

Review Article

Laparoscopic cholecystectomy in patients with liver cirrhosis: review of intraoperative measures and recommendations

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Received: 29 June 2021

Revised: 02 August 2021

Accepted: 06 August 2021

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ABSTRACT

Symptomatic biliary stones are related with higher morbidity and mortality rates in patients with liver cirrhosis, especially when patients undergo surgery. The difficulty of cholecystectomy is worsened by liver cirrhosis, especially in patients with extensive liver fibrosis and portal hypertension. Laparoscopic cholecystectomy can be performed safely in selected patients with cirrhosis. However, it can be challenging in many aspects and poses a greater degree of difficulty and thus should be performed by experienced surgical teams, who follow the recommendations and take in mind the special precautions which requested to increase safety of the operation and avoid or reduce the morbidity and mortality, and also who are able to tackle the more frequent intraoperative incidents or complications. In this review, we focus on the technical difficulties and intraoperative recommendations that could be used to approach laparoscopic cholecystectomy in this patient population (trocar placement, intraabdominal pressure, visualization, gallbladder dissection, adjunct for hemostasis, intraperitoneal drains, and conversion to open surgery), and the alternative which can be used in advanced cases.

Keywords: Liver cirrhosis, Gallbladder stone, Cholecystectomy, Laparoscopy, Laparoscopic cholecystectomy

INTRODUCTION

Gallstones are observed to be three times more common in persons with liver cirrhosis than in patients without cirrhosis.¹ This greater incidence is attributed to a number of factors, including intravascular hemolysis caused by hypersplenism, decreased hepatic bile salt synthesis and transport, and functional changes in the gallbladder (reduction in motility and emptying) caused by high oestrogen levels, and metabolic liver failure.^{2,3}

Symptomatic biliary stones are related with higher morbidity and mortality rates in patients with liver cirrhosis than in people with non-cirrhotic livers, especially when patients with advanced cirrhosis undergo surgery.^{4,5} Cirrhosis of the liver increases the risk of bleeding and infection in patients.⁶ The difficulty of

cholecystectomy is worsened by liver cirrhosis, especially in patients with extensive liver fibrosis (difficulty and fragility in retraction) and portal hypertension (increased bleeding). When surgery was unavoidable, open cholecystectomy (OC) was initially chosen over laparoscopic cholecystectomy (LC) due to these elevated risks.⁷ Because of the high rate of related mortality (from 8% to 83 percent in patients with a prothrombin time >12.5 seconds compared to controls) and morbidity (6.6–57 percent), OC in the cirrhotic patient population has not attained a positive reputation.⁸ Although initially contraindicated in cirrhotic patients, LC has increasingly replaced open cholecystectomy as the main surgical technique for gallstone disease.^{9,10} Several studies, most of which were retrospective, have shown that LC is superior to OC for a specific cohort of cirrhosis patients in terms of shorter hospital stays, reduced operation time, lower morbidity, and less

transfusion in the last decade of the twentieth century and the first decade of the twenty-first century.^{5,11,12} For selected cirrhotic patients with symptomatic GB stones, LC is now the standard of care instead of OC. This is backed up by a number of researches by Chmielecki et al, Laurence et al and de Goede et al.^{4,13,14}

Minimal tissue trauma and surgical stress, reduced postoperative immune suppression, less visceral exposure, less fluid and protein loss, less "third sector" sequestration, less respiratory compromise, less organ luxation, and less interruption of the abdominal wall collateral circulation are all advantages of LC.¹⁵ After calculating the risk, selecting the right patient is critical. The Child-Pugh classification aids in risk assessment and provides an indication of the patient's liver reserve.¹⁶ According to a study by Elisa Cassinotti et al LC is safe for children with Childs A; however, children with Childs B should be handled with caution, and children with Childs C should be approached only as a last resort in life-threatening and failing medical management.¹⁵ Eugen Târcoveanu et al show that LC is safe in patients with Child Pugh A cirrhosis and should be used with caution in patients with Child Pugh B cirrhosis, with a high but tolerable rate of morbidity and conversion rate.⁶ Several risk variables (i.e. intraoperative bleeding, transfusion needs, Child-Turcotte-Pugh (CTP) and Model for end-stage liver disease (MELD) scores influence the outcomes (rates of conversion to open surgery, morbidities, and mortality) after LC in cirrhotic patients.¹⁷ For a better outcome, proper patient selection and preoperative optimization (i.e. control of ascites, nutritional support, correction of coagulopathy, and upgrading of liver condition) are required, as well as intra-operative good hemostasis (using materials as oxidised cellulose (Gelfoam), surgical measure, and devices as Harmonic Scalpel and Argon).¹⁸ The conversion is done either on the spot due to ambiguous anatomy, inflammation, or adhesions that prevent a safe dissection, or as a result of major consequences such as biliary, visceral, or vascular lesions that can lead to life-threatening conditions.¹⁸ However, cholecystectomy in cirrhotic patients can be difficult in many ways, leading to a number of particular LC recommendations for this high-risk group of patients.¹⁵

When it comes to surgical therapy for symptomatic GB stones in patients with cirrhosis, there are a few things to keep in mind: Do we have any strategy to tackle the surgical difficulty that is increased in relation to local conditions in the surgical field? The procedures for LC in the cirrhotic patient, as well as potential alternatives, are issues that all surgeons today may face and prior to work-up, specific methods must be known. The purpose of this study was to examine the literature and to give an overview of the many surgical issues, measures, and recommendations that could be used to approach LC in this patient population. In this review, we review several relevant surgical issues specific to laparoscopic

cholecystectomy in cirrhotic patients with symptomatic GB stones.

TECHNICAL DIFFICULTIES

LC in cirrhotic patients is a difficult technique that should only be performed by surgeons who are familiar with both the operation and the peri-operative management of liver cirrhosis.¹⁹ The inherent technical problems of cholecystectomy in cirrhotic individuals are numerous and can be categorized as follows: 1) periumbilical collateral wound danger; 2) vascular adhesions risk; 3) liver difficult traction with Calot triangle difficult exposure; 4) vesicular pedicle risky approach in the context of portal hypertension; 5) vesicular bed haemorrhage risk.²⁰

INTRAOPERATIVE RECOMMENDATIONS

The following intraoperative recommendations were made by N' Guyen et al: use the open Hasson approach via an infra-umbilical incision to avoid periumbilical wall varices; transilluminate with the laparoscope to identify vascular collaterals or measure placement based on preoperative imaging; use the open Hasson approach via an infra-umbilical incision to avoid periumbilical wall varices; if undiagnosed cirrhosis is discovered during a regular LC, consider sealing the fascia and skin and transporting the patient to a tertiary medical centre with critical care, hepatology, and hepatobiliary and transplant surgery support, depending on the surgeon's experience and the resources.²¹

Palanivelu et al formalised certain technical aspects of LC for cirrhotic patients in these circumstances, including the placement of an optical trocar in the sub-umbilical position; the use of Ultracision for adhesions dissection; the placement of an additional 5 mm trocar to the right of the usual epigastric trocar to allow the use of a liver retractor; a systematic placement of an abdominal drain at the end of the procedure to avoid significant bleeding during gallbladder bed dissection or to limit the risk of biliary injury during cystic pedicle dissection, and a partial cholecystectomy to avoid significant bleeding during gallbladder bed dissection or to limit the risk of biliary injury during cystic pedicle dissection.²⁰

TROCAR PLACEMENT

Sleeman et al. proposed the following operating features because of their importance: operative setup: whereas trocars disrupt collateral circulation less than midline, the periumbilical area should be avoided; once the first trocar is introduced, transillumination of the abdominal wall permits collaterals to be avoided; placing the subxiphoid port to the right of the midline prevents injury to the falciform ligament and the (potentially re-permeabilized) umbilical vein; if the left lobe encroaches on the operative field, the surgeon should raise the patient's right shoulder and/or use a long port or converter inserted into

the epigastric port, or if that isn't enough, insert an extra port to retract the left; to avoid avulsion from the liver bed, severe traction on the gallbladder should be avoided intra-operatively.⁹

Târcoveanu et al experienced that the trocars were inserted outside of the high-risk haemorrhage area (Hasson approach), and the dissection was delicate with minimum liver manipulation to avoid or reduce bleeding and hence future sub-hepatic adhesions.⁶ To avoid and/or reduce bleeding Gad et al used various intra-operative measures (by Putting the subxiphoid port during insertion more to the right of the midline, and by putting the umbilical port during insertion on the right, left of the midline or below the umbilicus by open Hasson technique trying to avoid injury to the falciform ligament recanalized umbilical vein).¹⁹

INTRABDOMINAL PRESSURE

CO₂ pneumoperitoneum during LC can result in ischaemia reperfusion harm to internal organs including the liver and kidney. This could exacerbate the hepatic function damage. Because this injury was linked to a rise in pneumoperitoneum pressure.²² The effect of a sudden increase in intraabdominal pressure of 10 mmHg for half an hour in 14 patients with portal hypertension was evaluated by Luca A et al who found that such an increase in the (IAP) results in a 20% reduction in hepatic blood flow.²³ In cirrhotic individuals, Al-Dorzi et al observed the similar findings of decreased abdominal perfusion pressure with increased intra-abdominal pressure.²⁴ The cirrhotic's hepatic buffer response is compromised when the hepatic portal inflow is reduced (increased hepatic artery inflow to compensate the decreased portal inflow). Cobb et al advise that the intra-abdominal pressure be kept as low as feasible, and that exsufflation be done carefully and intermittently.²⁵

VISUALIZATION

To avoid collateral circulation, Eugen Târcoveanu et al recommend using intraoperative ultrasound imaging to safely describe the local architecture and transillumination of the abdominal wall.⁶ Indocyanine green fluorescence cholangiography has been put into clinical practise as a potential technology for facilitating visualisation of biliary structures and reducing time to obtain the critical view of safety.¹⁵

GALLBLADDER DISSECTION

Because the liver in cirrhotic patients becomes fibrotic and stiff due to excessive collaterals from portal hypertension (PHN), and the gallbladder tissue becomes woody and friable as the disease progresses, intra-operative meticulous and careful gallbladder dissection with devices like the Harmonic scalpel is required to avoid bleeding and improve outcome in those cirrhotic patients.²⁶ The Harmonic scalpel is an innovative

ultrasonic cutting and coagulating surgical device with a number of benefits (easier dissection, less lateral thermal tissue injury, more precision, and less smoke production), resulting in shorter operating times and less open surgery conversion.^{27, 28}

ADJUNCT FOR HEMOSTASIS

The regional anatomic alteration, variceal arteries, and bleeding tendency associated with portal hypertension may make cholecystectomy even more challenging, with more bleeding and a worse prognosis in cirrhotics compared to the general population.²⁹ Hemorrhage can occur as a result of abdominal wall varices caused by PHN, coagulopathy caused by inadequate coagulation factor production, and thrombocytopenia caused by PHN.^{7,30} Several adjuncts have been used in various surgical specialties. Several researches have been reported on the use of harmonic scalpels in LC for cirrhotic patients. Harmonic scalpels have been shown in several trials to have advantages such as quicker surgery times, reduced blood loss, and even fewer intraoperative GB ruptures.^{31,32}

Abdul Razaque Shaikh employed a harmonic scalpel during surgery to dissect the gallbladder from the liver bed in his study to avoid these issues in cirrhotic patients. During a gallbladder dissection, the bleeding is usually venous and can be easily controlled. Spongstan can be used to stop problematic bleeding. If the blood is gushing, a figure-eight stitch can help.³³ In another study, Gad et al and Machado et al advocate using a Harmonic scalpel to decrease haemorrhage occurrences.^{19,34} According to a study conducted by Mohamed I. Kassem and Hassouna, LC employing a totally clipless approach and the Harmonic ACE in cirrhotic patients with severe calculous cholecystitis. In the hands of a skilled professional, it is a safe and realistic strategy.³⁵ In addition, when Harmonic was utilised in their LC cases, Power et al., demonstrated a faster surgical time, minimum blood loss, and a low conversion.²⁷ In a research by Catena et al utilising harmonic during LC for AC resulted in much reduced blood loss and a lower conversion to open surgery as compared to mono polar diathermy.²⁸ Other hemostatic adjuncts, such as oxidised regenerated cellulose and Floseal® (Baxter International, Inc., Deerfield, IL, USA) hemostatic matrix, have been proposed in LC with positive results in addition to energy devices.^{36,37} Control of bleeding gallbladder bed was achieved by either argon cauterization or TachoSil®, according to Eugen Târcoveanu et al study.⁶

INTRAPERITONEAL DRAINS

In cirrhotic patients, the use of an abdominal drain in place of a stent is debatable. On the one hand, the higher risk of postoperative hemorrhagic complications in this difficult dissection setting may prompt enhanced monitoring during the process. On the other hand, the risk of ascites fluid ascending infection would deter the

routine removal of a drain.³⁸ Intraoperative drains, like other surgeries in the cirrhotic, should be avoided, especially with ascites, according to Liu CL et al.³⁹ In a research by Ashraf Goda et al, Kassem MI and Ehab MH, a subhepatic drain was kept in place in all subjects with no postoperative problems.^{16,20}

CONVERSION TO OPEN SURGERY

Despite increased experience and advancements in laparoscopic surgery and technology, conversion from LC to open surgery remains a source of concern; however, it is not a complication, but rather a means of avoiding more dangerous catastrophes; it can be classified as either elective (unclear anatomy due to adhesions or inflammations, difficult dissection, advanced pathology) or forced (emergent) conversions.^{40,41} In his assessment, François Cauchy points out that the conversion details were provided in 12 trials. The most common causes were the presence of a vesicular bed haemorrhage in 19 (41.3%) of patients, poor visualisation of structures in 12 (26.1%) of patients, adhesions in 6 (13.0%) of patients, and inflammation too high to allow safe laparoscopic surgery in 3 patients (6.5%) and another cause for 6 (13.0%) patients.^{38,40-42}

ALTERNATIVES

When the patient is a Child C or has a MELD of greater than 13, laparoscopic surgery is not recommended, and partial cholecystectomy is one option.⁴² Endoscopic drainage of the gallbladder, the latter especially in patients who may someday be candidates for liver transplantation.^{43,44} The presence of portal hypertension-related variceal arteries and a tendency to bleed make surgery difficult for cirrhotic individuals. If a good exposure of the hepatocystic triangle cannot be obtained, a subtotal cholecystectomy via laparoscopy may be an option to avoid iatrogenic biliary damage, albeit probable long-term consequences should be considered.⁴⁵ In a study by Eugen Târcoveanu et al., they use staplers to conduct subtotal cholecystectomies on rare instances (3 cases). These patients had acute cholecystitis, and this surgery was chosen to avoid any intraoperative visceral, biliary, or vascular accidents, as well as dangerous portal pedicle dissection.⁶ Percutaneous cholecystostomy has been recommended in high-risk patients with acute cholecystitis.⁴⁶⁻⁴⁸ has been favored. However, in patients with portal hypertension and/or ascites, the risk of bleeding and/or sepsis is significant. This has sparked discussion about whether the transhepatic or transperitoneal approach should be employed. Many people prefer the transhepatic method because it reduces the possibility of intraoperative bile leak and unintentional harm to the colon's hepatic flexure.⁴⁹

COMMON BILE DUCT STONES

The risk of morbidity and mortality in individuals with Common bile duct stone (CBD) stones is considerable,

ranging from 2 to 30-50 percent. Endoscopic management is preferred in this situation. Despite the fact that mortality is still approximately 15%, (vs. overall complication rate of about 10 percent and a mortality rate of 0.5 percent in non-cirrhotics).¹⁵ Endoscopic papillary balloon dilatation without sphincterotomy has a lower risk of bleeding, but is ineffective in the case of big stones. For bigger stones, endoscopic treatment with mechanical lithotripsy or sphincterotomy is advised.⁵⁰

CONCLUSION

Cholecystectomy in cirrhotic patients can be difficult in many ways, leading to a number of particular LC guidelines for this high-risk group of patients. LC in cirrhotic patients should be performed by experienced surgeons who can handle the more common intraoperative incidents or complications, such as pneumoperitoneum pressure, trocar placement, and the use of ICG fluorescence intraoperative cholangiography to increase safety during bile duct dissection.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Abdelrahman TM. Laparoscopic cholecystectomy in patients with liver cirrhosis: review of intraoperative measures and recommendations. *Int Surg J* 2021;8:2860-5.