and among severe forms of SP whose frequency is 20%, it is even over 40% on average) and with very frequent severe postoperative complications. Of no less importance are high costs and the stress of treatment of patients with severe SP, which is complex and very long ("the marathon runners of intensive care") (1,4).

The treatment of SP requires a complex multidisciplinary approach to each patient with the application of difficult surgical procedures, modern antimicrobial and immune agents, active reanimation treatment and intensive physical care. However, in the complex therapy chain of SP, the most important ring is the surgical therapy. Its basis was set by a German surgeon Martin Kirschner in 1926 (5). The bases are:

- 1) permanent elimination of the source of infection ("conditio sine qua non"),
- 2) evacuation of purulent and necrotic material out of the abdominal cavity.

By adopting these principles, the mortality among SP decreased from 90% to 46% within the period between 1890 and 1924. By applying these principles in one act (laparotomy), it is possible today to take care of 80–90% of peritonitis with the average mortality of 5–10%. Having passed the test of time, this surgical method with laparotomy in one act is still the most commonly used one. However, with severe forms of SP, it is not possible to eliminate the source of infection efficiently and permanently and prevent residual and recurrent infections by using this kind of surgical approach based on Kirschner's principles. Therefore, in most of these severe forms of SP, further (reoperative "on-demand") laparotomies detect unsuccessful control of the source and the infection itself, followed by intra-abdominal sepsis, MOF, and unacceptably high mortality. Unfortunately, taking in account that for a successful treatment of SP it is necessary to accomplish the efficient control of the infection source with the initial surgery (which is of key importance for surviving), in the most severe cases of SP, which appear with incidence of 10–15% (severe stercorous peritonitis, peritonitis more than 3 days old, etc.), at the beginning of the 80's, the aforementioned surgery method was followed by mortality of even more than 50%. Over the last two decades of the 20th century, besides other conse-

rvative therapy agents, new, more "aggressive" surgery techniques and approaches were introduced, some of which represent the support and "the most powerful weapon" in the fight against peritonitis today: postoperative continuous lavage and planned multiple relaparotomies with temporary closing of the abdomen (STAR or "etappen lavage")(1,4,6).

The continuous postoperative lavage (CPL) is a long-term cleansing of the abdominal cavity (until healing) with large amounts of Peritosteril solution (solution for dialysis to which suitable doses of antibiotics and heparins can be added), using surgically placed drains (from both sides sub-diaphragmatically and into Douglas's pouch) for the purpose of better cleaning and elimination of suppurating-necrotic contents along with conservative reanimation, clinical and laboratory monitoring.

The method of planned multiple relaparotomies with temporary closing of the abdomen (STAR) – "half-open" method that came out of the laparo (abdomino) stomy, which was inaugurated in 1975 by Pujol, starting from the principle of treating severe infections by leaving the wound (abdomen) open. The method consisted of an adequate application of Kirschner's principles, after which the abdominal cavity remained open with the intra-abdominal organs covered by compresses made of different material. Because of many flaws, the most significant of which were large secretion out of the abdominal cavity with the loss of proteins and electrolytes, intestine fistula, evisceration of the organs and a big postoperative defects of the abdominal wall with hernias, this method very quickly gave in to STAR-method (first time applied by Hay in 1979) (7). It represents a temporary closing of the abdominal cavity after the first laparotomy by sawing improvised or commercially attainable purpose devices onto the incisive edges of the abdominal fascia: two pieces of polyethylene folia (nylon) or mesh mutually connected by a "sliding zip" (Ethizip) or by an adhesive "burdock" cloth (Velcro) without drainage. The revision of the abdominal cavity for the purpose of controlling the source of infection is performed if necessary under total anesthesia. Most authors agree that there should be 2-3 "second look" relaparotomies within the first week. If the revisions of the abdominal cavity are performed daily (in stages), the method is called STAR-"staged abdominal repair" (previously called "etappen lavage").

The advantages of the aforementioned methods in surgical treatment of SP are: better control of the source of infection, successful evacuation of toxic (suppurating-necrotic) contents out of the abdominal cavity, removal of harmful effects of higher intra-abdominal pressure, i.e. abdominal

compartment syndrome (ACS) and elimination of the psychological (diagnostic) pressure of the surgeon while establishing the indications and making decisions to perform relaparotomy (1,6,8,9). Many authors of the accessible recent literature state that there is a remarkable decrease in mortality in their patients after the application of these methods (Wittmann, Schein, Garsia-Sabrido etc.) (13,14,16). However, even with these encouraging first results, precise indications for applying these methods have not been clearly defined yet, nor has their true value and importance in decrease of mortality among the most severe cases of SP (6). Numerous ongoing randomized multicentric studies will probably give answers to this relevant question of the modern emergency abdominal surgery soon.

THE AIM OF THE STUDY

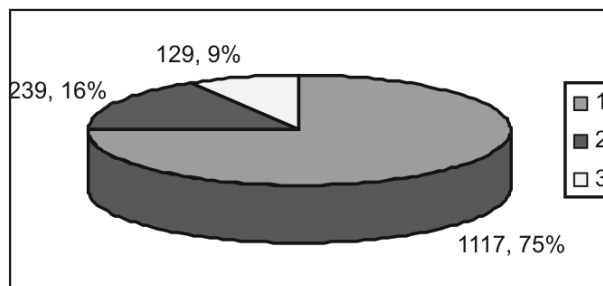
The aim of the study was to evaluate, by comparative analysis, therapeutic efficiency and significance of different operative methods in surgical treatment of severe secondary peritonitis and demonstrate our experience and results by using new "aggressive" surgical approaches.

MATERIAL AND METHODS

Having insight into the available medical documentation (history of disease, surgical protocol, disease evolution, discharge notes etc.), 1485 patients with secondary (perforative) peritonitis treated at the Surgical Clinic of Clinical Center of Niš in the period from June 1st, 1994 to June 1st, 2003 (3% of the total number of the operated – 49916) were retrospectively analyzed. The average age of the patients analyzed was 54.5 years (from 15 to 89 years). There were 556 women and 929 men. 1485 patients were included in this study, 1117 of which with SP as a result of a spontaneous morbid perforation of the hollow organ of the digestive tract; 239 patients had the dehiscence of surgical anastomosis of hollow organs of the digestive tract, whereas 129 patients had SP as the consequence of the traumatic rupture of one or more abdominal hollow organs (figure 1).

For better diagnostic-therapeutic orientation and more adequate perception of the patients, that is, detection of risk factors and evaluation of severity of SP, "Mannheim peritonitis index"(MPI) was used, according to which our patients were divided into 3 groups (figure 2).

1) I group – patients with slight damages – 741 patients (49.9%) with the average MPI=12.6±4.4

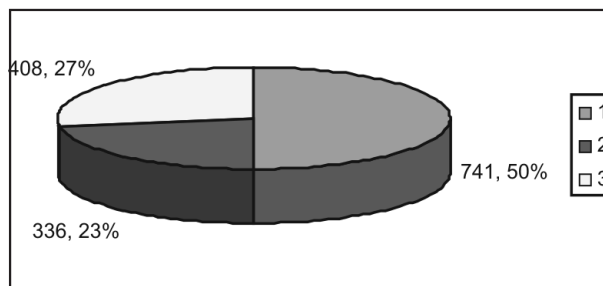


- 1) morbidic perforation of a hollow organ
- 2) dehiscence of anastomosis/suture
- 3) traumatic rupture of a hollow organ

Figure 1. Distribution of patients by etiology

2) II group – mild severe patients – 336 patients (22.6%) with the average MPI=22.9±1.6

3) III group – severe patients – 408 patients (27.5%) with the average MPI=33.1±5.7.



- 1) I group – patients with slight damages (MPI)
- 2) II group – mild severe patients (MPI)
- 3) III group – severe patients (MPI)

Figure 2. Distribution of patients by MPI score

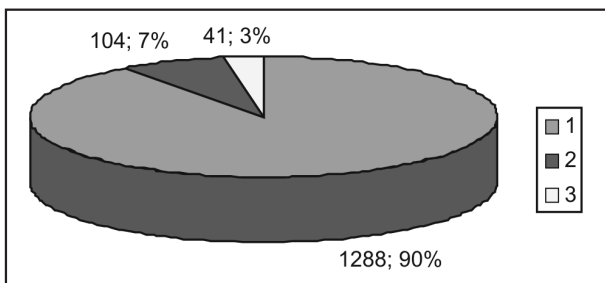
MPI represents the prognostic scoring system, created and put into the practice in 1983 by Wacha H. and Linder MM. (10) and which, by the analysis of 8 parameters and their appropriate scoring, performs evaluation of the severity of SP and estimation of risk of lethal result, when tested patients with MPI score >26 are defined as patients with high mortality rate. We did not use, because of the objective reasons (the expensive use and necessity of the modern technical equipment), the most frequently used scoring system APACHE II, which has the most reliable prognostic significance.

As for our patients, we applied the following surgical methods as the constituent part of the complex therapeutic approach (figure 3):

1) Classic, "one stage" surgical treatment (laparotomy in one act: elimination of peritonitis causes by standard principles of the urgent abdominal surgery, emptying of abdomen, drainage and closing of abdomen)–in 1288 patients (Ia subgroup – 741 patients, subgroup IIa – 284 patients and subgroup IIIa – 263 patients),

2) Continuous postoperative lavage (CPL) – in 156 patients (subgroup IIb – 52 patients and subgroup IIIb – 104 patients)

3) Planned, multiple laparotomies with the periodical closing of abdomen (STAR) – in 41 patients (subgroup III c).



- 1) Classical approach: initial surgery and laparotomy "on demand"
- 2) CPL method
- 3) STAR method

Figure 3. Distribution of patients by the applied method of treatment

The comparison of the efficiency of the applied methods, that is, the estimation of the treatment results was done by the analysis of the following parameters: mortality rate, incidence of systematic (mono or multi-organic insufficiency) and local complications (recurrence of infection) – in other words, the number of relaparotomies, duration of hospitalization and the amount of Peritosteril used (patients in whom the method of continuous postoperative lavage was applied). These results were mutually compared and statistically processed by the use of χ^2 test.

RESULTS

In the first group of patients with the slight indications of SP, there were, according to MPI scoring system, 741 patients (49.9%) with the average MPI score of 12.6 ± 4.4 , the average age of 49.8 years, duration of hospitalization of 11.6 ± 3.9 days and with the mortality rate of 22.3% (165 patients). All the patients of this group were treated by the classic, "traditional" approach: initial laparotomy with the healing of the infection sources, emptying of abdomen, drainage and primary closing of the stomach. 230 (31%) of these patients had some (transitory or permanent) clinical and/or laboratory manifestations of systematic complications (cardio-respiratory failure, lung edema, myocardial infarct, thromboembolic complications, CVI, TIA (Transitory ischemic attack), acute renal failure, secondary diabetes mellitus etc.). Due to the occurrence of some of the local postoperative complications,

that is, persistent or recurrent peritonitis (dehiscence of anastomosis or suture and consequent fistula, intra-abdominal abscess, intestinal gangrene, iatrogenic lesion etc.), 286 of all patients (38.6%) demanded one or more relaparotomies. In 119 of them a relaparotomy was done, 88 of them had two more relaparotomies "on demand", 54 had three more, whereas 25 patients had 4 more relaparotomies.

II group included 336 patients with mild severe form of SP (22.6%) according to MPI scoring system, with the average MPI score of 22.9 ± 1.6 , the average age of 58,1 years, approximate duration of hospitalization of 14.1 ± 5.2 days and the mortality rate of 38.4% (129 patients). According to the applied method of surgical treatment of SP, this group of patients was divided into two separately analyzed subgroups (figure 4).

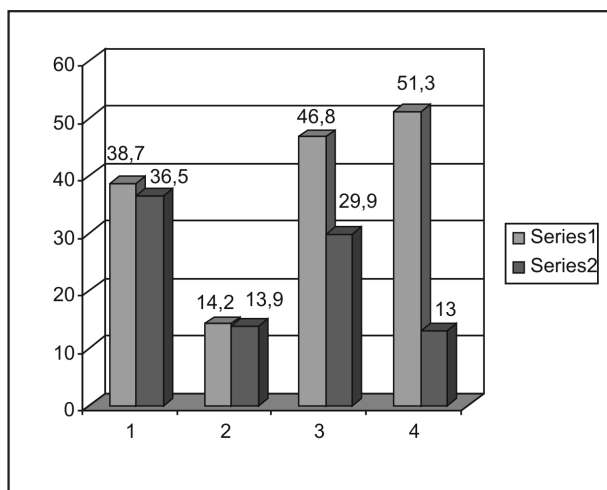
Subgroup IIa – 284 patients, in whom the classic "one stage" relaparotomy with the elimination of the infection sources, emptying of abdomen, drainage and primary closing of abdomen with the following results was applied:

- mortality rate of 38.7% (110 patients),
- mean duration of hospitalization 14.2 ± 5.6 days,
- incidence of systemic complications 46.8% (133 patients),
- incidence of one or more relaparotomies "on demand" because of the persistent or recurrent peritonitis 51.3% (146 patients).

Subgroup IIb – 52 patients who were treated by the initial relaparotomy (according to Kirschner's principles) and the method of postoperative continuous lavage with 2 l of Peritosteril every 4 hours (until convalescence) with the following results:

- mortality rate 36.5% (19 patients),
- mean duration of hospitalization 13.9 ± 4.8 days,
- incidence of systemic complications 39,9% (21 patients),
- incidence of one or more relaparotomies "on demand" because of persistent or recurrent peritonitis 13% (7 patients),
- the average amount of Peritosteril used for each patient was 66 l (mean duration of lavage was 5.5 days) (figure 4).

Group III consisted of 408 patients (27.5%) with severe SP in progress, according to MPI scoring system (average 33.1 ± 5.7), the mean age of 65.6 years, mean duration of hospitalization 17.5 ± 3.3 days and with mortality rate 50.1% (208 patients). According to the applied method of surgical treatment of SP, this group of patients was divided into 3 separately analyzed subgroups (figure 5).



- 1) mortality rate (%)
- 2) duration of hospitalization (days)
- 3) incidence of systemic complications (%)
- 4) incidence of revised relaparotomies "on demand" (%)

Figure 4. Comparison of the results of classical "on demand" technique and CPL method in group II

Subgroup IIIa – 263 patients treated by the classic approach (initial operation and relaparotomy "on demand") with the following results:

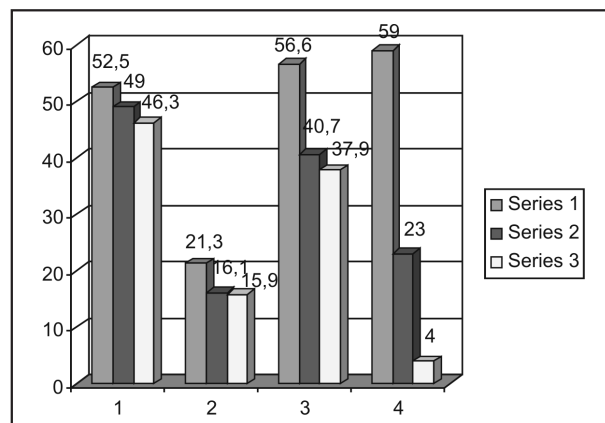
- mortality rate 52.5% (138 patients),
- mean duration of hospitalization 213±41 days,
- incidence of systemic complications 56.6% (149 patients),
- incidence of one or more relaparotomies "on demand" because of the persistent or recurrent peritonitis 59.0% (155 patients).

Subgroup IIIb – 104 patients treated by the initial relaparotomy and the method of continuous postoperative lavage with the following results:

- mortality rate 49.0% (51 patients),
- mean duration of hospitalization 16.1±2.3 days,
- incidence of systemic complications 40.7% (42 patients),
- incidence of one or more relaparotomies "on demand" because of the persistent or recurrent peritonitis 23.0% (24 patients),
- the average amount of Peritosteril used for each patient was 90 l (the mean duration of lavage-7.5 days).

Subgroup IIIc – 41 patients surgically treated by the method of the planned multiple relaparotomies-STAR, when polyethylene coverings joined together by "Ethizip" slippery zipper were used for a temporary closing of abdomen. Revisions of abdomen were performed every day or every second day with general anesthesia, with the following results:

- mortality rate 46.3% (19 patients),
- mean duration of hospitalization 15.9±3.4 days,
- incidence of systemic complications 37.9% (16 patients),
- average number of "the second look" revisions of the abdomen – 4.



- 1) mortality rate (%)
- 2) duration of hospitalization (days)
- 3) incidence of systemic complications (%)
- 4) incidence of revised relaparotomies (%)

Figure 5. Comparison of results of the classical "on demand" technique, CPL and STAR methods in group III

DISCUSSION

New knowledge about etiopathogenesis and pathophysiology of SP came from the development of microbiology, immunology, biochemistry and molecular biology, which enlightened complex infective processes in which bacterial causative agents, local and systematic defense mechanisms of the innate and acquired immunity of organism took place. The result of SP depends on the sort, number and virulence of causative agents and lasting of the bacterial invasion on the one hand and general condition and local and systematic defense mechanism of the ill on the other. The outcome may be the recovery, when the immune system overcomes bacterial invasion by coordinated local and systematic inflammatory reactions (LIRS and SIRS) spontaneously or, the most frequently, with the help of a complex therapy or the progression of a disease, from local to systematic infection, followed by the excessive and disharmonious SIRS, the uncontrolled activity of a great amount of cytokine and other mediators of inflammation and endotoxins, which lead to sepsis, septic shock, MOF and lethal result.

A high, persistent morbidity and mortality from SP, which is still considered to be a great therapeutic problem in the developed health environment as well, caused, in the 80's of the previous ce-

ntury, putting into clinical practice several new surgical treatment methods (CPL, STAR), named "aggressive", because of being different from the former surgical approach (initial relaparotomy and relaparotomy "on demand"). What these methods have in common is providing of more efficient surgery of SP, according to Kirschner's principles. Therefore, according to Stephen and Loewenthal, "the continuous removal of bacteria and fibrins can accelerate recovery of intra-abdominal infection and reduce the risk from chronicity and recurrence"(11). Although 30 years have passed and these new methods have definitely assumed their place in surgical treatment of SP, their absolute value in comparison with the conservative approach and real significance and efficiency have not been completely proved yet. The most important reasons are the lack of the precise indications for their application, a complex and expensive application and the lack of the studies that would surely illustrate the improved treatment results that these methods offer.

Namely, several large studies about STAR method resulted in satisfactory average mortality of 28.5% (Teichmann 1986, Wittmann 1990, Schein 1991) (12,13,14). In 1988, Garcia – Sabrido also showed that planned relaparotomies reduce mortality to 1/3 of patients with SP (16). In 1990, Wittmann observed a lower mortality because of the application of STAR method (24%) when compared to the classic approach (30%) in patients with the same risk of mortality, especially in patients at high risk (13). Other authors criticized relaparotomies "on demand", because they are "technically difficult to perform, they are characterized by high morbidity and mortality and they do not frequently improve organic malfunction, even though when the focuses of infection are eliminated" (Sinanan 1984)(3). According to Norton, waiting for persisting infections or organ insufficiency (the indications for the re-exploration of abdomen) does not often succeed (17). In 1997, Manasijevic concluded that "the significant reduction of mortality, by the application of STAR method, was accomplished (19%), which resulted in: 1) intra-abdominal complications which were noticed and removed on time; 2) efficient removal of a toxic purulent material and the healing of infection sources, and 3) a decrease of intra-abdominal pressure and its effects on the convalescence of respiratory, renal, hepatic and gastro-intestinal function (18). On the other side, in the available literature, there are some opposing results of many other authors saying that more conservative approach, along with the extensive intra-operative lavage, in 90% of cases reduce the need for re-operation in patients with SP. This approach also results in a lower mortality rate (12% and 14%)(Büchler, 1997)(19). In 2000, Koperna and Schulz concluded that relaparotomy on

time is the only surgical option which significantly enhances a satisfactory result of the treatment of persistent intra-abdominal sepsis (20). Also, according to many authors, there is not much difference in mortality, between STAR method and relaparotomies "on demand"(20). This implies that the method which enables faster elimination of infection sources should be applied (Götzinger 1996) (21). The problem is not solved by meta-analysis either (Lamme, 2002)(8). The planned relaparotomies are being criticized because they cause intra-operative complications and they are not appropriate for resolving organic malfunction. In other words, they lead to significantly higher degrees of cytokine and they can be an additional inflammatory stimulus in a human body prone to MOF ("secondary hit" theory). Therefore, the indications for the application of STAR method should be reduced to the absence of control of infection sources and the appearance of the indications of intra-abdominal hypertension ("abdominal compartment syndrome"). Hau and other authors 1995 published that in comparison with relaparotomy "on demand", in planned relaparotomies the dehiscence of suture, recurrent intra-abdominal sepsis and postoperative MOF are more frequent (15).

Similar contradictory results and attitudes about the treatment efficiency and significance of CPL method in the treatment of SP can be found in some literature sources. According to Beger's studies, clinical facts obviously point out that STAR and CPL methods are equally efficient, in regard to the morbidity and mortality (22). By CPL method, the decrease of mortality in the cases of severe peritonitis was accomplished. In 1998, Jiffry and other authors also got the reduction of mortality with the application of STAR and CPL methods (23). On the other side, in 1986, Leiboff and Soroff concluded that clinical significance of CPL method still remains vague (24).

The comparison of the results obtained by the use of the aforementioned, examined methods of surgical treatment (classic "on demand" technique, CPL and STAR methods) in our patients, showed (by all parameters) that new aggressive approaches had better treatment efficiency. In the II group of our patients with mild severe SP (MPI=22.9±1.6), subgroup IIb of patients treated by CPL method had lower mortality rate (36.5% versus 38.7%), shorter duration of hospitalization (13.9 versus 14.2 days), a lower incidence of systemic complications (39.9% versus 46.8%) and less need for relaparotomies (13% versus 51.3%) when compared with the patients of subgroup IIa who were treated by the classic initial operation and relaparotomies "on demand" (figure 4), with no statistic significance ($\chi^2=0.089$; $p>0.1$).

Also in group III of our patients with severe SP (MPI=33.1±5.7), in subgroup IIIb of the patients treated by CPL method and subgroup IIIc of patients treated by STAR method, by all the parameters examined, better treatment results are accomplished in comparison with the subgroup Ia of patients treated by the classic, "on demand" approach: lower mortality rate (49% and 46.3% versus 52.5%), shorter duration of hospitalization (16.1 and 15.9 versus 21.3 days), lower incidence of systemic complications (40.7% and 37.9% versus 56.6%) and smaller number of necessary relaparotomies "on demand" (23% versus 59%). In this group, there also was not any statistic significance of the difference in the treatment efficiency of the examined methods of surgical treatment of SP ($\chi^2=0.35$; $p>0.1$ for CPL and $\chi^2=0.53$; $p>0.1$ for STAR).

In surgical treatment of SP, there is consensus that the choice of the operative approach and surgical strategy depend on the source of infection, the degree of the contamination of abdomen, the current condition of the patient and (non)existence of secondary diseases. The absence of statistic significance of the difference in the treatment results of comparative methods decreases reliability of proofs presented in our study. In that sense, our facts correlate with the results of other studies that emphasize "the early diagnosis of intra-abdominal sepsis is still the main prerequisite of a successful reduction of mortality in patients with SP, apart from the applied operative technique and adjuvant, supportive conservative therapy. But, considering

the absence of precise indications for the application of new aggressive methods of surgical treatment of SP, still existing doctrinal controversies regarding the correction of the sources of infection (for example primary anastomosis in the condition of peritonitis) and inability of the adequate estimation of the success of the healing of infection sources, lower mortality rate, shorter duration of hospitalization and lower frequency of systematic and local complications (and the need for revised relaparotomies) that were attained in our patients surgically treated by new aggressive surgical methods (CPL and STAR) regardless of the statistical insignificance clearly illustrate their greater treatment efficiency, especially in patients with severe SP.

CONCLUSION

New aggressive surgical methods of the treatment of the most severe forms of SP are complicated, difficult and expensive for the application. They demand the maximum of engagement of the well-trained, highly specialized, multidisciplinary teams of experts and are reserved only for well-equipped centers. However, their selective application in the cases of the most severe forms of SP with adequate indications, still increases satisfactory prognostic prospects of the patients with SP. Therefore, "because of the lack of more efficient methods, they represent the strongest weapon in the surgical treatment of severe intra-abdominal infections" (Moshe Schein).

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AKTUELNA HIRURŠKA TERAPIJA SEKUNDARNOG PERITONITISA

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SAŽETAK

Cilj rada bio je da komparativnom analizom izvršimo evaluaciju terapijske efikasnosti i značaja različitih metoda hirurškog lečenja najtežih oblika sekundarnog peritonitisa (klasični "on demand" pristup, kontinuirana postoperativna lavaža – KPL i STAR-metoda) i prikazemo naša iskustva i rezultate u primeni novih, "agresivnijih" terapijskih pristupa.

Retrospektivno je analizirana serija od 1485 pacijenata sa SP, operativno tretiranih u Hirurškoj klinici Kliničkog centra u Nišu, u periodu od 1.6.1994. do 1.6.2003. godine, podeljena na tri grupe po težini SP, primenom MPI bodovnog sistema i dalje, na podgrupe bolesnika kod kojih su korišćene različite hirurške metode lečenja (klasični "on demand" pristup, KPL i STAR). Terapijska efikasnost primenjenih metoda procenjivana je analizom i komparacijom kliničkih parametara (trajanje hospitalizacije, lokalne i sistemske komplikacije, relaparotomije, stopa mortaliteta) uz korišćenje χ^2 testa.

Komparacija rezultata dobijenih primenom navedenih ispitivanih metoda hirurškog lečenja kod naših pacijenata ukazala je (po svim parametrima) na nešto bolju terapijsku efikasnost novih "agresivnijih" pristupa.

U nedostatku efikasnijih metoda, KPL i STAR danas, ipak, predstavljaju najjače oružje u hirurškom tretmanu teških intraabdominalnih infekcija.

Ključne reči: težak sekundarni peritonitis, hirurško lečenje