Laparoscopic cholecystectomy in obese patients

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Abstract

Laparoscopic cholecystectomy became widely accepted as the preferred treatment for cholecystitis and gallstone disease. This innovative method not only ushered in a new era of minimally invasive surgery, but it also altered the range of potential problems. Our article discusses laparoscopy-related complications, including procedure-related issues and access injuries. The literature is reviewed in accordance with typical accidents. The primary subjects of this article (still on a level of 0.2%–0.8%) include pneumoperitoneum setup (morbidity up to 0.2%); bleeding from trocar sites and vascular injury (mortality up to 0.2%); and biliary leaks and bile duct injuries. An overview of the most often described categories of bile duct injuries is provided, along with a graphic summary of the aetiology, diagnosis, and therapy. Lastly, the topic of bowel injuries—a unique consequence of laparoscopy with an incidence of up to 0.87%—is covered. Nowadays, laparoscopic cholecystectomy is the go-to procedure for any gallstone condition. However, there are still several questions that are being debated: What are the best course of action? More importantly, is the laparoscopic method actually better than the open treatment based on evidence-based medicine standards? What should we do if choledocholithiasis is occult? Does the idea of treating silent gallstones need to be updated in light of laparoscopic cholecystectomy, and is intraoperative cholangiography required?

Keywords: Laparoscopic cholecystectomy (LC), Open Surgery (OS), and Common bile duct (CBD).

1. Introduction

A minimally invasive surgical procedure called laparoscopic cholecystectomy is used to remove a damaged gallbladder. Due to its safety profile and quicker recovery times, this technique has mainly replaced the open approach for regular cholecystectomies since the early 1990s [1]. Acute and chronic cholecystitis, symptomatic cholelithiasis, hypo- or hyperfunctional biliary dyskinesia, acalculous cholecystitis, gallstone pancreatitis, and gallbladder polyps or tumors are among the conditions that can be treated by laparoscopic cholecystectomy [2]. Open cholecystectomy has historically been used to treat these identical problems. Due to its lower morbidity, the laparoscopic approach is still the favored method in the majority of cases; nonetheless, despite improvements in surgical skill and visualization, bile duct injury is still a major complication, with rates that have not decreased much over the previous 30 years [3]. The conventional procedure in cases of gallbladder cancer, whether confirmed or suspected, is still an open cholecystectomy. An estimated 20 million Americans suffer from gallstones, and over 300,000 cholecystectomies are carried out annually. Roughly 10% to 15% of people with gallstones have no symptoms, but 20% of them have. Complications such acute cholecystitis, pancreatitis, choledocholithiasis, or gallstone ileus occur in 1% to 4% of the symptomatic population [4]. Gallstones are more frequent in women than in males, and their prevalence rises with age. Gallstones affect about 20% of women and 5% of men between the ages of 50 and 65. Approximately 75% of gallstones are cholesterol-based, with pigmented stones making up the remaining portion; however, clinical symptoms are identical for all forms of gallstones[5].
Biliary stones can form as a result of rapid weight loss after bariatric surgery and obesity [6,7]. The primary metabolic precursor of cholesterol gallstones is elevated biliary cholesterol concentration, which is caused by fast weight loss [8,9]. Gallstones can also be caused by gallbladder hypomotility, increased calcium secretion, biliary mucus, arachidonic acid derivative, and disrupted enterohepatic circulation of biliary salts [10]. Patients are so susceptible to developing stone problems following bariatric surgery, including gallstone migration, acute cholecystitis, acute pancreatitis, and biliary colic. In cases of gastric bypass (GB) or biliopancreatic diversion (BPD), gallstone migration becomes a challenging condition to treat. Standard endoscopic retrograde choledochopancreaticography therapy is hampered by the anatomical changes [11]. A preventative cholecystectomy performed alongside bariatric surgery may help prevent the development of gallstones and the difficulties associated with them. Additionally, hospitalization and expenses associated with additional surgery would be decreased with concurrent cholecystectomy. However, due to

visceral obesity, poor port placement, extended operating time, and the gallbladder's frequent engulfment by the big liver, concomitant cholecystectomy during laparoscopic bariatric surgery is technically challenging [12].

2. Methods

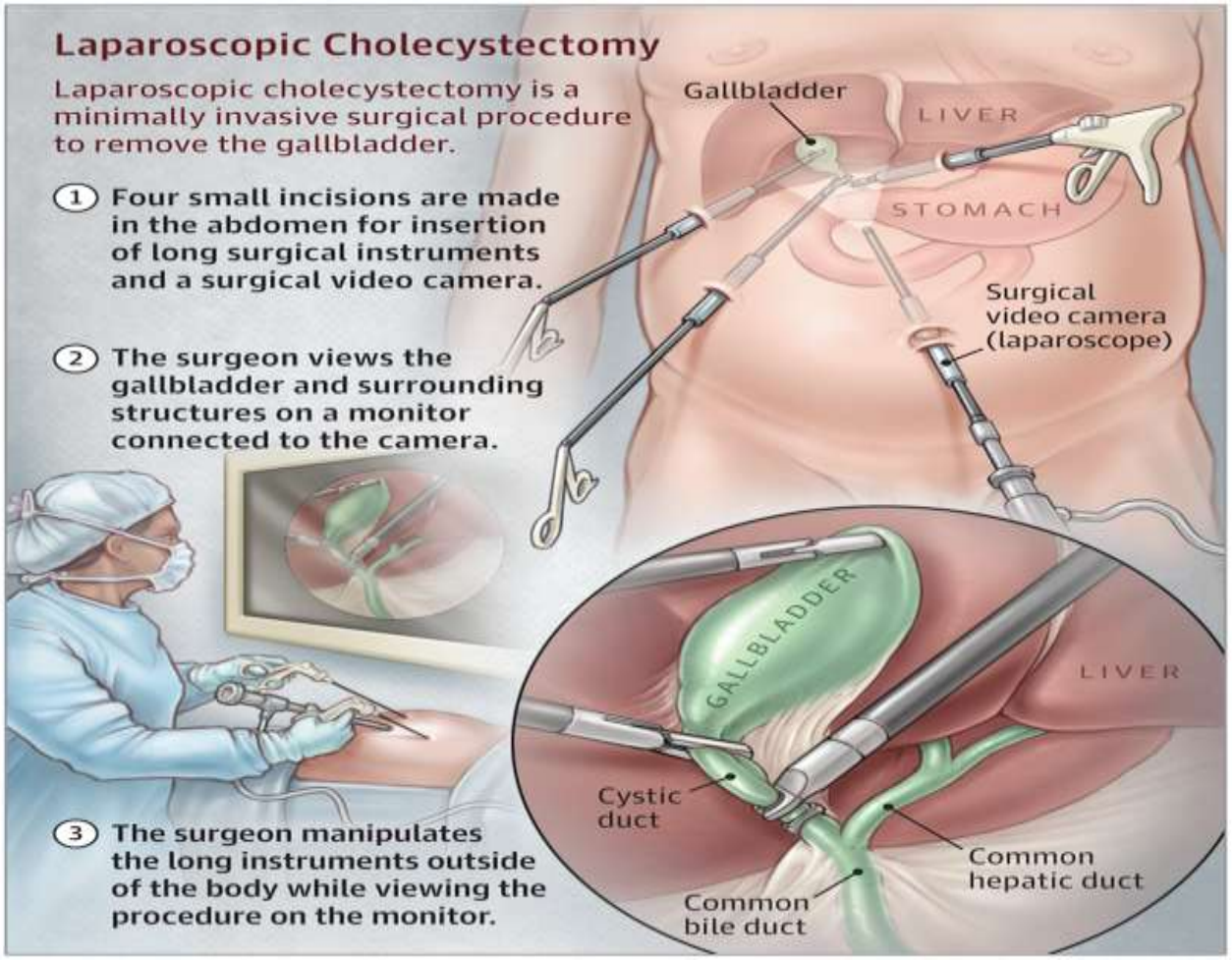
An extensive exploration of pertinent reviews and articles was conducted through the utilization of the PubMed and Google Scholar databases. In this review, we can mainly focus on 'Laparoscopic cholecystectomy in obese patients' diagnosis and management. Also, by tracking the citations of the papers that were retrieved, more pertinent articles were found using Google Scholar.

3. Laparoscopic Cholecystectomy Technique

To achieve the best exposure of the right upper quadrant, the patient is placed supine with a small reverse Trendelenburg and left tilt after general anesthetic induction and endotracheal intubation. The abdomen is sterilely prepared and covered. The peritoneal cavity is accessible under direct sight after a 5-mm laparoscope is inserted at the supraumbilical location using an optical trocar. By insufflating carbon dioxide to an intraabdominal pressure of 15 mm Hg, pneumoperitoneum is created. Four trocars are usually positioned: two working ports in the right upper quadrant, usually in the midclavicular and anterior axillary lines; a subxiphoid (epigastric) port for dissecting tools; and a 10-mm supraumbilical port for the camera. To reveal the Calot triangle, the table is positioned to maximize exposure, and the gallbladder's fundus is grabbed and retracted laterally toward the right shoulder and cephalad [13].

4. Clinical Significance of Laparoscopic Cholecystectomy

Cholelithiasis, cholecystitis, biliary dyskinesia, and gallstone pancreatitis are among the gallbladder disorders for which laparoscopic cholecystectomy is the only effective treatment. The most common causes of gallbladder disease are hyperconcentrated bile formation and gallbladder motility failure. The main mechanism causing cholesterol stones is cholesterol supersaturation, whereas pigmented stones are linked to biliary infections or persistent hemolysis. A major factor in the formation and persistence of stones is gallbladder stasis. Symptomatically, patients frequently exhibit epigastric or right upper quadrant pain, which typically follows fatty meals and radiates to the right shoulder or back. If the pain persists for longer than twenty-four hours, acute cholecystitis may be developing. Fever, diarrhea, nausea, and bilious vomiting are possible further symptoms. A thorough history and physical examination are the first steps in the diagnostic evaluation process. The Murphy sign, which manifests as inspiratory stoppage following deep probing of the right upper quadrant, is a crucial physical finding. Leukocytosis, increased bilirubin, and high liver enzymes are frequently found in laboratory tests; if pancreatitis is suspected, amylase or lipase levels are examined [14].



5. Diagnosis

The following claims should be taken into consideration in order to comprehend why there is still no agreement regarding the diagnosis of CBDS and why numerous tests have been and are being suggested: Up to 20% of the general population has gallbladder stones [15], and up to 20% of these individuals also have concurrent CBDS; in up to half of these later cases, CBDS is asymptomatic [17]. According to these findings, up to 2% of the general population may experience unknown CBDS at some point in their lives; CBDS should be identified and treated because it can result in potentially fatal consequences such acute pancreatitis or acute cholangitis [17, 18, 19]. The most popular imaging methods for identifying CBDS increase in accuracy, invasiveness, potential therapeutic use, and cost in a parallel fashion: they are lowest for transabdominal US and highest for ERC, where the counterpart of intrinsic therapeutic implications (endoscopic sphincterotomy) is non-negligible morbidity/mortality [20,21]; Unless jaundice, cholangitis, or a high risk of synchronous CBDS provide a strong indication, these latter factors exclude the systematic use of imaging modalities other than transabdominal US as first-line imaging and ERC as second-line evaluation prior to cholecystectomy [22, 23].

6. Treatment

The best option for gallbladder pathology is laparoscopic cholecystectomy. Cholecystectomy alters the flow of bile acids between the liver and gut and affects bile concentration and excretion. The loss of gallbladder fluid storage and modifications to bile acid metabolism are the conventional explanations for altered intestine function. Specifically, the fecal content of deoxycholic acid rises, increasing rectal sensitivity and resulting in an urge to defecate [24]. Therapeutic objectives for the post-cholecystectomy condition are revealed by the subsequent physiological changes. Drugs that target bile acid receptors and transporters or that try to alter bile acid pools may be used to treat BAD,

which is typically thought to be incurable [25,26,27]. The quality of life is greatly impacted by the diarrhea, which is thought to be difficult to treat and only lessened in half of cases. As a result, long-term monitoring is required, along with treatment method modifications and the creation of novel strategies [28].

7. Discussion

We sought to determine the primary preoperative patient-related risk factors for conversion from LC to OC in patients with gallstone disease in the gallbladder in the current systematic review and meta-analysis. Redefining the surgical approach and enhancing patient safety may be possible with the use of these factors' assessments. Conversion may occasionally be required to alleviate intraoperative problems and prevent harm [29]. Overall, the included studies have examined the relationship between the likelihood of conversion and a number of risk variables, including male sex, older age, BMI > 30 kg/m2, gallbladder wall thickness > 3 mm, prior abdominal surgery, and comorbidities. It was challenging to compile the evidence in a methodical manner, though, because the results were contentious and the data that was accessible was diverse. Furthermore, not every study has examined the same risk variables that influence conversion. In order to quantify the conversion rate and then look at the primary risk factors for conversion, we conducted a systematic review of 35 research. Our findings revealed a pooled conversion rate of 6.0%, despite the fact that each study's stated conversion rate varied from 1% to 23.3%. Eleven of the studies that were part of the systematic review and had information on the relationship between clinical variables and conversion risk were included in separate meta-analyses. First, ten research examined the association between the likelihood of converting from LC to OC and male gender [30,31,32,33]. Male gender was found to be a risk factor for conversion in a number of studies, with ORs ranging from 1.6 to 5.9 [34]. Nevertheless, other research likewise showed no correlation between conversion and male gender [35, 36]. When we combined all the trials, we found that male patients had 1.91 times the odds of converting compared to female patients. Although the exact cause is unknown, it might be related to the way that body fat is distributed differently in men and women, which makes laparoscopic procedures more challenging for men than for women. Men may also be less prone than women to seek medical advice, according to certain theories [37]. Men's conversion was also commonly attributed to inflammation and thick adhesions [38]. Five studies examined the association between age and the likelihood of converting from LC to OC among the primary factors [39]. With ORs ranging from 3.0 to 6.2, every study showed a strong correlation between conversion and age above 60. Our meta-analysis supported this conclusion, demonstrating that being older than 60 raised the likelihood of conversion (OR = 4.3). It is conceivable that gallstones and cholecystitis episodes are more common in elderly adults [40]. Our meta-analysis comprised six studies that examined the impact of acute cholecystitis on conversion rate [41]. A single research found no statistical correlation between conversion and acute cholecystitis [42]. When we included all of the trials, we found that patients with acute cholecystitis had 5.5 times the chance of converting compared to their counterparts. Acute cholecystitis may have high conversion rates from LC to OC because to a technical challenge in treating severe inflammatory adhesions surrounding the inflamed gallbladder, which makes it more challenging to dissect Calot's triangle and identify the anatomy. Comorbid conditions including diabetes and hypertension were linked to a higher conversion rate in this case, most likely because they both increased the patient's risk of infections and overall poor health. The association between diabetes and the likelihood of converting from LC to OC was assessed in seven studies [43]. Diabetes was identified as a risk factor for conversion in a number of investigations, with ORs varying from 1.9 to 5.5 [44]. There were, meanwhile, other investigations that showed no connection between conversion and diabetes. When we combined all of the research, we showed that diabetes raised the likelihood of conversion, with an OR of 2.6, showing that the presence of acute inflammation or wall alterations from microvascular illnesses is the cause of this association. Furthermore, autonomic and peripheral neuropathy may prevent some diabetic patients from experiencing gallbladder disease symptoms in a timely manner, delaying diagnosis and increasing conversion risk. Similarly, three trials with ORs ranging from 1.2 to 7.0 indicated a correlation between hypertension and a higher likelihood of converting from LC to OC. Our meta-analysis supported this conclusion, reporting an OR of 1.9. Additionally, obesity and cardiac conditions may be regarded as risk factors for conversion from LC to OC among coexisting conditions in individuals having cholecystectomy. According to earlier descriptions, obesity is a significant issue in conversion, most likely because of factors including excessive intra-abdominal fat, trouble mobilizing the liver, difficulty putting trocars, and difficulty moving the tools because of the thickness of the abdominal wall [5]. The association between obesity and conversion was examined in earlier research, but the findings were debatable, most likely because there weren't many obese patients [45]. According to our meta-analysis, patients with diabetes had 2.2 higher conversion probabilities than their counterparts. Similarly, we showed that patients with a history of heart illness had a 2.9 higher chance of converting when we combined all the research examining the significance of heart disorders as risk factors for conversion. Due to peritoneal adhesions that make gallbladder dissection challenging, prior abdominal surgery has been regarded as a risk factor for conversion in this case. The

chance of conversion linked to prior upper abdominal surgery was assessed in seven trials, with ORs ranging from 1.6 to 15.5 [46]. A history of upper abdominal surgery was associated with a higher risk of conversion, as shown by the pooled OR of 3.3 following the application of the meta-analysis. Overall, the results of our study supported the findings of a prior meta-analysis that found the following preoperative prognostic factors: male gender, age >65, acute cholecystitis, history of diabetes, thicker gallbladder walls, and prior upper abdominal surgery. Rothman and colleagues' meta-analysis also showed that acute cholecystitis, age > 60 years, male gender, and gallbladder wall > 4–5 mm were risk variables for conversion from LC to OC [47]. Planning the surgical scenario and enhancing the post-operative period may benefit from the existence of several preoperative variables that are not adjustable, according to the analysis of clinical considerations. Strong recommendations for methodical quality improvement initiatives were offered by our systematic study and meta-analysis. By encouraging effective patient counseling during precise risk factor evaluation, the current findings may enhance clinical practice. By improving patient clinical conditions, a deeper comprehension of preoperative risk factors for conversion from LC to OC may assist prevent conversion. On the other hand, a more accurate assessment of conversion risk and recovery time might be established by optimizing individuals with comorbidities prior to surgery. Because of this, better patient care prior to surgery should be required. The validation of certain suggestions for physicians and their subsequent training may be an example of a crucial strategy. Ad hoc surveys might then be created to assess how well clinicians are following the recommendations for treating these individuals. It is commonly known that in this situation, laboratory and radiological parameters should also be investigated for their possible influence on the probability of conversion from LC to OC [48]. It is important to take into account the constraints of our work. First off, over the long period under consideration, there were significant advancements in laparoscopic cholecystectomy technology and expertise, as well as a fluctuating conversion rate. The studies that were included had a variety of research durations. We acknowledge that it may be crucial to eliminate research done prior to a specific year or use a meta-regression to assess the influence of the study period. Nonetheless, much of the research was carried out over a broad period of time [49]. We are therefore unable to use meta-regressions and/or subgroup analyses. The retrospective nature of the data collection is another drawback, which could make it difficult to accurately categorize the preoperative diagnosis and result in a highly diverse group under analysis. The meta-analysis includes studies where patients underwent elective surgery or both elective and emergency surgery, even though we eliminated all epidemiological studies where cholecystectomy was performed solely as an emergency procedure. We conducted a special meta-analysis to assess the effect of admission status on conversion rate; however, no significant correlation was found. Furthermore, we were unable to do meta-analyses for additional significant risk factors for conversion, such as radiographic and laboratory variables, due to a lack of data (e.g., ORs and 95%CI) [50,51,52]. Patients with acute cholecystitis typically range in age from 40 to 80 years. Women are three times as likely than men to have this disorder. When upper right quadrant pain persists after analgesia, patients with gallstones should be suspected of having acute inflammation. There have been sporadic episodes of biliary colic throughout history. A moderate fever, tachycardia, and noticeable pain in the upper right quadrant are typically found during physical tests. A palpable hydropic gallbladder is seen in 25% of individuals. The classic Murphy symptom is typified by a sudden cessation of respiration upon direct examination of the gallbladder. Leukocytosis and slightly elevated bilirubin, alkaline phosphatase, transaminase, and amylase levels may be found in laboratory results. Ultrasonography plays a crucial role in diagnosis. The diagnosis of acute cholecystitis is supported by the presence of gallstones or gallbladder sludge, thickness of the gallbladder wall of 4 mm or more, and the finding of pericholecystic fluid. For the diagnosis and assessment of the disease's severity, the Tokyo criteria were established [53]. Patients are diagnosed with AC based on these criteria if they exhibit Murphy's sign, any local symptoms like mass, discomfort, or soreness in the right hypochondrium, and any systemic symptoms like fever, leukocytosis, or elevated C-reactive protein. AC is also categorized in this research according to its severity. This means that with mild cholecystitis (grade 1), there is no organ failure and the inflammation is restricted to the gallbladder. There is significant inflammation but no organ impairment in moderate cholecystitis (grade 2). Organ malfunction occurs in severe cholecystitis (grade 3). This classification states that patients with moderate or severe AC and high comorbidity may benefit from percutaneous transhepatic bile drainage (PTHBD) [54]. It is stressed that doing so can result in a noticeable decrease in morbidity and a noticeable clinical improvement [55,56]. When treating acute cholecystitis, it is common practice to start with fluids, analgesics, and broad-spectrum antibiotics. LC was identified as a relative contraindication for AC in the early years of laparoscopic surgery. However, LC has been shown to be safe in the treatment of AC, particularly in recent years [57]. The best time for this process is still up for discussion, though. According to certain research, the best time for LC is six to nine weeks following conservative treatment, taking into account the patients' overall health and comorbidities and assuming that the acute inflammation will go away in six weeks [58,59]. However, proponents of early LC claim that fibrotic adhesions that form between the gallbladder and surrounding structures after inflammation and edema may make dissection extremely challenging for patients who are ready for late LC following conservative therapy [60]. They contend that early LC carried out at

the right time in carefully chosen patients will make it easier to dissect the edematous plane, lower morbidity, and lessen the chance of late complications such gangrenous or emphysematous cholecystitis [61]. One of the most terrifying side effects of LC is biliary tract damage. Because of sepsis, it may potentially be lethal. Even remedial surgery can have a negative impact on quality of life and result in high rates of morbidity and mortality [62.63]. In particular, biliary tract injuries and related morbidities have decreased in early LC due to more expertise, enhanced abilities, and new technologies [64]. Early laparoscopic cholecystectomy performed within 24 to 96 hours in acute cholecystitis ensures shorter hospitalization despite having similar complication rates to late laparoscopic cholecystectomy, according to a meta-analysis by Japanese researchers. Patients were split into three groups by Condilis et al.: those who had surgery within the first 48 hours (group 1), 48 hours to 4 weeks later (group 2), and 5 to 8 weeks later (group 3) [65]. Group 1 had the highest rates of problems and postoperative hospitalization, while Group 2 had the highest rates of switching to open surgery. The patients were split into three groups once more in the research done by Popkharitov et al. and Lee et al. [66,67]. Patients who underwent surgery within the first 72 hours were categorized as early-operated patients. In terms of complications, length of hospital stay, or switching to open surgery, neither trial showed a significant difference between the groups [68,69,70]. Masayuki et al.'s study found no differences between the groups in terms of hospitalization time, blood loss, postoperative morbidity, switching to open surgery, or operation duration [71]. It was recommended in all three studies that patients with acute cholecystitis undergo LC at the time of admission. In our analysis, patients who had an early cholecystectomy had greater problems [18.2%–3%], albeit this difference was not statistically significant. We blamed poor patient selection and a lack of experience for the higher complication rates in the early LC as compared to the literature. Reviewing the conducted studies reveals that the rates of transition to open surgery vary significantly [0-39%] [72,73]. This significant discrepancy can be explained by the various patient demographics, the degree of inflammation, the surgeons' experience, and the timing. According to Abdulmohsen et al.'s study, their center has excellent gallbladder surgical expertise, with a rate of 6.7% [74]. These rates were discovered to be 16% for early surgery and 7% for late surgery. There was a difference between the two groups that was statistically significant [P: 0.020]. According to our research, the most frequent justification for converting to open surgery was the inability to complete Callot's dissection correctly because of anatomical challenges related to inflammation [75].

8. Conclusion

Laparoscopic cholecystectomy is one of the best choice in obese patients to do their surgery easily and recover soon. Selecting individuals for early surgery should be done carefully, though, as there is a risk of consequences from transitioning to open surgery and from patients who are admitted with severe inflammatory attacks and high comorbidities. It is well known that laparoscopic cholecystectomy considerably lowers patient expenses.

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