

Comparative evaluation of simultaneous and isolated laparoscopic surgery for cholelithiasis

Saparbek S. Toktorov (0000-0001-8320-0697)¹, **Baiyshbek Z. Osumbekov** (0000-0001-5345-0476)², **Zamirbek S. Arynov** (0000-0002-8321-5773)³, **Kamoliddin Z. Salahiddinov** (0000-0002-0512-3718)⁴, **Zhypargul D. Abdullaeva** (0000-0001-5777-4478)⁵⁽¹⁾

¹Osh State University, Medical Faculty Clinic, Osh, Kyrgyzstan

²Osh State University, Department of Pathology, Basic and Clinical Pharmacology, International Medical Faculty, Osh, Kyrgyzstan

³Osh State University, Department of Pathology, Basic and Clinical Pharmacology, International Medical Faculty, Osh, Kyrgyzstan

⁴Andijan State Medical Institute, Andijan, Uzbekistan

⁵Science and Research Department, Osh State University, Osh, Kyrgyzstan

Abstract. Research aim in this article is to investigate comparative evaluation between simultaneous and isolated laparoscopic surgery of patients with cholelithiasis. Operation in laparoscopic cholecystectomy considered as a standard method of treatment with the main advantage of quick recovery. The technique is safe and frequency of conversions to open surgery is minimal. Comparative evaluation results showed that simultaneous laparoscopic surgery in cholelithiasis have advantages as removal of the gallbladder and at the same time additional removal of other organs pathologies in abdominal cavity or small pelvis or retroperitoneal space with cholecystectomy. In addition, simultaneous laparoscopic surgery is economically beneficial for patients, it is not necessary for patients to test again and duration of patients' temporary disability can be reduced. At the same time more than two organs can be operated with reduction of the postoperative stay days of patients in the hospital.

Keywords: laparoscopic surgery · comparative evaluation · isolated surgery · simultaneous surgery · cholelithiasis

1. Introduction

Laparoscopic cholecystectomy is an intervention that is characterized by a small surgical trauma, a quick and fairly easy recovery [1, 2]. Instruments and a video camera are inserted through punctures in the abdominal wall. As a result of air injection, a view is provided for carrying out the necessary operations. In some cases, at the end of the operation, the doctor provides drainage of fluid from the subhepatic space. After 2-3 days, the patient leaves the department on his own and recovers at home.

¹ Corresponding author: jypar.science@oshsu.kg

Great attention paid to use of traditional laparoscopic cholecystectomy, minilaparoscopy, laparoscopy from a single laparoscopic access and endoscopic transluminal surgery through natural holes [3,4]. According to ultrasound and autopsies, isolated cholecystolithiasis detected in 5–10% of population, and 70% in structure of cholelithiasis [5].

The gallbladder is a pear shaped organ in the digestive tract, which is located under the right lobe of the liver. Its main role is the deposition and concentration of bile, produced by the liver. Bile enters the gallbladder from the liver through the bile ducts. During meals, bile accumulated in the gallbladder excreted through the bile ducts into the duodenum and participates in digestion act. Bile plays an important role in digestion, in particular breaks down fats and activates many enzymes in the digestive tract. The gallbladder removal does not lead to a deterioration in digestion, since in the absence of a gallbladder bile enters the duodenum directly from liver [6].

Ultrasonography was performed to confirm the clinical diagnosis of cholelithiasis with number of stones, sizes, diameter of common bile duct pericholecystic collection, and gallbladder wall thickness [7]. Complications that may develop during laparoscopic cholecystectomy are the biliary tract injury, bile leakage, bleeding, conversion to open procedure that can be reduced by experienced surgeons and new tools [1,8,9]. Common complications include infection, surrounding structure damage and bleeding of vascular organs [10, 11].

Comparative analysis was performed for laparoscopic cholecystectomy by traditional laparoscopic and single laparoscopic approaches in patients with acute cholecystitis in which conversion to standard laparoscopic cholecystectomy was carried out due to pronounced infiltrative inflammatory changes in the gallbladder neck, in bleeding from the cystic artery and due to a laparoscope malfunction. All patients in the postoperative period received intramuscular injections of tramadol hydrochloride 100 mg for pain relief [12].

Univariate analysis of risk factors for laparoscopic cholecystectomy postoperative complications are shown in Table 1. The most common complications were pneumonia, a superficial surgical site infection (SSI) and a retained common bile duct stone in patients.

Table 1. Independent risk factors for conversion based on stepwise forward logistic regression (Terho et al., 2016).

| Risk factor | Odds ratio (95% CI) | P |
|--|--------------------------------|----------|
| Analysis of preoperative risk factors only | | |
| CRP over 150 mg/ml | 3.0 (1.8–5.0) | <0.001 |
| Diabetes | 1.8 (1.0–3.3) | 0.045 |
| Analysis including both preoperative and intraoperative risk factors | | |
| Abscess | 9.2 (2.7–31.1) | <0.001 |
| Age over 65 years | 1.9 (1.1–3.3) | 0.023 |
| Gangrene of the gallbladder | 5.9 (3.4–10.2) | <0.001 |

The following preoperative findings were included in the stepwise forward logistic regression analysis of risk factors for conversion: age over 65 years, previous laparotomy on the upper abdomen, diabetes, CRP over 150 mg/ml and WBC over 13x10⁹/l. Gangrene of the gallbladder and abscess were added for the stepwise analysis of all risk factors. CRP C-reactive protein, WBC white blood cell count [1].

On admission, all patients underwent abdominal organs ultrasound examination, complete blood count (CBC), general urinalysis, biochemical blood counts (bilirubin, amylase, urea, creatinine), blood

glucose, blood type, Rh and coagulogram [13]. Before operational patients' identification is including biochemical laboratory tests for higher direct bilirubin level in plasma, alkaline phosphatases, transaminase, amylase or lipase levels, fibrinogen with C-reactive protein [14]. Abdomen usual radiography may show shading in the right hypochondria [15]. A chronic calculous cholecystitis, gallbladder cholesterosis, gallbladder polyposis and acute cholecystitis are indications for laparoscopic cholecystectomy operation. Contraindications for laparoscopic cholecystectomy include absolute: 1) general contraindications for laparoscopic surgery; 2) gallbladder cancer; 3) thick infiltrate in the gallbladder neck area; 4) late terms of pregnancy [16].

2. Materials and Method

Laparoscopic equipment EFA-MEDIKA (St. Petersburg, Russia) and KARL STORZ (Germany) joined with video endoscopic camera [17,18] applied as minimally invasive technology in emergency surgery. Preoperative preparation of patients for laparoscopic surgery includes mandatory examination at the prehospital stage. Instrumental methods: 1) electrocardiogram to assess the cardiovascular system condition; 2) fluorography to exclude pathology from the chest organs; 3) ultrasound examination of abdominal organs in order to identify gallbladder calculi and verify the diagnosis.

Laboratory methods include the following stages: 1) complete blood count to assess the levels of hemoglobin, erythrocytes, platelets, ESR, leukocyte count and leukocyte formula; 2) urine general analysis in order to identify pathology of the urinary system; 3) liver tests to assess the liver condition and liver function; 4) blood glucose to detect diabetes mellitus and correct treatment; 5) blood test for infections (Syphilis-RW, AIDS-HIV (anti-HIV); 6) Hepatitis B-HBsAg, Hepatitis C (anti-HCV Ig G) to rule out viral hepatitis; 7) coagulogram to determine the blood coagulation system condition.

Preparation of patients for laparoscopic surgery in the hospital. Purpose of preoperative preparation is to ensure that the surgical intervention can be successfully performed, and to make it as easy as possible for both the patient and the surgeons.

Patient's psychological preparation was performed according to indicated operation type, what complications may develop, and what kind of changes may appear in post operational stage. Preparation of the gastrointestinal tract includes avoidance of food and liquid consumption on the surgery day. Cleansing enema to empty the intestines performed by general hygiene. A few hours before the operation, patient's body washed, during the operation and in the postoperative period, elastic bandaging of the lower extremities in order to prevent thromboembolic complications.

3. Results

Benefits of using the laparoscopic cholecystectomy technique (Figure 1) are pain reduction after surgery, short period of hospital stays less than a day, quick return of patient to his usual life, good cosmetic effect, improvement in the quality of life, probability of development ventral hernia is practically excluded and a minimal trauma to the abdominal wall.

Operation stages. Laparoscopic cholecystectomy (Figure 2) performed under general anesthesia approximately for 40 minutes. Gallbladder seizure, dissection of adhesions and isolation of the cystic duct with arteries performed. In the operation progress, carbon dioxide injected into patient's abdominal cavity; tubes with valves were inserted so that instruments can be inserted without releasing gas, and a laparoscope tube with a video camera. Monitors reflect operation progress with a multiple increase. Trocars are installed. They hold gallbladder with special tools, clamp the duct and artery with clips. The gallbladder is separated and removed, after which the drainage of the abdominal cavity was performed.

Rehabilitation. Patient spends postoperative hours in intensive care room, after which he is transferred to the ward. The drainage was removed on the next day. Recovery carried out within a month after operation: it is necessary to observe the daily routine, medications and physical activities were prescribed to patient. The need to follow a diet exists only in the first months after operation,

while the body is adapting to new conditions. Comparative evaluation of simultaneous and isolated laparoscopic surgery operation progress shown in Table 2.

Table 2. Comparative evaluation of simultaneous and isolated laparoscopic surgery operation progress.

| Operation stages | Isolated laparoscopic surgery for cholelithiasis (Laparoscopic cholecystectomy) | Simultaneous laparoscopic surgery for cholelithiasis |
|-------------------------------|--|--|
| Anesthesia | General, endotracheal or inhalation | General, endotracheal or inhalation |
| Patients position | Patients position on back, left side tilt to 20-30 degrees with legs together | Patient is on back with head down, legs are pulled apart |
| Surgical area handling | Stage 1: surgical area cleaning with chemical antiseptics (iodine-containing preparations, 70% alcohol or chlorhexidine); Stage 2: patient's skin surface wiped with 5% alcohol solution of iodine from the center to the periphery 3 times | Stage 1: surgical area cleaning with chemical antiseptics (iodine-containing preparations, 70% alcohol or chlorhexidine); Stage 2: patient's skin surface wiped with 5% alcohol solution of iodine from the center to the periphery 3 times |
| Operation | After applying pneumoperitoneum through a Veress needle with CO ₂ gas up to 12 mm Hg, a 10 mm trocar is installed in paraumbilical region and a laparoscope is inserted. After abdominal cavity assessment, additional trocars were installed. A second 10 mm trocar is inserted into the epigastrium. The 3rd trocar, 5 mm, is placed below the costal arch along the mid-clavicular line, and the 4th trocar along the anterior axillary line 4-5 cm below the costal arch. The cystic duct and artery dissected and clipped, gallbladder dissected from the lodge and removed through epigastric troacic incision, wounds sutured and aseptic bandage is placed. | In simultaneous operation performed in the upper abdominal cavity organs, trocars are installed during cholecystectomy can be used; if operation is performed in lower abdomen organs then installed 2nd, 3rd and 4th trocars are removed, wounds are hermetically sutured, the 2nd port is installed about 5 cm below the navel along the striatal line, remaining ports are installed in the right or left iliac region. After surgery, all trocars are removed, wounds are sutured and aseptic bandage is placed. |
| Operation time | Average 40 minutes (usually lasts from 25 min. to 1 hour) | 1 to 3 hours |
| Postoperative period | Medicinal purposes non-narcotic analgesics. Patient allowed to go from hospital 3-4 days after the operation. | Medicinal purposes non-narcotic analgesics. Patient allowed to go from hospital 3-4 days after the operation. |



Figure 1. Patient's position in the laparoscopic cholecystectomy operation.

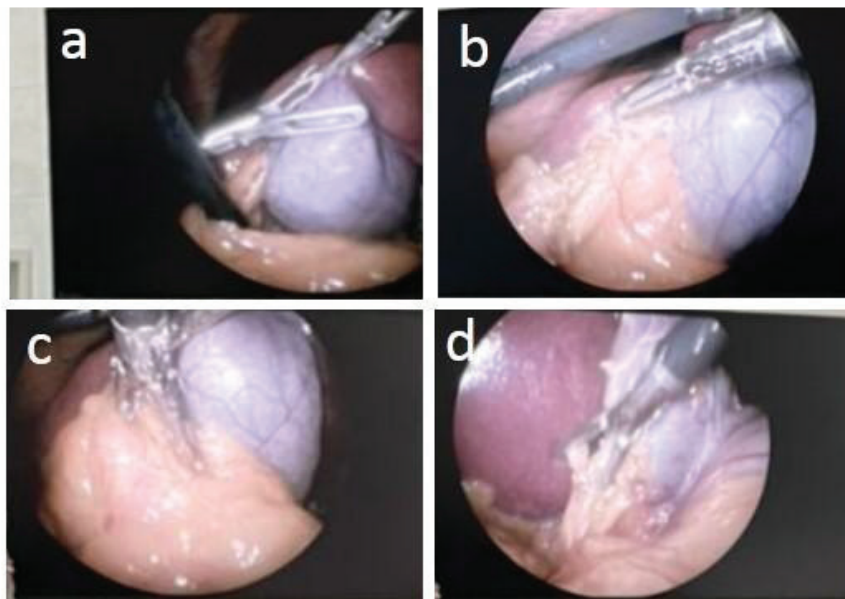


Figure 2. a) Gallbladder seizure; b) dissection of adhesions; c) isolation of the cystic duct; d) isolation of the cystic duct with arteries.

4. Discussion

Isolated laparoscopic cholecystectomy operation. Anesthesia: general, endotracheal anesthesia. Indication for surgery gallbladder stones. Operation duration 30 minutes. The course of operation after appropriate processing of surgical field, a Veress needle was inserted along the upper contour of the navel. Carboxyperitoneum in the mode of 10-12 mm Hg. The first 10 mm trocar was installed with endocamera. After abdominal cavity assessment, remaining 2nd 10 mm trocar installed in the epigastrium; 3rd trocar 5 mm in diameter, was installed below the costal arch along the midclavicular line, and the 4th trocar installed along the anterior axillary line, 4-5 cm below the costal arch. On observation, hollow organs showed no features. The liver size was not changed with sharp edges and smooth surface. Gallbladder reduced in size, walls thickened, compacted, a solid calculus determined in the lumen, choledochus not expanded. The gallbladder bottom clamped and pushed through the subdiaphragm.

The cystic duct and arteries were isolated, clipped and transected separately. Selected and removed through the epigastric port. The gallbladder bed coagulated, control for hemostasis was dry. All trocars removed, CO₂ gas removed from patient's abdomen, wounds sutured after that aseptic bandage performed. Removed gallbladder walls thickened, compacted, in the lumen with 1 calculus 1.2x0.9 cm in size.

Simultaneous laparoscopic cholecystectomy and cystectomy from the left ovary. Anesthesia: general, endotracheal anesthesia. Indication for surgery gallbladder stone, cyst of the left ovary. Operation duration 1 hour 20 minutes. Operation course. After surgical field handling, a Veress needle inserted along the upper contour of the navel and the carboxyperitoneum in the mode of 10 to 12mm Hg. The first 10 mm trocar installed with endocamera. On assessment, hollow organs were without features. The liver size normal, liver edges are sharp with smooth surface. The gallbladder is enlarged in size, its walls are thickened, compacted, multiple calculi are determined in the lumen, the choledochus is not expanded. The uterus and right appendages are without pathology.

A cystic formation with about size 7.0x6.0 cm observed in the left ovary. After assessment of abdominal cavity, the remaining trocars installed. 2nd 10 mm trocar installed in the epigastrium, 3rd trocar 5 mm was installed below the costal arch along the midclavicular line, and the 4th trocar installed along the anterior axillary line, 4-5 cm below the costal arch. Gallbladder bottom is clamped and pushed through the subdiaphragm. The cystic duct and arteries were isolated, clipped and transected separately. The gallbladder bed coagulated, hemostasis control is dry. 2nd, 3rd and 4th trocars were removed, then wounds were hermetically protected. The 2nd port was installed 5 cm below the navel in the midline, another port was installed in the left iliac region. The ovarian cyst was punctured and a clear liquid with volume of 80 ml was aspirated. The cyst capsule was completely removed and extracted through the 2nd port. Hemostasis control dry. Further revision revealed no other pathologies. All trocars have been removed. CO₂ gas removal by descifulation from patient's abdomen. Aseptic bandage after wound suture. Removed gallbladder walls thickened, compacted, multiple stones 1.0 cm in size and less found in the lumen. Removed ovarian cyst capsule walls are loose in places. Postoperative diagnosis: chronic calculous cholecystitis. Cyst in the left ovary.

5. Conclusion

Benefits of isolated laparoscopic surgery are minimal trauma to the abdomen muscles and skin, reduced pain due to smaller incisions and minimal blood loss and shorter recovery time [19]. Both the speed of patient's recovery and pain in the postoperative period depend on incision size with an open access to the gallbladder that can be decreased to minimal with laparoscopy. Blood loss level is close to zero in laparoscopic intervention. The risk of postoperative hernia formation is also reduced as a good cosmetic effect. Rapid patient recovery includes patient treatment lasting for no more than 2 to 3 days, return to normal life occurs after 1 to 2 weeks.

Simultaneous laparoscopic surgery advantages include possibility of simultaneous treatment of gynecological, surgical and urological pathologies such as simultaneous removal of the gallbladder and treatment of gynecological diseases. Saving time. Patients' recovery period after surgery averages

from 1 to 10 days. Simultaneous operations allow the patient to reduce the total time spent in the hospital. Money saving, surgical interventions, laparoscopic simultaneous operations can significantly reduce the treatment total cost. Psychological comfort is important for the patient, as simultaneous operation perceived as one surgical intervention significantly reducing the stress and anxiety level before and after operation.

References

1. Terho, P.M., Leppäniemi, A.K. & Mentula, P.J. (2016). Laparoscopic cholecystectomy for acute calculous cholecystitis: a retrospective study assessing risk factors for conversion and complications. *World J Emerg Surg.*, 11, 54, 1-9. <https://doi.org/10.1186/s13017-016-0111-4>
2. Farda, W., Tani, M.K., Manning, R.G., Fahmi, M.S., & Barai, N. (2021). Laparoscopic cholecystectomy: review of 1430 cases in Cure International Hospital, Kabul, Afghanistan. *BMC Surg.*, 21, 344, 1-8. <https://doi.org/10.1186/s12893-021-01342-9>
3. Starkov, Yu.G., Shishin, K.V., & Solodinina, E.N. (2009). Endoscopic transluminal surgery in diseases of the abdominal cavity. *Pacific Medical Journal*, 2(36), 90-92. URL: <https://cyberleninka.ru/article/n/endoskopicheskaya-translyuminalnaya-hirurgiya-pri-zabolevaniyah-organov-bryushnoy-polosti>
4. Batalova, Y.S., & Nuzova, O. B. (2015). Modern laparoscopic technologies in the treatment of gallstone disease. *Orenburg Medical Bulletin*, III (4 (12)), 61-67. URL: <https://cyberleninka.ru/article/n/sovremennye-laparoskopicheskie-tehnologii-pri-lechenii-zhelchnokamennoy-bolezni>
5. Ermolov, A.S. (1998). Surgery of gallstone disease. *Annals of Surgery*, 3, 13–24.
6. Koshenov, M.R. (2012). Laparoscopic cholecystectomy. *Bulletin of Surgery of Kazakhstan*, (4 (32)), 22-23. URL: <https://cyberleninka.ru/article/n/laparoskopicheskaya-holetsistektomiya-1>
7. Taki-Eldin, A., & Badawy, A. E. (2018). Outcome of laparoscopic cholecystectomy in patients with gallstone disease at a secondary level care hospital. *Arquivos brasileiros de cirurgia digestiva: Brazilian archives of digestive surgery*, 31(1), e1347. <https://doi.org/10.1590/0102-672020180001e1347>
8. Acar, T., Kamer, E., Acar, N., Atahan, K., Bağ, H., Hacıyanlı, M., & Akgül, Ö. (2017). Laparoscopic cholecystectomy in the treatment of acute cholecystitis: comparison of results between early and late cholecystectomy. *The Pan African medical journal*, 26, 49. <https://doi.org/10.11604/pamj.2017.26.49.8359>
9. Amreek, F., Hussain, S., Mnagi, M. H., & Rizwan, A. (2019). Retrospective Analysis of Complications Associated with Laparoscopic Cholecystectomy for Symptomatic Gallstones. *Cureus*, 11(7), e5152. <https://doi.org/10.7759/cureus.5152>
10. Hassler, K.R., Collins, J.T., Philip, K., Jones, M.V. (2022). Laparoscopic Cholecystectomy. In: Treasure Island (FL): StatPearls Publishing; URL: <https://www.ncbi.nlm.nih.gov/books/NBK448145/>
11. Malik, A.M., Laghari, A.A., Mallah, Q., Hashmi, F., Sheikh, U., & Talpur, K.A. (2008). Extra-biliary complications during laparoscopic cholecystectomy: How serious is the problem? *Journal of minimal access surgery*, 4(1), 5–8. <https://doi.org/10.4103/0972-9941.40990>
12. Zamyatin, V.A., & Faev, A.A. (2014). Unified laparoscopic approach in surgery of acute cholecystitis. *Medicine of Kuzbass*, 1, 12-16. URL: <https://cyberleninka.ru/article/n/edinyy-laparoskopicheskiy-dostup-v-hirurgii-ostrogo-holetsistita>
13. Stepanov, Yu. A. (2010). Analysis of complications of laparoscopic cholecystectomy in acute cholecystitis. *Kuban Scientific Medical Bulletin*, (3-4), 174-178. URL:

- <https://cyberleninka.ru/article/n/analiz-oslozhneniy-laparoskopicheskoy-holetsistektomii-pri-ostrom-holetsistite>
14. Di Buono, G., Romano, G., Galia, M., Amato, G., Maienza, E., Vernuccio, F., Bonventre, G., Gulotta, L., Buscemi, S., & Agrusa, A. (2021). Difficult laparoscopic cholecystectomy and preoperative predictive factors. *Scientific reports*, 11(1), 2559. <https://doi.org/10.1038/s41598-021-81938-6>
 15. Fedorov, I.V. (2012). Diagnosis and treatment of choledocholithiasis in the era of endosurgery. *Chief Physician of the South of Russia*, 4(31), 12-15. URL: <https://cyberleninka.ru/article/n/diagnostika-i-lechenie-holedoholitiaza-v-epohu-endohirurgii>
 16. Slavin, L.E. (2010). Laparoscopic cholecystectomy. *Practical Medicine*, (41), 30-35. URL: <https://cyberleninka.ru/article/n/laparoskopicheskaya-holetsistektomiya>
 17. Galiullin, R.N. (2014). Laparoscopic operations in emergency surgery of the abdominal organs. *Creative Surgery and Oncology*, (4), 25-28. URL: <https://cyberleninka.ru/article/n/laparoskopicheskie-operatsii-v-neotlozhnoy-hirurgii-organov-bryushnoy-polosti>
 18. Osumbekov, B., Chokotaev, M., Osumbekov, R., Mamanov, N., Arynov, Z., & Abdullaeva, Z. (2020). Displacement of the Residual Liver Cavity in Laparoscopic Echinococectomy. *Surgical Science*, 11, 281-288. <https://doi.org/10.4236/ss.2020.1110030>
 19. Srivastava, A., & Niranjan, A. (2010). Secrets of safe laparoscopic surgery: Anaesthetic and surgical considerations. *J Minim Access Surg.*, 6(4): 91–94. <https://doi.org/10.4103/0972-9941.72593>