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A COMPARATIVE ANALYSIS OF SINGLE-PORT AND FOUR-PORT LAPAROSCOPIC CHOLECYSTECTOMIES IN PATIENTS WITH CHRONIC CALCULOUS CHOLECYSTITIS

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Abstract

The objective: To conduct a comparative analysis of the results of single-port and four-port laparoscopic cholecystectomies in patients with chronic calculous cholecystitis. **Materials and methods.** During 2015 – 2017 years 214 patients underwent surgery for chronic calculous cholecystitis. All patients were divided into 2 groups. The first group consisted of 102 (47.6%) patients, who underwent single-port laparoscopic cholecystectomy (SILC). The second included 112 (52.3%), for whom standard laparoscopic cholecystectomy was performed. The results in both groups were compared on the following criteria: 1) patient characteristics: age, sex and body mass index (BMI); 2) the duration of surgical intervention;

3) the total time of the patient hospitalisation; 4) the presence of drainage in the abdominal cavity; 5) anaesthetic assessment of the patient's physical condition prior to surgical intervention (classification of ASA); 6) the level of pain within 6 hours after the operation – visual analogue scale (VAS; from 0 to 10, where 0 – no pain, 10 – maximum pain); 7) the necessity for the administration of opioid analgesics in the postoperative period; 8) the presence of complications arose during surgery (bleeding, injury of the common bile duct, gallbladder perforation, leak of bile into the abdominal cavity); 9) the postoperative quality of life, cosmetic outcome (evaluation was performed using the 4-Likert scale. **Results.** When choosing access to remove the gallbladder, it is important to evaluate carefully the patient's data before surgery. The age of the patient, the presence of concomitant diseases, BMI, patient tolerance to the expected mode of operation play an important role. The history of proven acute cholecystitis, frequent biliary colics determine the performance of laparoscopic 4-ports cholecystectomy. Umbilical hernia can be used to place a port for interference through one-port access. When planning a single-port operation, one should be aware of the possibility of intra-operational occurrence of technical difficulties that may require the installation of additional trochars. **Conclusions.** The single-port method is a modern safe operation, one of the alternatives to the traditional four-port cholecystectomy, which causes the best cosmetic result of a low level of postoperative pain. Both technologies should not be opposed, but, on the contrary, it is necessary to combine and connect the advantages of both technologies in order to achieve the optimal result of surgical treatment.

Key words: single-port access, laparoscopic cholecystectomy, cholelithiasis, chronic calculous cholecystitis.

Background. Cholecystectomy is one of the most common operations where laparoscopic techniques are most often used. One of the important achievements of the new minimally invasive approaches for the removal of the gallbladder is one-port laparoscopic cholecystectomy (SILC), as well as the first transvaginal cholecystectomy with regard to chronic calculous cholecystitis. Further attempts to use body natural openings for access to the abdominal cavity through the vagina, stomach or rectum have led to controversial results, which greatly complicate the removal of the gallbladder and make it impossible to use such types of access as an alternative to laparoscopic cholecystectomy [1, 2].

The next interest of surgeons in the modernization of minimally invasive methods of surgical intervention by reducing the number of anterior abdominal cuts was determined in the creation of the SILC method. SILC is also produced through the natural opening of the

body, but has significant triangulation advantages over NOTES. In a single-port cholecystectomy the incision is usually performed transvascularly, that determines a number of advantages: reduction of postoperative pain, dyspepsia, rapid recovery, reduction of the number of complications associated with the wound, the best cosmetic outcome [3]. Today, despite some difficulties of port technology, including limited visualization and the lack of triangulation, a number of surgeons has demonstrated the safety and efficacy of SILC, other researchers point to the difficulties encountered during surgery. This has led to the emergence of new hardware to reduce the difficulty with SILC. The importance of a patient safety was highlighted in the consensus of the Consortium for SILC. When a surgeon feels that the operation that was begun with single-port access will be safer to complete it with use of additional trochars, the transition to a four-port operation is requiered [4, 5]. Therefore, some authors approved the following contraindications to SILS for so-called "severe bile ducts": 1) patients with acute cholecystitis; 2) BMI ≥ 35 kg / m2; 3) suspicion of the presence of concretions of the common bile duct [6, 7].

Numerous studies compare SILC and laparoscopic four-port cholecystectomy LC, but data in these studies are limited. In some of these works, the comparison group does not match the traditional four-port cholecystectomy and includes a trunk or miniport [8-9]. If the concept of minimal invasive single-access surgery is attractive, then the expected benefits of this new technology, such as reducing post-operative pain, shorter hospitalization, improving cosmetic outcome and quality of life, must be proved [10]. Therefore, today, the determination of the advantages of single-port laparoscopic cholecystectomy to traditional laparoscopic cholecystectomy with a differential approach to each of these types of surgical intervention remains relevant.

Objective. To conduct a comparative analysis of the results of single-port and four-port laparoscopic cholecystectomy in patients with chronic calculous cholecystitis.

Materials and methods. During 2015 – 2017 years 214 patients underwent performed surgery for chronic calculous cholecystitis.

All patients were divided into 2 groups. The first group consisted of 102 (47.6%) patients, who were performed single-port laparoscopic cholecystectomy (SILC). The second – 112 (52.3%) of patients, who were performed standard laparoscopic cholecystectomy.

Inclusion criteria: chronic calculous cholecystitis with uncomplicated course, presence of large and multiple gallbladder concretions that might create difficulties and significantly increase the size of the surgical while gallbladder extraction from the abdominal cavity during

four-port laparoscopic cholecystectomy, the presence of umbilical hernia or extended umbilical rings.

Non-inclusion criteria: complicated flow of chronic cholecystitis, acute inflammation of the gall bladder, patients with BMI greater than 35 kg / m^2.

The results in both groups were compared on the following criteria:

1) patient characteristics: age, sex and body mass index (BMI);

2) the duration of surgical intervention;

3) the total time of the patient hospitalisation;

4) the presence of drainage of the abdominal cavity;

5) ananesthetic assessment of the patient's physical condition prior to surgical intervention (classification of ASA);

6) the level of pain within 6 hours after the operation – visual analogue scale (VAS) (from 0 to 10, where 0 – no pain, 10 – maximum pain);

7) the necessity for the administration of opioid analgesics in the postoperative period;

8) the presence of complications arose during surgery (bleeding, injury of the common bile duct, gallbladder perforation, leak of bile into the abdominal cavity);

9) the postoperative quality of life, cosmetic outcome (evaluation was performed using the 4-Likert scale.

The statistical data were processed using the statistical program STATISTICA 2012. The probability of discrepancy was calculated using Mann-Whitney test. The normality of the distribution of indicators in the variation series was checked using the Shapiro-Wilk W test. The considered sufficient degree of probability was $p < 0.05$.

Results

All the groups under study did not have statistically significant differences in age and gender: the first group of women 84.3%, the average age – 53,0 (45; 61), the second group: women (83.04%), mean age 53,0 (42.5; 59.0), $p \leq 0.05$. There were minor differences in BMI: the first group – BMI 27 (26; 29), the second group – BMI 29 (27; 30), $p < 0.01$.

The average duration of the operation was less in the group with four-port cholecystectomy - 35 minutes (35; 40) compared with the one-way technique - 55 minutes (55; 60) $p<0.01$, that was caused by some complexity of technical execution and the use of special equipment.

There were no indications for intraoperative cholangiography, all patients underwent a thorough pre-operative examination and, if necessary, they were administered to the additional examination: contract CT, retrograde cholangiopancreatography.

The average length of hospitalisation after the completion of SILS was 2 days (2; 3), the patients who were performed the traditional laparoscopic cholecystectomy – 3 days (3; 4), $p<0.01$.

In the first group (SILC), the drainage of the abdominal cavity was performed in 11 (10.8%) patients, in the second one – in all patients 112 (100%).

The level of postoperative pain in balls for (VAS) in 6 hours after surgery in the first group was minimal – 3 (2; 4), in the second – 5 (5; 5), $p <0.01$.

A comparison was made in both groups regarding the need for opioid analgesics: in the group (SILC) – in 23 (22.5%) patients, with four-way cholecystectomy in the LC group – in 6 (93.7%).

Table 1

Anesthetic assessment of the patient's condition by ASA

Type of the operation	1 scale ASA	2 scale ASA	3 scale ASA
SILC	11.7%	88.3%	-
Traditional laparoscopic cholecystectomy	-	87.4%	12.6%

In both groups patients with mild systemic diseases prevailed, that was not a contraindication to the both methods of treatment.

In the first group (SILC) in 5 (4.9%) cases there were intraoperative complications, namely: bleeding from the bladder artery in 2, perforation of the gallbladder by forcepts - in 3. In the second group: in 4 (3.5%), bleeding from the bladder artery in 2, perforation of the gallbladder with forcepts - 2.

Postoperative complications in the first group (SILC) were in 3 (2.9%) cases: accumulation of fluid in the area of the gallbladder bed, that was evacuated by a puncture method using an ultrasound scanner. In 1 (0.9%) of patients, after a repeated ultrasound scan, bile was detected, a drainage tube was removed and an endoscopic papillomotorotomy was performed.

Postoperative complications in the second group occurred in 1 (0.8%) patient, bleeding from the box of the gall bladder, that led to the need for repeated laparoscopic intervention.

Satisfaction of the patient with the cosmetic outcome of the operation was noted in the performance of SILS-4 (4; 4), compared with the traditional laparoscopic cholecystectomy - 3 (3; 3), $p <0.01$.

There were no complications associated with access or due to gall bladder removal technology.

Thus, the most significant positive differences in treatment outcomes using the presented techniques were found in the first group (SILC) regarding the level of postoperative pain and satisfaction with the cosmetic outcome. Both of these indicators reflect the high quality of life of the patient from the first days of the postoperative period.

Discussion

When choosing an access to remove the gallbladder, it is important to evaluate the patient's data before surgery.

The age of the patient, the presence of concomitant diseases, BMI, patient tolerance to the expected mode of operation play an important role.

The presence of proven acute cholecystitis and frequent bile ducts complications in the history determines the performance of four-port laparoscopic cholecystectomy.

The umbilical hernia can be used to establish a port for interference through one-port access. An additional argument in favour of one-port access will be the need for a safe "open" way of installing the first trochar if there is a laparatomy in the anamnesis.

During the implementation of standard laparoscopic intervention through the hernia gates, the surgeon has to suture the anterior abdominal wall defect to maintain tightness of the abdominal cavity during surgery. One-port laparoscopic access allows the use of a special trochar to achieve tightness in the hernia gates.

It is necessary to find out the size and number of bile marrow, the degree of filling of the gallbladder. Large joints or a group of concretes that fill the gall bladder cavity tend to cause a surgeon to extend one of the 10-millimeter ports to 20-30 mm in order to be able to remove from the abdominal cavity safely. In this case, it is advisable to use a single-port device, which on average has a diameter of 25 mm and allows you to be remove easily from the abdominal cavity a gall bladder of almost any size. The presence of one or more concomitant diseases requiring surgical intervention is an additional argument in favour of using single-port access (one-way operations).

When planning a one-port operation, one should always keep in mind the possibility of an intraoperative occurrence of technical difficulties that may necessitate the installation of additional trochars. Therefore, even before the operation, it is important to plan optimal zones for the probable introduction of additional trochars.

Conclusions

Single-port method is a modern safe operation and one of the alternatives to the traditional four-port cholecystectomy, which results in the best cosmetic outcome and low postoperative pain. Both technologies should not be opposed, but, on the contrary, it is necessary to combine and incorporate their advantages in order to achieve the optimal result of surgical treatment.

Conflicts of interest: authors have no conflict of interest to declare.

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