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CONSIDERATION OF MORPHOLOGICAL-FUNCTIONAL CHANGES IN THE COMPONENTS OF CALOT'S TRIANGLE IN ACUTE CHOLECYSTITIS AND THEIR INFLUENCE ON THE SPECIFIC LAPAROSCOPIC CHOLECYSTECTOMY TECHNIQUE IN PATIENTS WITH ACUTE CHOLECYSTITIS

V.K. Grodeckyi, V.D. Foundiur, A.G. Iftodiy, S.O. Yakobchuk, O.Y. Khomko, O.V. Foundiur

Bukovinian State Medical University, Chernivtsi, Ukraine

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E-mail:
grodeckyj.valentyn@bsmu.edu.ua
iftodiy.a@gmail.com
homko.oleg@bsmu.edu.ua

Abstract. *From 2018 to 2023, a study was conducted on 89 (100%) patients operated on for acute cholecystitis in the surgical department of the Storozhynets Multidisciplinary Hospital for Intensive Care.*

The goal *is to study the clinical features of acute cholecystitis based on the results of surgical treatment in the general surgery department of a multidisciplinary district hospital for intensive care.*

Materials and methods. *From 2018 to 2023, 89 patients who underwent surgery for acute cholecystitis were studied in the surgical department of the Storozhynets Multidisciplinary Hospital for Intensive Care. Clinical, laboratory, instrumental examinations, and surgical treatment were performed on 89 patients of various age groups (from 18 to 74 years) with manifestations of acute cholecystitis. The patients were divided into two groups. The diagnosis was confirmed clinically, laboratory, by instrumental methods, intraoperative examination, and histological study of the removed specimens. The state of changes in peripheral blood was assessed: the number of erythrocytes, hemoglobin content, number of leukocytes, leukocyte formula, erythrocyte sedimentation rate, and leukocyte intoxication index according to the Kalf-Kalif formula. Statistical processing of the material was performed using the t-test with the determination of the probability corresponding to the Student's t-criterion. When performing statistical processing, the arithmetic mean (M) and the reliability of differences in study results (p) relative to the indicators of different groups were calculated. The results were considered reliable when the confidence coefficient was less than or equal to 0.05.*

Results. *The results of our laparoscopic cholecystectomies for grade I and II (moderate) severity of acute cholecystitis (according to the International Classification) showed a quantitative advantage in prioritizing the laparoscopic method of surgical intervention. However, in the presence of a purulent-inflammatory process in the hepatobiliary zone, priority is given to performing cholecystectomy by the "open method," involving highly experienced surgeons in the surgical team. This option of cholecystectomy is advisable mainly for severe acute cholecystitis (stage III of the pathological process) with a purulent-necrotic process in the hepatobiliary zone detected at the preoperative stage and in the case of peritonitis. Contraindications for laparoscopic cholecystectomy include chronic duodenal obstruction, gangrenous-perforative cholecystitis, and diffuse peritonitis. Considering the features of surgical tactics for treating acute cholecystitis confirms the need for its differentiated determination based on already developed tactical and therapeutic recommendations, the effectiveness of which is evidenced by the accumulated experience of the international school of surgeons and confirmed by our clinical results.*

Conclusions. 1*. Laparoscopic cholecystectomy is currently performed for both chronic and acute cholecystitis. 2. The most optimal time for performing "laparoscopic cholecystectomy" is the first two days from the onset of the inflammatory process in the gallbladder. 3. Performing laparoscopic cholecystectomy considering anatomical landmarks according to the recommendations for "safe cholecystectomy" by Steven Strasberg (1992, 1995 - SVS) and Gary G. Wind (1999) is an effective component of successful laparoscopic cholecystectomy for chronic cholecystitis and in the early stages of acute inflammatory processes in the gallbladder. 4. For acute destructive cholecystitis, the "elephant trunk" technique is practically preferred.*

Original research

РОЗГЛЯД МОРФОФУНКЦІОНАЛЬНИХ ЗМІН У СКЛАДОВИХ ТРИКУТНИКА КАЛЛО ПРИ ГОСТРОМУ ХОЛЕЦИСТИТІ ТА ЇХ ВПЛИВ НА СПЕЦИФІКУ ТЕХНІКИ ЛАПАРОСКОПІЧНОЇ ХОЛЕЦИСТЕКТОМІЇ У ХВОРИХ НА ГОСТРИЙ ХОЛЕЦИСТИТ

В.К. Гродецький, В.Д. Фундюр, А.Г. Іфтодій, С.О. Якобчук, О.Й. Хомко, О.В. Фундюр

Ключові слова: *холецистектомія, лапароскопічна холецистектомія, трикутник Калло, гострий та хронічний калькульозний холецистит.*

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Резюме. *З 2018 по 2023 рр. у хірургічному відділенні Сторожинецької багатопрофільної лікарні інтенсивного лікування провели дослідження 89 (100%) хворих, яких прооперували з приводу гострого холециститу.*

Мета дослідження – *вивчити особливості клінічного перебігу гострого холециститу за результатами операційного лікування, в умовах загально-хірургічного відділення багатопрофільної районної лікарні інтенсивного лікування.*

Матеріал і методи. *За період з 2018 по 2023 рр. у хірургічному відділенні Сторожинецької багатопрофільної лікарні інтенсивного лікування проведено дослідження 89 (100%) хворих, яких прооперовано з приводу гострого холециститу. Клінічне, лабораторне, інструментальне обстеження та хірургічне лікування виконане 89 хворим різних вікових груп (від 18 до 74 років) із проявами гострого холециститу. Досліджувані хворі були розподілені на дві групи. Діагноз підтверджувався клінічно, лабораторно, інструментальними методами, інтраопераційним обстеженням та гістологічним дослідженням видалених препаратів. Проводили оцінку стану змін у периферичній крові: кількість еритроцитів, вміст гемоглобіну, кількість лейкоцитів, лейкоцитарну формулу, швидкість зсідання еритроцитів, лейкоцитарний індекс інтоксикації за формулою Kalf-Kalif. Статистичну обробку матеріалу здійснювали за допомогою t-тесту з визначенням імовірності, яка відповідала t-критерію Стьюдента. При проведенні статистичної обробки обчислювали середню арифметичну величину (М), достовірність різниць результатів дослідження (р) відносно показників різних груп. Результати вважались вірогідними у тому разі, коли коефіцієнт достовірності був менший або дорівнював 0,05.*

Результати дослідження та їх обговорення. *Результати виконаних нами лапароскопічних холецистектомій при I та II (середньому) ступені тяжкості перебігу гострого холециститу (за Міжнародною класифікацією) сформували кількісну перевагу в пріоритеті вибору лапароскопічного способу операційного втручання. Однак, за умови прояву гнійно-запального процесу в гепатобіліарній зоні, пріоритетом є виконання холецистектомії «відкритим способом», із залученням до хірургічної бригади висококодосвідчених хірургів. Такий варіант холецистектомії доцільно виконувати переважно при тяжкому перебігу гострого холециститу (III ст. розвитку патологічного процесу) з виявленим на доопераційному етапі гнійно-некротичним процесом у гепатобіліарній зоні та за умови перитоніту.*

Протипоказанням до виконання лапароскопічної холецистектомії є хронічна дуоденальна непрохідність, гангренозно-перфоративний холецистит, розлитий перитоніт. Врахування особливостей хірургічної тактики лікування гострого холециститу підтверджує необхідність її диференційованого визначення на підставі вже опрацьованих тактико-лікувальних рекомендацій, ефективність яких засвідчена накопиченим досвідом міжнародної школи хірургів та підтверджена нашими клінічними результатами.

Висновки. *1. Лапароскопічну холецистектомію в сучасних умовах виконують як при хронічному, так і гострому холециститі. 2. Найбільш оптимальним терміном виконання операційного втручання «лапароскопічна холецистектомія» є перші дві доби від початку активації запального процесу в жовчному міхурі. 3. Виконання лапароскопічної холецистектомії з урахуванням анатомічних орієнтирів згідно з рекомендаціями з виконання «безпечної холецистектомії» за Стівеном Стразбергом(1992,1995 р. – SVS) та Gary.G. Wind (1999 р.), є ефективною складовою успіху досконалого виконання лапароскопічної холецистектомії при хронічному холециститі та*

за умови активації гострого запального процесу на початковому етапі формування запального процесу в жовчному міхурі. 4. При гострому деструктивному холециститі практичну перевагу має методика «хобот слона».

Introduction. In Ukraine, 15-20% admitted into surgical department are the patients with acute inflammation of the gallbladder. 48 to 50% of them are 60-70-year old patients [2,3]. In acute cholecystitis, the dynamics of inflammatory process in the hepatobiliary area quickly acquires a dangerous manifestation of an infiltrative-inflammatory nature. Such changes in the area of Calot's triangle cause an increasing risk of sub- and postoperative complications [2-4]. This fact requires a clear differentiation of criteria to select tactical and therapeutic measures and consider sub-operative anatomical features for the safe performance of surgery [1, 2-3, 7].

Objective. To study peculiar features of the influence of pathomorphological changes in the area of Calot's triangle in acute destructive cholecystitis and determine the optimal list of criteria to perform safe cholecystectomy.

Materials and methods. 89 (100 %) patients operated on for acute cholecystitis were examined at the surgical department of Storozhynets Multidisciplinary Intensive Care Hospital from 2018 to 2023. The diagnosis was confirmed clinically, by means of laboratory and instrumental methods, intra-operation examination and histological studies of the specimens removed. 28 (31,46%) men and 61 (68,5 %) women were examined (Table 1).

Table 1

Distribution of patients by number and gender

Group of patients	Number of men	Number of women	General number of patients (n)
Examined patients	29 (32,58%)	60 (67,41%)	89 (100%)

Table 2

Distribution of patients of both groups by their age

N	Group of patients	Distribution by age				Age (M±m)
		18-44 years	45 -59 years	60-74 years	75-90 years	
Total number of patients 89 (100%)		4 (4,49%)	24 (26,96%)	61 (68,12%)	-	56±3,3

An average age of patients was 56±3,3 years (Table 2). The ratio of men to women was 1:2. The majority of patients were of a middle and old age groups from 45 to 74 years (on an average 56±3,3) (Table 3). 4 patients (4,49%) under 30 were operated on. The number of patients operated laparoscopically prevailed in their number and age – 77 patients (86,5%). 12 patients (13,48) underwent open surgery (Tables 1-2). The analysis of the study conducted indicated that the most probable time of hospitalization was 51±26 hours (from 24 to 78 hours) (Table 3), and the patients aged 60-74 prevailed (50 patients – 56,17%). Considering peculiarities of the manifestation of the disease and concomitant pathology, all the patients were prepared 12-24 hours before surgery. In case of a destructive process in the gallbladder, surgery was performed within 12 hours since the moment of admission to the hospital. When the disease lasted for 4-5 days resulting in the formation of an infiltrative process, comprehensive antibacterial therapy was conducted followed by individual determination of indications for surgery [4]. In case purulent-inflammatory process manifested in the hepatobiliary area with the signs of peritonitis, open cholecystectomy was prioritized involving highly qualified specialists into the team of surgeons. Chronic duodenal obstruction, gangrenous-perforating cholecystitis, and diffuse peritonitis were contraindications for performing laparoscopic cholecystectomy. In these cases, the surgery was exclusively open. During laparoscopic cholecystectomy, under conditions of an infiltrative process formed, puncture decompression of the gallbladder with aspiration of its liquid contents was performed (Fig. 3-a).

When laparoscopic cholecystectomy was performed, a careful and step-by-step dissection of the elements of Calot's triangle was carried out with identification of its components. To remove destructively changed gallbladder auxiliary technical means were used, that made it impossible for infected biological components enter the abdominal cavity and operative wound. Those were a container, wound dilators adapted for laparoscopic access or operative-technical methods including extracorporeal removal of contents from the container due to elimination of the calculi with a Luer clamp, dilation and retraction of the paraumbilical access, and the use of aspiration devices. The anatomical landmarks for performing safe cholecystectomy recommended by Stephen Strasberg (in 1992, 1995 – SVS) and Gary.G. Wind (in 1999) were considered suboperatively [5, 11].

The main technical difficulties occurring when performing cholecystectomy in the examined patient with acute calculous cholecystitis were associated with sclerotic changes in the gallbladder and infiltrative process in the area of Calot's triangle (Table 4).

Different types of surgery in acute cholecystitis are demonstrated in Table 5.

The following tactic-therapeutic measures were carried out in surgery:

Laparoscopic cholecystectomy was performed as soon as possible before infiltrative or determined sclerotic changes were formed in the area of the gallbladder (Fig.1).

Table 3

Distribution of patients by age and time since the onset of the disease and hospitalization

Distribution by age													
Age		18-44 years				45-59 years				60-74 years and >				Age M±m
Time of hospitalization since the onset of the disease		hours 6 | 12	6 | 24	24 | 78	> | 78	6 | 12	hours 6 | 24	24 | 78	78 | >	hours 6 | 12	6 | 24	24 | 78	> | 78	
Type of surgery	Open Cholecystectomy (12 - patients 13,48%)	- 0 %	1 1,12 %	- 0 %	- 0 %	- 0 %	1 1,12 %	5 5,61 %	- 0 %	- 0 %	2 2,24 %	3 3,37 %	- 0 %	58± 3,3
	Number of patients by age, %	1 – 1,12 %				6 – 6,74%				5 – 5,61 %				
	Laparoscopic cholecystectomy (77 patients 86,5%)	- 0 %	1 1, 12 %	2 2, 24 %	- 0 %	1 1, 12 %	5 5, 61 %	17 19, 10 %	- 0 %	4 4, 49 %	9 10, 11 %	38 42, 69 %	- 0 %	54± 3,3
	Number of patients by age, %	3 – 3,37%				29 – 32,58%				51 – 57, 30%				
Total number of patients (89 - patients 100%)		1+3 = 4 (4,49)				6 + 23 = 29 (32,58%)				51 + 5 = 56 (62,92 %)				56± 3,3

Table 4

Causes of technical difficulties occurring when performing cholecystectomy in the examined patient with acute calculous cholecystitis

Cause	I group (n=12)	II group (n=77)
Sclerosed gallbladder	3 (4,23 %)	3 (4,23 %)
Infiltration in the body of the gallbladder	4 (4,49 %)	42 (47,19%)
Infiltration in the neck of the gallbladder	2 (2,24 %)	15 (16,85%)
Marked infiltrative changes in the wall of the gallbladder	2 (2,24%)	5 (5,61%)
Intraoperative perforation of the gallbladder	0 (%)	3 (3,37%)
Bleeding from the gallbladder bed	1 (1,12 %)	2 (2,24%)
Bleeding from the cystic artery	0 (%)	0 (0%)
Intrahepatic location of the gallbladder	0 (%)	4 (4,49 %)

Table 5

Surgery performed in patients with acute calculous cholecystitis

Type of surgery	Open cholecystectomy (n=12)	Laparoscopic cholecystectomy (n= 77)	Total (n=89)
Open cholecystectomy	9 (11,11%)	0 (%)	9 (11,11%)
Laparoscopic cholecystectomy	0 (%)	71 (79,77%)	71 (79,77%)
Conversion + cholecystectomy	0 (%)	3 (3,37%)	3 (3,37%)
Laparoscopic cholecystectomy + removal of stones from the gallbladder	0 (%)	0 (%)	0 (%)
Endoscopic papillosphincterotomy + Laparoscopic cholecystectomy	0 (%)	1 (1,12%)	1 (1,12%)
Laparoscopic cholecystectomy + Endoscopic papillosphincterotomy	0 (%)	2 (2,24%)	2 (2,24%)
Open cholecystectomy + revision of the common bile duct	3 (3,37%)	0 (%)	3 (3,37%)
Total	12 (13,48%)	77 (86,51%)	89 (100%)

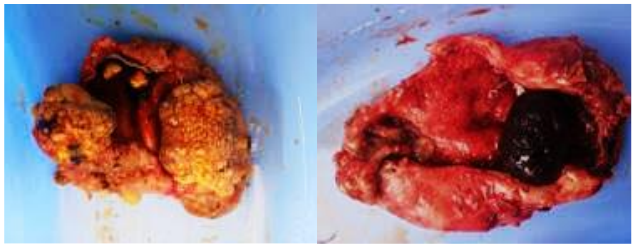

Fig 1. Morphological signs of sclerotic changes in the wall of the gallbladder

1. The nature of inflammatory changes in the area of gallbladder was estimated in order to determine anatomical features in the area of Calot's triangle (Fig. 2-3).

2. Peculiarities of anatomical changes caused by an inflammatory process in the superior-horizontal area of the duodenum, hepatoduodenal ligament, antral portion of the stomach and the area of the transverse colon close to the gallbladder were considered.

3. Before deciding the sequence of the dissection stage and taking into account the inflammatory changes in the gallbladder, the surgeons focused on several parameters. They are the location of Reviere's notch, considered the condition of the superior-horizontal area of the duodenum, location of the round ligament of the liver, and the part of the anterior wall of the transverse colon close to the gallbladder (Fig.2).

4. The cystic artery and the cystic duct are the only structures combined with the neck of the gallbladder which was confirmed suboperatively (Fig. 2 - D, E; Fig. 3 - e, f).

5. Special attention was paid to the peculiarities in the location of the lymph node in the area of the neck of the gallbladder, since the cystic artery is often located behind it (Fig. 2, A-C).

6. The most optimal variant of dissection of the neck of the gallbladder was determined under the supervision of an experienced surgeon. The priority of performing this stage was "from down to up" in the inferior lateral area of the neck of the gallbladder (Fig. 3-5).

7. The lower part of the gallbladder bed was immobilized along its lateral margin (Fig. 3 b, c, d).

8. After the elements of Calot's triangle were released from infiltrative and adhesive components, attention was focused on the stage of separate clipping of the cystic artery and cystic duct (Fig.2 F; 3 e, f).

9. When separate isolation of Calot's triangle elements was impossible due to destructive cholecystitis, cholecystectomy according to "elephant's trunk" method was performed, and the risk of an increased probability of possible injury to the common bile duct was considered.

10. Complete release of the cystic duct and cystic artery from the adjacent tissues is the guarantee to perform safe laparoscopic cholecystectomy most frequently performed in patients with chronic cholecystitis within 48 hours since the onset of activation of the inflammatory process, mainly among the patients under 45 (Fig.1).

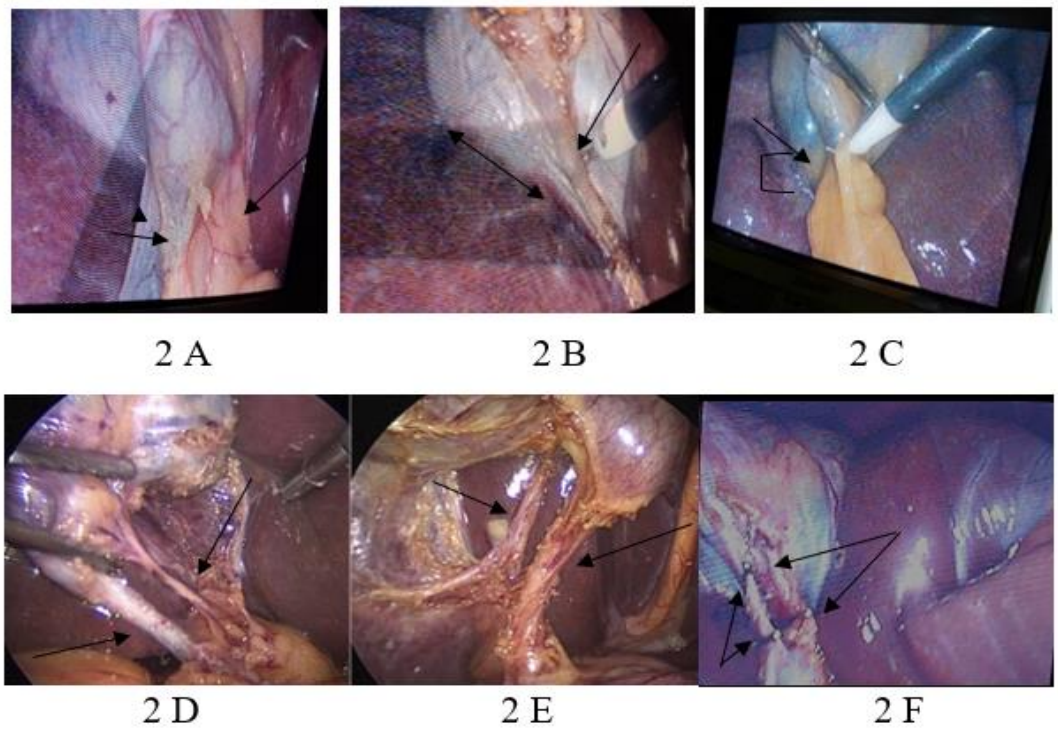

Fig. 2. Suboperative stages of separate dissection of Calot's triangle elements according to the method of "safe cholecystectomy" by Stephen Strasberg (in 1992, 1995 - SVS) and Gary.G. Wind (in 1999)

2A- identification of the location of the cystic duct and cystic artery; 2 B, C – dissection in the area of the cystic duct in the direction to the inferior-lateral area and upwards; 2 D, E – separate isolation of the cystic duct and cystic artery; 2 F – separate clipping of the cystic duct and cystic artery

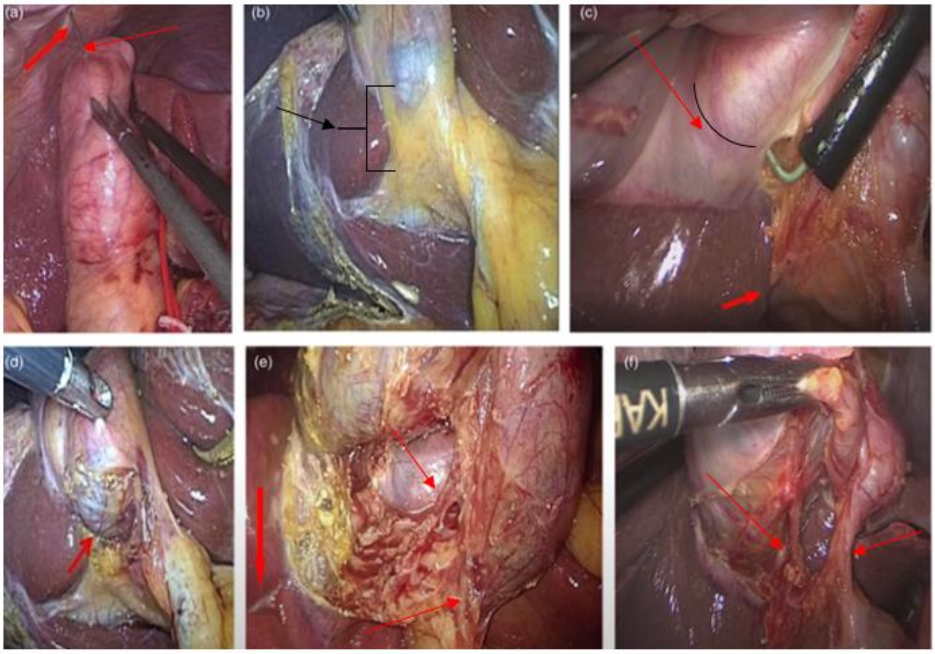

Fig. 3. Suboperative anatomical landmarks according to the recommendations of performing "safe cholecystectomy" and dissection of the inferior lateral area of the gallbladder
3 (a) - performed decompression of the gallbladder with aspiration of its liquid contents; 3 (b,c,d.)– priority area of gallbladder dissection; 3 (e,f.) – completed bilateral dissection of Calot's triangle elements above Reviere's notch

11. With the signs of infiltrative changes in order to reduce the risk of clip failure or detachment from the anatomical structures, two clips were applied in a distal direction and one – in the proximal direction (on the cystic artery and cystic duct). In case anatomical changes of the specified anatomical structures were preserved and a long stump was possible to form with intersection of the cystic artery and cystic duct, one clip in the distal and proximal directions was applied (Fig. 2 F).

12. After the stage of gallbladder coagulation (from up to down) етапу коагуляції ложа жовчного міхура (згори донизу) drainage of the subhepatic space was carried out with the drainage removed through a separate lateral contraperture access in the right subcostal area.

13. Accumulated liquid including blood, washing solution, bile, inflammatory exudate were extracted by means of vacuum aspiration through the central port in the epigastric area.

14. Joint work in the team of surgeons having skills of laparoscopic surgery and an experienced specialist having the skills of traditional open cholecystectomy, allowed the possibility to timely conversion that decreased considerably the duration and risk of surgery performed.

15. When the cystic artery was isolated, attention was focused on localization and morphological changes in the area of the lymph node located close to the neck of the gallbladder. Careful layer-by-layer dissection in the "from up to down" direction enabled to perform the safest variant of isolation of this portion with minimum risk to injure the cystic artery and other Calot's triangle structures.

16. Before removal of the gallbladder from the abdominal cavity, the gallbladder was placed into the container and removed through the access in the paraumbilical area.

17. In our opinion, with destructive changes in the area of Calot's triangle the variant of laparoscopic cholecystectomy optimal for chronic cholecystitis according to the methods recommended by Stephen Strasberg (in 1992, 1995 - SVS) and Gary.G. Wind (in 1999) is inferior to a more practical "elephant's trunk" method under such circumstances.

18. Probable suboperative complications were minimized due to involvement of an experienced surgeon-consultant into the team that allowed successful performance of 89 (100%) cholecystectomy without lethal outcome and complications.

The results of our performed cholecystectomies with I and II (moderate) degrees of severity of acute cholecystitis (according to the International classification) formed a quantitative advantage in the priority of choosing laparoscopic method of surgery. Nevertheless, when purulent-inflammatory process is manifested in the hepatobiliary area, open cholecystectomy should be prioritized, and highly qualified surgeons involved into the team. This variant of cholecystectomy is reasonable in severe acute cholecystitis (III degree of pathological process) with purulent-necrotic process found in the hepatobiliary area and peritonitis before surgery.

Contraindications to perform laparoscopic cholecystectomy are chronic duodenal obstruction,

gangrenous-perforating cholecystitis, and diffuse peritonitis.Taking into account the peculiarities of surgical tactics in the treatment of acute cholecystitis confirms the necessity for its differentiated definition based on already developed tactical and therapeutic recommendations, the effectiveness of which is evidenced by the accumulated experience of the international school of surgeons [8-10, 12] and our own clinical results.

Conclusions

1. In modern conditions, laparoscopic cholecystectomy is performed both for chronic and acute cholecystitis.

2. The most optimal term to perform laparoscopic cholecystectomy is the first two days since the activation of the inflammatory process in the gallbladder.

3. Performance of laparoscopic cholecystectomy considering anatomical landmarks according to the recommendations of safe cholecystectomy by Stephen Strasberg (in 1992, 1995 - SVS) and Gary.G. Wind (in 1999), is an effective component of a successful perfect performance of laparoscopic cholecystectomy in chronic cholecystitis and when acute inflammatory process is activated at the initial stage of inflammatory process formation in the gallbladder.

4. In case of acute destructive cholecystitis, the “elephant’s trunk” method has a practical advantage.

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Відомості про авторів
Гродецький Валентин Корнелійович – канд. мед. наук, доцент кафедри хірургії № 2 закладу вищої освіти Буковинського державного медичного університету, м. Чернівці, Україна. ORCID iD 0000-0001-6614-4849
Фундюр Володимир Дмитрович – канд. мед. наук, д-р філософії медичних наук, асистент кафедри хірургії № 2 закладу вищої освіти Буковинського державного медичного університету, м. Чернівці, Україна. ORCID iD 0000-0003-3239-0413
Іфтодій Андрій Григорович – д-р мед. наук, професор, професор кафедри хірургії № 2 закладу вищої освіти Буковинського державного медичного університету, м. Чернівці, Україна. ORCID iD 0000-0002-7061-5305
Якобчук Світлана Олександрівна – канд. мед. наук, доцент кафедри хірургії № 2 закладу вищої освіти Буковинського державного медичного університету, м. Чернівці, Україна. ORCID iD 0000-0002-9050-6384
Хомко Олег Йосипович – канд. мед. наук, доцент кафедри догляду за хворими та вищої медсестринської освіти закладу вищої освіти Буковинського державного медичного університету, м. Чернівці, Україна. ORCID iD 0000-0003-0268-0524
Фундюр Олександр Володимирович – лікар - хірург КНП, Староконстянтинівська БЛІЛ, відділення загальної хірургії, м. Старокостянтинів, Україна.

Information about the authors
Grodeckyj Valentyn Korneliyovych – PhD in Surgery, Assoc. Professor, Department of Surgery №2 Bukovinian State Medical University, Chernivtsi, Ukraine. ORCID iD 0000-0001-6614-4849
Foundiur Volodymyr Dmytrovych – PhD in Surgery, Doctor of Philosophy in Medical Sciences, Department of Surgery № 2, Bukovinian State Medical University, Chernivtsi, Ukraine. ORCID iD 0000-0003-3239-0413
Iftodii Andrii H. – MD of Medical Sciences, Professor, Professor of the Department of Surgery № 2, Bukovinian State Medical University, Chernivtsi, Ukraine. ORCID iD 0000-0002-7061-5305
Yakobchuk Svitlana Oleksandrivna – PhD in Surgery, Assoc. Professor, Department of Surgery №2, Bukovinian State Medical University, Chernivtsi, Ukraine.ORCID iD 0000-0002-9050-6384
Khomko Oleh Yosypovych – MD, PhD (Med), Assoc. Professor, Department of Nursing and Higher Nursing Education, Bukovinian State Medical University, Chernivtsi, Ukraine. ORCID iD 0000-0003-0268-0524
Foundiur Oleksandr V. – surgeon of KNP, Starokonstiantynivska BLIL, Department of General Surgery, Starokostiantyniv, Ukraine.

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Рецензент – проф. Гринчук Ф.В.