Multiple landmark identification and Clavien–Dindo classification system for complications after laparoscopic cholecystectomy

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Background
Since 1989 the World Health Consensus Conference established laparoscopic cholecystectomy as the standard operation for cholecystectomy. Laparoscopic cholecystectomy was associated with the significant rise in the rate of biliary complications compared with open surgery due to lack of experience and absence of standard anatomical landmarks and inefficient knowledge about the laparoscopic anatomy. The dependence on more than one landmark is suspected to be associated with the low rate of complications, and this is best monitored by the Clavien–Dindo grading system.
Patients and methods
Participants included 250 patients, who were admitted to the Department of Surgery at Al-Azhar University Hospital, Assiut branch. Laparoscopic cholecystectomy for variable etiologies such as gallstone disease was done depending on more than one landmark for cystic duct and cystic artery identification.
Results
Laparoscopic cholecystectomy was performed on 250 patients due to variable etiologies over a period of 13 months. Out of 250 patients, 145 (58%) were females and 105 (42%) were males. There were only three major complications that included postoperative hemorrhage, pulmonary embolism, and one bile leak.
Conclusion
Biliary complication is a preventable condition during laparoscopic cholecystectomy. Dependence on more than one landmark leads to avoidance of dissection and injury to important structures and hence leads to the absence of postoperative complications.

Keywords:
Clavien-Dindo score, laparoscopic cholecystectomy, complications

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Introduction

Laparoscopic cholecystectomy has been the gold standard treatment for gallstone diseases in acute and elective surgeries. With the appearance of this new technique in 1990s, there was a high increase in the incidence of surgery-related complications, which was higher than conventional open cholecystectomy [1–6].

Laparoscopic cholecystectomy is associated with more biliary, vascular, and visceral complications when compared with open cholecystectomy. A different anatomy in the laparoscopic view around the gall bladder especially the Calot's triangle contributes to the misidentification of structures [2].

The development of newer surgical instruments with high-definition monitors and a decrease in the learning curve for the surgical procedure, there has been a dramatic decrease in the incidence of biliovascular injuries [1–3].

Calot's triangle, which is a good landmark during laparoscopic cholecystectomy, gives a different view of the area and as the gallbladder is flipped over during this method, it may lead to further anatomical distortion [6,7].

The cystic lymph node also known as the lymph node of Lund is an important landmark related to the cystic artery. Cystic lymph nodes, when used appropriately, greatly reduce the occurrence of bile duct injury in laparoscopic surgeries [8,9].

The Rouviere's sulcus is a fissure on the liver between the right lobe and the caudate process and is visible during a laparoscopic cholecystectomy during posterior dissection in a majority of patients. Being an extrabiliary reference, it does not get affected by distortion due to pathology [10,11].

The critical view of safety, described as two parallel structures running parallel toward the gall bladder, helps to reduce biliovascular injury. The term critical view of safety was used first described in 1958. During the past 20 years, this method has been adopted increasingly by surgeons for performing laparoscopic cholecystectomy [4,7].

The most common cause of serious biliary injury is misidentification. Usually, the common bile duct is mistaken to be the cystic duct and, less commonly, an aberrant duct is misidentified as the cystic duct [4].

Complications during operation are avoided by understanding the surgically relevant anatomy. Identification of factors predictive of difficult cholecystectomy: a correct technique that includes correct exposure of the hepatocystic triangle in dissection, judicious use of energy sources, achieving the critical view of safety; handling of a difficult situation, stopping rules, second opinion/surgical assistance, and the use of intraoperative imaging to clarify the anatomy [8].

The Clavien–Dindo classification is a standardized system for the registration of surgical complications. The classification was initially developed by Clavien in 1992 for reporting negative outcomes after cholecystectomy and was modified by Dindo and colleagues to increase its accuracy and acceptability in clinical practice [5,6]. The major characteristic of the system is that the severity of a complication is graded based on the type of therapy required to treat the complication [7–9].

The main objective of this study was to assess the occurrence of complications and the degree of complications and also the change of incidence with the use of multiple specific landmarks.

Patients and methods

This study was conducted from August 2020 to September 2021 in the Department of Surgery, Faculty of Medicine, Teaching Hospital, Al-Azhar University, Assiut Branch.

The 250 patients who were admitted to the Department of Surgery planned to undergo laparoscopic cholecystectomy for variable etiologies as gallstone disease after taking informed consent.

Investigations included blood tests, renal function tests, radiograph chest, ECG, serum bilirubin, serum alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase, and abdominal ultrasound. When ultrasound was not able to diagnose any associated pathology, magnetic resonance cholangiopancreatography was done. To rule out malignancy contrast-enhanced computed tomography was done in selected cases.

Surgical technique

The operations were done under general anesthesia using endotracheal intubation. The incision sites were locally infiltrated with 3 ml of 0.25% bupivacaine before incision and after removal of the gallbladder. Intraperitoneal installation of 0.25% bupivacaine was done in the gallbladder bed. CO_2 gas was injected. The abdominal cavity is entered through an infraumbilical incision using the open Hasson technique or direct trocar insertion using a visual port. Another three ports were used: one 10-mm subxiphoid port, which is the working port and two 5-mm ports (one at the midline midway between the umbilicus and the xiphoid and one in the right flank). The operation was done with the patient in reverse Trendelenburg position. Adhesion was dissected and exposure of Calot's triangle was first done. Avoiding dissection posterior to the sulcus of Rouviere and not to dissect beyond the cystic lymph node, dissection was done to isolate the cystic duct and the artery obtaining a critical view of safety. Cystic duct and artery were clipped and divided. The gallbladder was removed from its bed. The gallbladder was extracted through the epigastric incision. A tube drain was placed and the incisions were closed [12].

Ethical approval

This research was performed at the Department of General Surgery, Teaching Hospital, Al Azhar University Assiut Branch. Ethical Committee approval and written, informed consent were obtained from all participants.

Results

Laparoscopic cholecystectomy was done for 250 patients due to variable etiologies over a period of 13 months. Out of 250 patients, 145 (58%) were females and 105 (42%) were males. The majority of patients were found to be in the age group of 40–60 years among the total age range of 27–65 years with a median age of 46 years. Laparoscopic operation was done for 248 patients, at a rate of 99.2% success. The operating time varied from 20 min to 2 h (mean, 40 min) (Tables 1 and 2).

Table 1 Etiology of gallbladder removal

Etiology	*n* (%)
Acute calculus cholecystitis	42 (16.8)
Chronic calculus cholecystitis	150 (60)
Chronic noncalculus cholecystitis	22 (8.8)
Gallbladder polyp	8 (3.2)
Gallbladder stones	28 (11.2)

Table 2 Landmark identified intraoperatively

Landmark	*n* (%)
Calot's triangle	238 (95.2)
Cystic lymph node	214 (85.6)
Critical view of safety	228 (91.2)
Rouviere's sulcus	187 (74.8)
CBD localization	232 (92.8)

CBD, common bile duct.

Table 3 Postoperative complications

Complication	*n* (%)
Postoperative nausea and vomiting	25 (10)
Shoulder pain	18 (7.2)
Wound infection	5 (2)
Bleeding from abdominal cavity	2 (0.8)
Bile leaks	1 (0.4)
Missed CBD stone	1 (0.4)
Subhepatic collection	1 (0.4)
Pulmonary embolism	1 (0.4)

CBD, common bile duct.

There are three major complications (postoperative hemorrhage, pulmonary embolism, and one bile leak) as regards our study. Intraoperative hemorrhage occurred in one case, but no conversions were done for hemorrhage, and laparoscopy was done successfully for all cases with the aid of a gauze piece and suction to control the hemorrhage laparoscopically (Table 3). The laparoscopic procedure had to be converted to open cholecystectomy for two patients because of cholecystoduodenal fistula and gangrenous gallbladder, giving a conversion rate of 0.8% for the total performed cases. The gallbladder was not identified at first during laparoscopy in 43 patients due to adhesions. We successfully identified the gallbladder in all cases. There were no deaths in our study (Table 4).

Discussion

The rise in laparoscopic intervention as a treatment for gallstone disease has shown a rise in the incidence of postoperative complications, which were not known during open surgery. There were more common complications like biliary or vascular or bowel. This has been related to lack of knowledge about laparoscopic anatomy, and false judgment of surgeon disorientation during surgery.

Table 4 Postcholecystectomy complications according to Clavien–Dindo Classification

Grades	Complications	*n* (%)
Grade I	Any deviation without the need of treatments	48 (19.2)
Grade II	The need for treatment	1 (0.4)
Grade IIIa	Required radiological or endoscopic intervention	3 (1.2)
Grade IIIb	Required surgical intervention	1 (0.4)
Grade IV a	Life-threatening complications with organ dysfunction	1 (0.4)
Grade IV b	Life-threatening complications with multiorgan dysfunction	0
Grade V	Death of patients	0

Figure 1

Sulcus of Rouviere was identified in which injury was avoided to the right hepatic duct, which was mistaken as the cystic duct as it is inserted abnormally at the right hepatic duct.

Dependence on more than one landmark reduced the risk of bile duct injury. One of the major issues concerning misidentification and loss of awareness of the surrounding organs during surgery is subsequently reinforced to continue and is even reinforced by the team approach, where two surgeons make a decision before clipping or cutting the cystic duct or the artery. The creation of a standard method for routine laparoscopic cholecystectomy to create an operation-specific checklist can lead to preventable biliary complications.

Clavien–Dindo [10,11] classification has been used increasingly in surgical procedures, because of it being simple, reproducible, and flexible.

Calot's triangle is a potential space formed by the downward retraction of Hartmann's pouch. Its contents usually include right hepatic artery, cystic

artery, cystic lymph node of Lund, connective tissue and lymphatic tissue.

Dissection of the gall bladder begins by safely dividing the peritoneum just ventral to the Rouviere's sulcus as shown in Fig. 1.

The cystic lymph node of Lund provides a guide to the cystic duct and right hepatic artery posteriorly as shown in Fig. 2.

Obtaining a critical view of safety was done by dissection of the gallbladder from the cystic plate with only two tubular structures entering the gallbladder (Fig. 3).

Rouviere's sulcus was identified in 74.8% in our study, which is little different from the study by Thapa *et al.* [13], which is 82%.

In our study, biliary injury occurred in 4% (Table 3); only one case was with less than the complication rate, which is about 5% [14].

Bleeding occurred at a rate of up to 0.8% (Table 3). In this study, which is observed by incidence of 1–2% by Opitz *et al.* [15].

Conversion was necessary in two patients with an incidence of 8% with a higher incidence of conversion by many researchers [14].

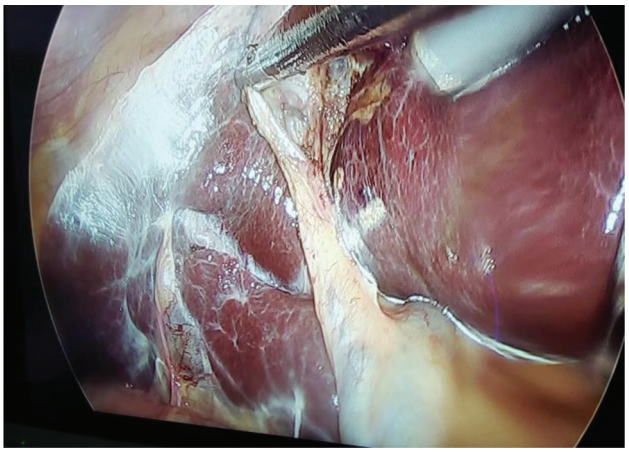
Surgical wound infection is a complication that occurred at low incidence with laparoscopic cholecystectomy [16]. In our study, we report seven (0.94%) patients with operative wound infection (Table 3), which agrees with studies published by other researchers [17].

Of the patients 96% percentage had an early discharge except for 10 patients admitted for more than 1 day for another intervention, that is, ERCP or ultrasound-guided drainage or readmitted for collection with higher incidence done by Jaunoo *et al.* [18].

Limitations

The classification was developed to record postoperative complications, recognizing that intraoperative complications, for example, bleeding or a tear on the small bowel, is often difficult to define, and, therefore, is unlikely to be reported unless it leads to postoperative complications, with the associated comorbidity which may have an impact on the outcome.

Figure 2



Cystic lymph node identification with dissection of cystic plate.

Figure 3

Obtaining critical view of safety before clipping.

Conclusion

Complications during laparoscopic cholecystectomy are a preventable condition if the procedure is carried out systematically, with good delineation and assessment of more than one anatomical landmark and careful dissection of tissues during operation.

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Conflicts of interest

There are no conflicts of interest.

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