

# Assessment of the Possibility and Reliability of Laparoscopic Cholecystectomy in Patients with Liver Cirrhosis

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**Abstract** Gallstone disease occurs in approximately 1/3 of patients with cirrhosis of the liver (LC). Increased lithogenesis in such patients is presumably associated with an increase in the secretion of unconjugated bilirubin, a decrease in the content of bile acids and phospholipids in bile, and hypomotility of the gallbladder. Gallstones in the gallbladder in patients with cirrhosis rarely migrate, and therefore gallstone disease in most of them is asymptomatic. The need for cholecystectomy in patients with cirrhosis arises, as in patients without cirrhosis, with the appearance of symptoms of biliary colic, acute cholecystitis. It is well known that cirrhosis with portal hypertension increases the risk of intraoperative and postoperative complications in any type of surgical intervention, especially in operations on the biliary tree.

**Keywords** Cholelithiasis, Liver cirrhosis, Laparoscopic cholecystectomy

## 1. Introduction

In surgical publications of the 80s of the last century, a high incidence of complications (from 5 to 23%) and deaths (from 7 to 20%) was reported in open surgical interventions on the gallbladder and bile ducts in patients with cirrhosis, with the main causes of adverse outcomes were excessive blood loss, postoperative liver failure and sepsis [6,7]. Initially, cirrhosis with portal hypertension was considered a contraindication for laparoscopic cholecystectomy (LC) due to potential bleeding risks [8]. With the accumulation of experience in laparoscopic surgery, this minimally invasive approach began to be used in a number of difficult situations associated with the gallbladder, including cholelithiasis in patients with cirrhosis. At the same time, recent publications [9] reported a fairly wide range of postoperative complications (6.6-47.3%) and mortality (0-4.3%) in HL in patients with cirrhosis. The first report on the results of HL in patients with cirrhosis was published in 1993 [9]. Subsequently, data from several meta-analyses and randomized controlled trials appeared, confirming the benefits of HL in carefully selected patients with cirrhosis [10-13]. In the present study, we tried, based on our own experience, to assess the feasibility and reliability of HL in the treatment of cholelithiasis in patients with cirrhosis.

Gallstone disease occurs in approximately 1/3 of patients with liver cirrhosis (LC) [1]. Increased lithogenesis in such patients is presumably associated with an increase in the secretion of unconjugated bilirubin, a decrease in the content of bile acids and phospholipids in bile, and hypomotility of the gallbladder [2]. Gallstones in the gallbladder rarely migrate in patients with cirrhosis, and therefore gallstone disease in most of them is asymptomatic [3]. The need for cholecystectomy in patients with cirrhosis arises, as in patients without cirrhosis, when symptoms of biliary colic, acute cholecystitis appear [4]. It is well known that cirrhosis with portal hypertension increases the risk of intraoperative and postoperative complications in any type of surgical intervention, especially in operations on the biliary tree [5].

## 2. Material and Methods

The case histories of 46 patients with cirrhosis who underwent HL in the clinical bases of the Department of Surgical Diseases and Resuscitation of the Bukhara Medical Institute were subjected to a retrospective analysis for the period from June 2019 to December 2021. The age of patients, gender, etiology of cirrhosis, the nature of gallbladder disease, duration of surgery, intraoperative and postoperative complications, conversion rate to laparotomy, length of hospital stay. There were 30 women (65.2%), men - 16 (34.8%), their mean age was  $56.6 \pm 12.5$  years (range 23-74 years). Hepatitis C was the cause of cirrhosis in 15 (32.6%) patients, hepatitis B in 12 (26%), hepatitis B and C in 5 (10.9%), alcohol abuse in 5 (10.9%), fatty degeneration

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of the liver - in 7 (15.2%) patients. The etiology of cirrhosis could not be established in 2 patients. The severity of cirrhosis was classified according to Child-Pugh, according to which 34 (73.9%) patients were included in class A, 12 (26.1%) patients were included in class B. There were no patients with decompensated cirrhosis (class C Child—Pugh) in our study. (Table 1).

**Table 1.** Characteristics of patients with liver cirrhosis who underwent laparoscopic cholecystectomy

Indicator	Numerical value
Gender: male/female	30/10 (65,2%/34,8%) Age, years (range) 50 (23—74)
Accompanying illnesses	27 (58,7%)
class Child-Pugh A	34 (73,9%)
class Child-Pugh B	12 (26,1%) Etiology of cirrhosis:
hepatitis C	15 (32,6%)
Hepatitis B	12 (26,1%)
hepatitis C and B	5 (10,9%)
alcohol	5 (10,9%)
metabolic disease cause unknown	7 (15,2%)
Diagnosis of cirrhosis:	2 (32,6%)
preoperative	31 (67,4%)
intraoperative	15 (32,6%) Indication for Lch:
acute cholecystitis	21 (45,6%)
chronic cholecystitis	25 (54,4%)
Duration of operation, min	75 (30—130)
Conversion to laparotomy	2 (4,34%)
Postoperative complications	11 (23,9%)
Average length of hospitalization days	2.5 (1-6)

In accordance with the ASA (American Society of Anesthesiologists) classification, 30 patients were included in the ASA-I group, and 16 patients were included in the ASA-II group. Preoperative examination of patients included laboratory tests, abdominal ultrasound, gastroduodenoscopy. Concomitant diseases, including hypertension, diabetes mellitus, coronary heart disease, varicose veins of the lower extremities alone or in combination, were noted in 27 (58.7%) patients. LC was diagnosed before surgery in 31 (67.4%) patients, during surgery - in 15 (32.6%) patients. Ascites was present in 8 patients, splenomegaly - in 32, varicose veins of the esophagus - in 17, jaundice - in 11 patients. Some patients with jaundice underwent ultrasound examination. At the same time, no pathological changes in the common bile duct were found in any of the cases. The diagnosis of cirrhosis was confirmed by intraoperative visual evaluation of the appearance of the liver and by the results of histological examination of liver biopsies taken during surgery. Indications for HL were acute calculous cholecystitis in 21 (45.6%) patients and chronic calculous cholecystitis in 25 (54.4%) patients. 12 (26.7%) patients were urgently operated on, 34 (73.9%) patients were operated on in a planned manner.

Special preoperative preparation using hepatoprotectors, albumin solution, diuretics for 2-4 weeks was performed in patients admitted with jaundice and ascites (Child-Pugh class B). These patients were operated on after elimination of ascites and correction of liver function parameters. LH was performed under general anesthesia, as standard, by the four-port method, in the American version with some modifications. Placement of ports in patients with cirrhosis not diagnosed before surgery was performed as in patients without cirrhosis.

In the case of the installed CP, the first trocar was inserted subumbilically, three other trocars under laparoscopic control through the avascular areas of the abdominal wall, while the subxiphoidal port was placed slightly to the right of the midline to avoid damage to the vessels in the round ligament of the liver. They tried to maintain the pressure in the abdominal cavity within 8–10 mm Hg, taking into account its possible negative effect on hemodynamics of the liver [14]. Adhesions with the gallbladder, which in some patients were highly vascularized, were dissected by electrocoagulation using a hook-shaped electrode, a dissector, or an ultrasonic scalpel. Blunt tissue dissection was avoided whenever possible to minimize bleeding. In 5 patients, a fifth, additional 5 mm trocar was inserted in the right hypochondrium to retract the hypertrophied segment of the left lobe of the liver, covering the field of view of the video camera. According to intraoperative visual assessment of the liver, macronodular cirrhosis was noted in 15 patients, micronodular cirrhosis - in 31 patients. Changes in the gallbladder, such as catarrhal cholecystitis, were regarded in 40 patients, as phlegmonous - in 5, as gangrenous - in 1 patient. Accumulation of turbid serous fluid in a small amount in the area of operation was noted in 4 patients. Expansion of blood vessels on adhesions with the gallbladder and liver occurred in 14 patients, including 6 in the area of the hepatoduodenal ligament. In the presence of an enlarged strained gallbladder, it was emptied by a thick-needle puncture or opening the lumen and evacuating the contents with an electric suction. The cystic duct and cystic artery were isolated using a hook-shaped electrode or a dissector connected to an electrocoagulator. The separation of tissues in a blunt way was carried out here using a dissector or a suction tip, making sure that there were no dilated vessels.

Bladder removal usually started from the neck. Dissection of tissues in the region of the Kahlo triangle was performed in small portions closer to the gallbladder after their identification and clipping. Isolation of the gallbladder from the bed in the liver was performed submucosally, if possible, which made it possible to avoid significant bleeding. When the majority of the gallbladder was located in the liver tissue or with dense adhesions of its wall to the liver, subtotal cholecystectomy was performed, leaving a section of the bladder wall on the liver (in 6 patients). The use of ultrasonic scissors made it possible to cut the bladder wall almost bloodlessly. The mucous membrane of the left wall of the bladder was subjected to mucoclasia in chronic cholecystitis,

curettage with a gauze ball moistened with iodine solution, in acute cholecystitis.

Bleeding from the bladder bed was stopped by electrocoagulation, pressing a gauze strip or a hemostatic sponge. At the end of the operation, a piece of the liver was excised for histological examination. Before removing the ports, the reliability of hemostasis was monitored for 3–5 min. The abdominal cavity was drained in all cases. The ports were removed under visual control to exclude bleeding from the puncture points.

### 3. Results

An attempt at HL, undertaken in 46 patients with cirrhosis, was successfully completed in 44 of them. In 2 cases, a transition to an open operation was required. The cause of conversion in one case was severe bleeding from the bladder bed, which could not be stopped by endoscopic means, in the other case, severe inflammatory infiltration in the bladder neck (Table 2).

**Table 2.** Intraoperative and postoperative complications after laparoscopic cholecystectomy in patients with liver cirrhosis

	abs.	%
Intraoperative		
significant bleeding from adhesions and during manipulations in the area of the Kahlo triangle	3	6,5
severe bleeding from the gallbladder bed	2	4,3
bleeding from port	2	4,3
Total	7	15,2
Postoperative		
functional disorders of the liver	3	6,5
inflow of bloody fluid through the drainage tube	2	4,3
appearance of ascites	2	4,3
wound complications	4	8,8
Total	11	23,9

Bleeding during HL occurred in 7 (15.2%) patients. Blood loss did not exceed an average of 50 ml (10-200 ml). Severe bleeding from the bladder bed occurred in one patient. Transfusion of blood components was required in 1 observation. The duration of HL averaged  $75.5 \pm 14.4$  min (range 30-130 min). Drainage tubes were removed on the 2-3rd day. In 2 patients, due to the outflow of bloody ascitic fluid, they were removed on the 5th and 6th days. Early postoperative complications were registered in 11 (23.9%) patients.

Deterioration of liver function (increased bilirubin content in the blood, encephalopathy) was noted in 3 patients, bloody fluid inflow through the drainage tube in the amount of about 200 ml per day - in 2, ascites - in 2, hematoma or infection of the paraumbilical wound - in 3, bleeding from the site of the 5 mm port - in 1 patient. These complications were eliminated by drug therapy or passed without treatment. Only in one patient with bleeding from the site of the 5-mm port, the bleeding wound was sutured. No reoperation was

performed. There were no deaths in this group of patients. The length of stay of patients in the hospital averaged 2.5 days (1-6 days). Patients were usually discharged from the clinic on the 2-3rd day after the operation, except for those who had symptoms of liver failure or leakage of ascitic fluid from the postoperative wound. These patients were hospitalized for 4-6 days after surgery.

### 4. Discussion

Cholecystectomy is the most common surgical intervention in patients with cirrhosis [15]. It can be dangerous in end-stage liver disease and in portal hypertension due to the greater likelihood of serious complications, especially bleeding and hepatocellular insufficiency. Perhaps for this reason, HL was initially contraindicated in patients with cirrhosis. Later, with the accumulation of experience, as well as the improvement of equipment in laparoscopic surgery, the minimally invasive method gradually replaced open cholecystectomy in this group of patients and became the preferred intervention for cholelithiasis. Recent publications have confirmed the safety and good tolerability of HL in patients with compensated liver cirrhosis [12,14]. The advantages of HL in cirrhosis are a reduction in the incidence of postoperative bleeding, infection, liver failure, and death [10,11]. In this study, we presented our own experience of LC performed in 46 patients with compensated cirrhosis, paying special attention to the indications for this operation, the technique of intervention, and complications. The cause of cirrhosis in most of the patients we observed was hepatitis B and C. (32.6%) cirrhosis of the liver was an unexpected operational finding. The diagnosis of early cirrhosis before surgery for HL is not established, according to some authors, in 18.5-40% of cases [16,17].

Ultrasound, as the most accessible non-invasive method, is highly informative in advanced forms of cirrhosis, while its value in the diagnosis of early cirrhosis is still debatable. Perhaps, with the introduction of a relatively new non-invasive method for assessing liver fibrosis, ultrasound elastography (Fibro Scan) will fill the gap in this area. The duration of the operation, the frequency of complications, and the conversion rate for HL in patients with cirrhosis are significantly higher than in patients without this disease [10,11]. The duration of HL in our observations averaged 75 min, which differs little from similar indicators given by other authors [18]. In 4.34% of our observations, a transition to an open operation was required. In recent reports, the conversion rate to laparotomy in HL ranged from 0 to 15.7% [14]. Absolute indications for changing the method of surgery for HL in patients with cirrhosis are bleeding that cannot be stopped by endoscopic means and the risk of manipulations in the hilum of the liver due to varicose vasodilation and anatomical complications.

Despite a significant decrease in the frequency of deaths in HL in patients with cirrhosis, postoperative complications in

these patients remain at a fairly high level (7.8-35%) [8]. Most often after these operations, liver failure, bleeding, development of ascites, wound infection are noted.

In total, we noted complications in 23.9% of patients. In most cases, they were minor, only in one patient the complication turned out to be serious, and a transition to an open operation was required.

After surgery, the frequency of deaths in HL in the group of patients with cirrhosis varies, according to the literature, from 0 to 4.3%, averaging 0.45% [14]. Most published studies report no deaths in compensated cirrhosis [19]. There were no deaths in our observations.

LH is by far the best option for cirrhosis surgery primarily due to the excellent focal visibility and magnified image provided by the monitor to clearly see the dilated vessels, as well as the availability of appropriate endoscopic hemostatic instruments (ultrasonic scissors, argon plasma coagulator).

In addition, with the endoscopic method, the risk of infection of the operating team with hepatitis B and C viruses, which may be in patients with cirrhosis, due to injury with piercing and cutting instruments, is significantly reduced. After HL, there are almost no adhesions in the abdominal cavity, which, probably, may be important in the future for liver transplantation in these patients. At the same time, there are some technical difficulties in LC with CP. The nodularity, hardness of the cirrhotic parenchyma may interfere with the removal of the gallbladder behind the fundus in the cranial direction, which is a necessary maneuver in HL. In addition, in patients with cirrhosis, hypertrophy of the left lobe of the liver, which covers the gate of the liver, is often observed. To eliminate these inconveniences, we, like other authors [8,12], use an additional 5 mm trocar or the introduction of a retractor.

Of particular danger in HL in patients with cirrhosis is bleeding from dilated venous collaterals located at the hilum of the liver. The use of ultrasonic scissors allows the dissection to be relatively bloodless. In the absence of confidence in the safety of work in the area of the Kahlo triangle, some authors suggest using options for subtotal cholecystectomy [17].

The results of our study and data from other authors show that HL is most suitable for the treatment of symptomatic cholelithiasis and acute cholecystitis in patients with mild to moderate cirrhosis (Child-Pugh class A and B).

At the same time, cholecystectomy in patients with decompensated cirrhosis (Child-Pugh class C) is a difficult task due to the very high risk of bleeding and liver failure, often leading to an unfavorable outcome [19,20].

According to the generally accepted opinion of researchers, elective cholecystectomy in this group of patients should be avoided, and emergency operations should be performed according to emergency indications in the absence of the effect of conservative therapy in progressive cholecystitis [14].

Several published studies have shown the effectiveness of percutaneous transhepatic cholecystostomy in such patients [21]. Even attempts were made to endoscopically stent the

cystic duct as an alternative to cholecystectomy in patients with cirrhosis [22]. HL in patients with cirrhosis differs in some features that should be taken into account when performing this operation. First, rigorous patient selection is required based on Child-Pugh operative risk assessment or end-stage liver disease (MELD) model. Secondly, a good surgical technique is needed to skillfully circumvent the difficulties and complications to which patients with cirrhosis are especially prone. Thirdly, modern equipment should be used, such as an ultrasonic scalpel or argon plasma coagulator, to minimize bleeding from incised tissues. Finally, great patience is required in this operation in order to successfully complete it laparoscopically, since the transition to open surgery may not always be successful with some complications, such as bleeding due to coagulopathy.

## 5. Conclusions

Thus, laparoscopic cholecystectomy can be successfully performed with careful selection of patients with compensated liver cirrhosis. It is advisable to perform this operation by an experienced laparoscopic surgeon in specialized hepatobiliary surgery centers.

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