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GENERAL SURGERY

30-day outcomes in 1 000 consecutive laparoscopic cholecystectomies undertaken in four Cape metropole public hospitals

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Background: Laparoscopic cholecystectomy (LC) is the standard of care for symptomatic gallstone disease. The procedure has a steep learning curve and may result in significant postoperative morbidity and mortality.
LC carries a morbidity of 1.6–5.3%, a mortality of 0.05–0.14% and readmission rates of 3.3% (0–11.7%). We aimed to evaluate the 30-day outcomes of LC across four metropole hospitals in the Western Cape (WC) including mortality, length of stay, readmissions and complications according to the Clavien-Dindo classification system.
Methods: A retrospective review of a prospective database was performed. Data were collected between September 2019 and July 2022. Relative clinical, operative findings and postoperative outcomes were analysed.
Results: There were 1 000 consecutive LCs included in this study. The mean postoperative length of stay was 1.92 days. Forty surgical complications were noted of which the most common were a bile leak (n = 14) and intra-abdominal collections (n = 11). Seven patients with bile leaks required reintervention. Four (0.4%) bile duct injuries (BDI) were reported in our series. Twenty-five percent of postoperative complications were graded as Clavien-Dindo IIIa and 28% were graded as Clavien-Dindo IIIb. The 30-day readmission rate was 3.8% (n = 38). Thirty-five patients were readmitted with surgical complications. There were three reported deaths (0.3%).
Conclusion: Laparoscopic cholecystectomy is considered the standard of treatment for gallstone disease but a small percentage may have serious complications. The outcomes reported in this series are similar to that of other reported studies.
Keywords: laparoscopic cholecystectomy, outcomes

Introduction

Gallstones are one of the most commonly encountered diseases in general surgical practice and has a global incidence of between 10–20%.[1,2] Laparoscopic cholecystectomy (LC) has since its introduction in the late 1980s grown rapidly in its acceptance and is now the standard treatment for symptomatic gallstone disease.[3] The procedure, however, has an inherent steep learning curve with the potential for serious complications.[1]

The technique of LC is probably one of the most significant major surgical advances since its inception. The advantages of the laparoscopic approach include less postoperative pain, shorter hospital stay, faster recovery, improved cosmetic result, earlier return to work and fewer complications, such as surgical site infections, adhesions and operative time.[4] Despite the advances of laparoscopy, there is up to a fivefold increase in the rate of bile duct injuries (BDI) with individual reports suggesting BDI rates between 0.2–1.5% compared to the open procedure with BDI rates of between 0.1–0.2%.[2,3] Other substantial risks of LC include major vascular injury, biliary leak and cautery injuries.[2]

Over 750 000 LCs are performed in the United States of America (US) and 50 000 in the United Kingdom (UK) annually.[5] Indications for surgery include colic, cholecystitis, cholangitis, pancreatitis, choledocholithiasis and gallbladder polyps.[1] The literature suggests that 90% of elective and 70% of emergency cholecystectomies are performed laparoscopically. LC has a morbidity of 1.6–5.3% and a mortality of 0.05–0.14%.[2] Reported readmission rates following LC are 3.3% (0–11.7%).[5] Surgical complications slightly outweigh medical complications.[3,5-7]

By far the highest risk of readmission occurs within the first postoperative week. In a study performed on ambulatory LC, 11.1% of patients were admitted within the first 24 hours and 53.3% of patients were readmitted within the first seven days.[7] Unanticipated hospital admissions within 30 days of surgery are important measures of quality of care and relate to both the inconvenience to patients as well as to cost, resource utilisation and associated morbidity and mortality.[5] A previous local study reported an overall complication rate of 16.2% in 210 patients with similar complication rates to other international series.[8] Although a common surgical procedure, there is a paucity of South African data on the outcomes of LC. This study evaluated the 30-day outcome of LC in four metropole hospitals in the Western Cape and assessed length of stay, readmission rate, postoperative complications and mortality.

Methods

A retrospective analysis of a prospectively maintained ethics approved (HREC: R040/2019) database was performed. The database was initiated in September 2019 and the population sample number needed for this study was reached in July 2022. Data were collected on a standard proforma checklist and operative note, and entered into the database using the secure, web-based Research Electronic Data Capture (REDCap) tool hosted at the University of Cape Town (UCT).[8,9] This checklist and operative note included information on patient characteristics, indication for LC, patient comorbidities, preoperative investigations and intraoperative checklists, procedural details and final comments. Patient follow-up included length of stay, surgical and non-surgical complications and interventions required. 30-day readmissions were determined using the Electronic Continuity of Care Record (ECCR), the Western Cape Government Health website displaying patients' admissions, hospital stays and discharges.

A review of readmissions was conducted using the National Health Laboratory Service (NHLS) for blood investigations, Picture Archiving and Communication System (PACS) for radiological investigation or intervention, discharge summaries on ECCR or folder reviews at the relevant participating hospitals. Postoperative complications and readmission at 30 days were graded using the Clavien-Dindo classification system.[10]

Inclusion criteria included all LC in patients 18 years and older. All intended open, oncological and cholecystectomies as part of another operation, i.e., trauma or pancreaticoduodenectomy, were excluded.

Privacy and confidentiality

Patients were included in the database according to the previously determined HREC requirements for written informed consent, which includes the possibility of using data from the database in future studies, therefore a separate informed consent for this study was not required. The REDCap database is a secure, password-protected database. All data were exported without patient identifiers for the purpose of analysis to ensure that patient confidentiality was maintained. Exported data were stored electronically on a password-protected computer. Only authors of the manuscript had access to the REDCap database and any electronic or hard copy forms of extracted data.

Statistical analysis

Numerical values were used for the different variables used. Where applicable percentages were assigned to numerical values. Furthermore, some data were summarised as medians with interquartile range or frequency and percentage for non-parametric continuous and categorical data respectively.

Results

Patient demographics and clinical characteristics

This data series analysed 1000 consecutive LC performed in the Cape metropole during the study period, of which 850 (85%) were female and 150 (15%) were male with a mean age of 41 years. A total of 392 (39.2%) patients had associated comorbidities, with cardiovascular disease being the most common (n = 236). The most common American Society of Anaesthesiologist (ASA) classification was physical status II with 457 (51.8%) patients. There were no ASA IV or V patients. The mean body mass index (BMI) was 32.47 kg/m^2. A total of 57 (6.2%) patients were documented to be human immunodeficiency virus (HIV) positive, however, in 590 patients the HIV status was not recorded (Table I).

Of the 1 000 LCs performed, 707 (70.7%) LCs were elective and 293 (29.3%) were performed on the same admission. Same admission procedures were defined as patients who were admitted and investigated as a first presentation of gallstone disease and/or complications thereof and underwent a LC before discharge. The most common indication for LC was acute cholecystitis (n = 338), followed by biliary colic (n = 309), choledocholithiasis (n = 184) and gallstone pancreatitis (n = 149). The remaining 20 patients had LC for other indications, which included Mirizzi syndrome (n = 6), gallbladder polyps (n = 4), gallbladder empyema (n = 3), cholangitis (n = 3), adenomyomatosis (n = 1), acalculous cholecystitis (n = 1), cholecystoduodenal fistula (n = 1) and recurrent biliary sepsis (n = 1).

Thirty-six percent of LCs were performed at a tertiary academic hospital while 64% of LCs were undertaken at secondary or district level hospitals. Of note, all four participating institutions are public sector hospitals.

LC was the definitive procedure performed in 907 (90.7%) of the patients, while 84 (8.4%) laparoscopic subtotal cholecystectomies (LSC) were performed of which 69 (83.1%) were fenestrating LSC and 14 (16.9%) were reconstituting LSC. One gallbladder was left in situ and eight procedures were converted to open.

Seventy-three per cent of females had an elective LC and 27% had a LC during an unplanned admission. Fifty-nine per cent of males had an elective LC and 41% had an emergency LC. The most common indication in females was biliary colic (n = 271, 31.9%) and acute cholecystitis in males (n = 38, 25.3%). Table II illustrates indications for males and females and the timing of surgery.

There were a total of 64 reported complications in 51 patients. Fifty-two (81.3%) surgical and 12 (18.7%) non-surgical complications were noted. Eight patients had more than one surgical complication and five patients had associated non-surgical complications. Complications are shown in Figures 1-4.

Bile leaks

There were 14 bile leaks of which 10 were in female and four were in male patients. Eight patients underwent LC for acute cholecystitis, three for gallstone pancreatitis and three for choledocholithiasis. Of the 14 bile leaks reported, LC was the final procedure in five patients. A subtotal cholecystectomy was performed in eight of the patients and one open subtotal cholecystectomy was performed. Seven patients required reintervention. Six patients required re-operation, two of whom required an additional endoscopic retrograde cholangiopancreatography (ERCP) and one required an additional percutaneous drainage. One patient required an ERCP and percutaneous drainage.

Three patients who had a bile leak were readmitted within 30 days. Two patients were admitted with intra-abdominal collections – the first patient treated with antibiotics and the second treated with percutaneous drainage. The third re-admission presented with an upper gastrointestinal bleed secondary to warfarin toxicity.

Bile duct injuries

There were four BDI in this series. All four were elective admissions for LC. In two the indication was acute cholecystitis – one for biliary colic and one for choledocholithiasis. Of the four BDI, two patients underwent LSC – one LC was performed, and one procedure was converted to open. In three a BDI was identified immediately; two BDIs were classified as Strasberg D – one BDI was primarily repaired and the other managed conservatively with an intraoperatively placed drain; the third patient was converted to an open procedure with an hepaticojejunostomy for a Strasberg E1 injury. The fourth case was a delayed diagnosis and was managed with a delayed open hepaticojejunostomy. Of the four BDIs, one patient was readmitted with an intra-abdominal collection which was treated with antibiotics.

Intra-abdominal collection

There were 11 intra-abdominal collections reported. Four of the LC were performed electively and seven on the same admission. LC was the final procedure performed in six of the patients and a LSC in five patients. Six patients required reintervention. Two patients required reoperation and an ERCP, one patient required and ERCP and a percutaneous drain and one patient required a percutaneous drain and an ERCP. One patient was managed with an ERCP alone and the other with a percutaneous drain.

Table I: Demographic characteristics of patients undergoing laparoscopic cholecystectomy in the Cape Metro West

Variables	Laparoscopic cholecystectomy *n* = 1 000 (%)
Demographics	
Female Male	850 (85%) 150 (15%)
Age in years, median (IQR)	43 (34–56)
BMI, median (IQR)	31 (27–37)
Comorbidities	
Cardiovascular	237 (23.7%)
Respiratory	62 (6.2%)
Liver	9 (1%)
Diabetes	86 (8.6%)
Retroviral disease*	57 (5.7)
Other	112 (11.2%)
ASA	
ASA I ASA II ASA III ASA IV ASA unknown	376 (42.6%) 457 (51.8%) 50 (5.7%) 0 (0%) 117 (11.7)

*590 patients with unknown HIV status
IQR – Interquartile range, BMI – Body mass index, ASA – American Society of Anaesthesiologists

Table II: Indications for patients undergoing laparoscopic cholecystectomy according to gender and admission type

Indication	Female (*n* = 850)		Male (*n* = 150)		Total
	Elective	Same admission	Elective	Same admission	
Biliary colic	271	17	20	1	309 (30.9%)
Cholecystitis	198	78	38	24	338 (33.8%)
Choledocholithiasis	98	53	16	17	184 (18.4%)
Gallstone pancreatitis	47	78	11	13	149 (14.9%)
Other	5	5	3	7	20 (2%)
Total	619 (72.8%)	231 (27.2%)	88 (58.7%)	62(41.3%)	1 000

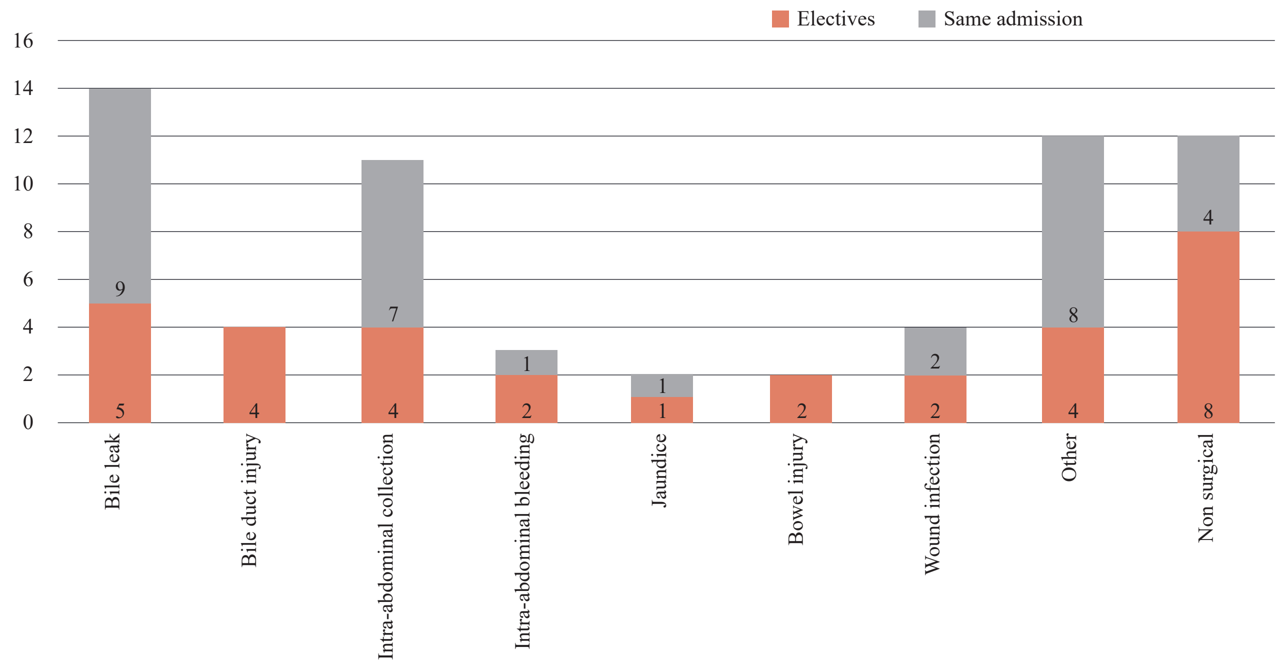

Figure 1: Surgical and non-surgical complications from patients undergoing laparoscopic cholecystectomy in the Cape Metro West

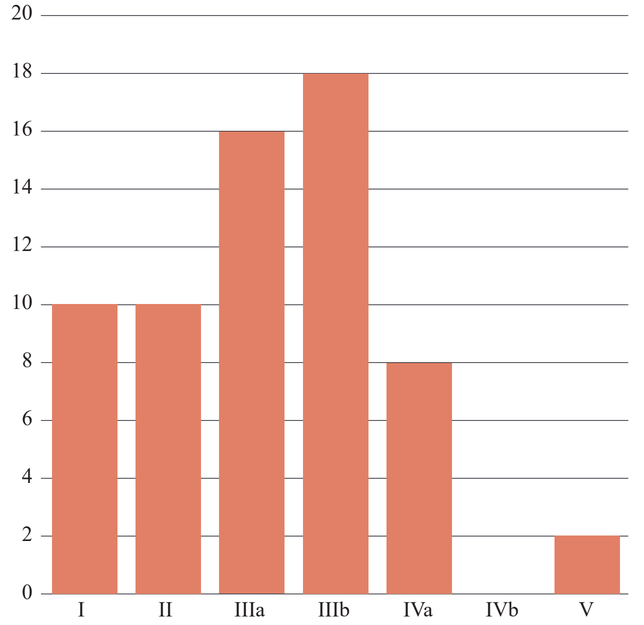

Figure 2: Clavien-Dindo grading per complication for patients undergoing laparoscopic cholecystectomy

Intra-abdominal bleeding

In our series, three patients had intra-abdominal bleeding. One patient had had a LC and the remaining two a LSC. Two patients required re-operation and one patient was managed conservatively.

Jaundice

Two patients presented with jaundice postoperatively and both were treated with an ERCP with subsequent clearance of the common bile duct (CBD) of stones. The first patient underwent a LC for cholelithiasis and the second patient underwent a subtotal cholecystectomy for choledocholithiasis. The second patient had had a preoperative ERCP with stone extraction.

Wound complications

Four patients developed wound complications. Three patients developed wound infection and the other a wound haematoma. Two patients required re-operation and the other two were managed conservatively with antibiotics.

Bowel injury

There were two bowel injuries in patients undergoing an elective LC. The first bowel injury was in a female undergoing a LC for choledocholithiasis who sustained a colonic injury. This procedure was converted to an open right hemicolectomy and primary anastomosis. The second bowel injury occurred in a male patient undergoing a LC for biliary colic who sustained a small bowel injury which was primarily repaired laparoscopically.

Other

Retained stones accounted for nine of the complications of which eight required a postoperative ERCP. The other documented complications included an ileus and postoperative pain in two patients. Four procedures were done electively and eight on the same admission.

Non-surgical complications

There were 12 reported non-surgical complications. Four patients were admitted electively, and eight same-admission procedures were performed. Of these 12 patients, five patients had associated surgical complications.

Complications were mostly Clavien-Dindo grade IIIa (n = 16) and IIIb (n = 18). There were two deaths in the perioperative period.

The first, a 29-year-old male underwent a same-admission LC for choledocholithiasis and mild cholangitis. A LC was performed, and he had an on-table ERCP during which the CBD was cleared of two stones. He was morbidly obese and had a cardiac arrest on postoperative day 1 due to a myocardial infarction based on an elevated troponin level done at the time of the cardiac arrest. The second patient

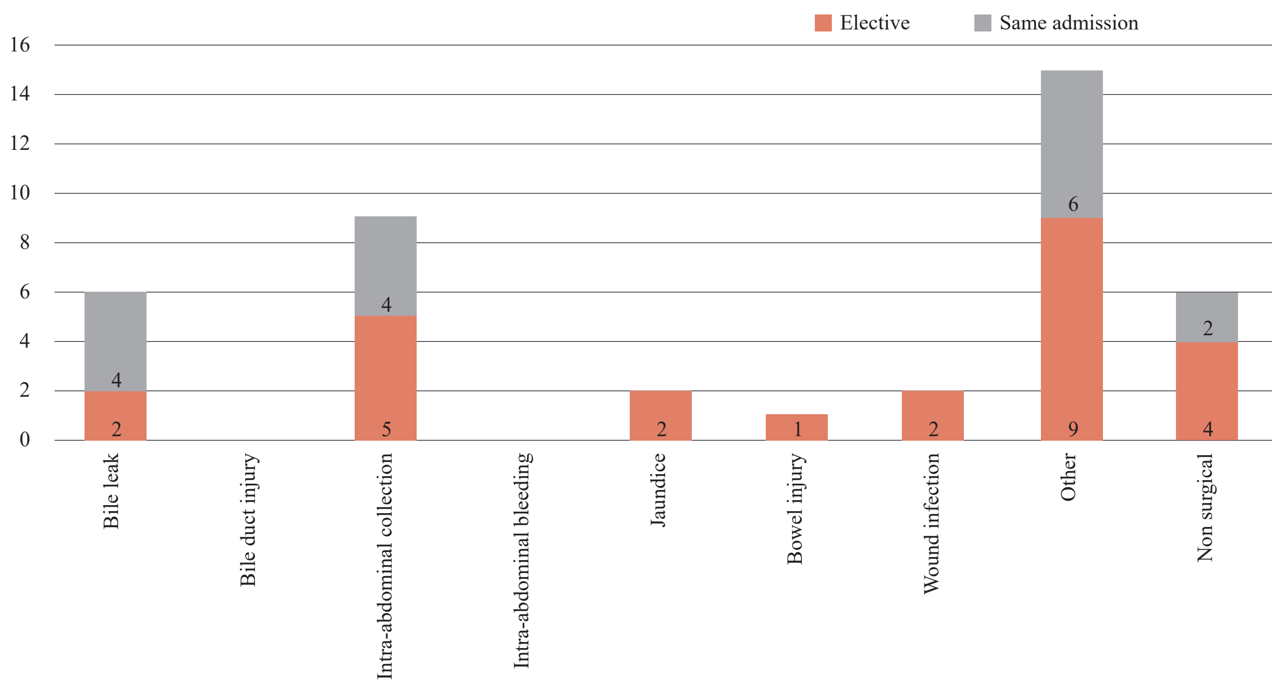

Figure 3: Readmissions for patients undergoing laparoscopic cholecystectomy

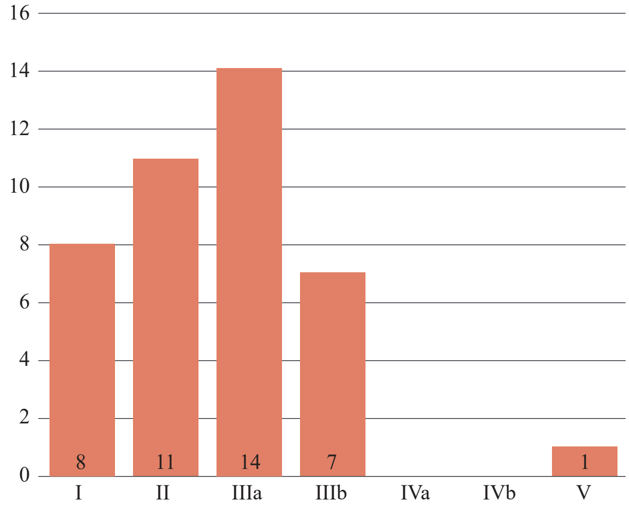

Figure 4: Clavien-Dindo grading for readmissions per complication for patients undergoing laparoscopic cholecystectomy

was a 47-year-old female who had significant cor pulmonale and underwent an elective LC for biliary colic; she died postoperatively of renal and respiratory failure.

Thirty-eight patients were admitted within 30 days of discharge. Thirty (78.9%) patients were female and eight (21.1%) patients were male. Sixteen (42.1%) cases were performed electively and 22 (57.9%) were performed on the same admission. The most common indication for LC in those patients who were readmitted was choledocholithiasis (n = 11), gallstone pancreatitis (n = 9) and acute cholecystitis (n = 9). LC was the final procedure in 31 cases, eight patients had a LSC and one patient had an open procedure. Five patients had had a previous surgical or non-surgical complication. There were 43 documented complications in the 38 patients readmitted of which 37 (86%) were surgical complications and six (14%) were non-surgical complications. The most common indications for readmission were intra-abdominal collections (n = 9), postoperative pain (n = 7), a bile leak (n = 6) and retained stones (n = 6). In all, 22 (62.8%) patients required reintervention. Of the documented readmissions, 14 (36.8%) patients were Clavien-Dindo grade IIIa. There was one mortality, a 74-year-old female who had undergone a same admission subtotal cholecystectomy for recurrent biliary sepsis. She was discharged on postoperative day 3. She was subsequently readmitted on postoperative day 4 in septic shock. She was reoperated on but died of septic shock within 12 hours of her reoperation.

Discussion

LC represents a significant change in the management of gallstone disease. Not only is LC the most commonly performed operation on the digestive tract, but is considered the standard of care for gallstone disease.[11] The advantages of LC are less postoperative pain, shorter hospital stay, faster recovery, improved cosmetic results, early return to work, fewer complications, such as infection and adhesions, shorter operating time and is superior to other developed techniques because of economic advantage.[12,13] A recent local study reported a 92% increase in the rate of cholecystectomies in South Africa over the past 10 years.[14]

Of the 1 000 LC reported in this series, 85% of LC were performed on female patients. The median age was 41 years and 39.2% of patients had associated comorbidities with a median BMI of 32.47 kg/m^2 while 93% of patients had a preoperative ASA I/II. Published data from a similar developing country as South Africa, reported a slightly less female predominance at 67.2% and 32.8% of males undergoing LC in their series. The mean age reported in this series was 43 in females and 51 in males and 97% of patients had a preoperative ASA score of I/II.[15]

Postoperative complications and hospital readmission impose a significant burden relating to patient inconvenience, on health systems financially as well as resource utilisation particularly on an already strained health system such as in our setting. Although the cost implication was not evaluated in this study, a meta-analysis performed by McIntyre et al. reported a readmission rate of 3%.[5] In the United States of America (USA), where close on 1 000 000 LCs are performed annually, this would equate to 30 000 readmissions annually which is almost all index LC performed in the United Kingdom (UK).[1]

Our series had a surgical complication rate of 5.2% (n = 52) and an overall complication rate of 6.4% (n = 64). Pucher et al. reported morbidity rates of 1.6 – 5.3% in a systematic review of complications following LC.[3] Biliary complications are the most common surgical complication[16] and there was a total of 48 biliary complications in our study. Of the 48 biliary complications, 32 patients required reintervention either with reoperation, ERCP, percutaneous drainage or a combination of the aforementioned modalities. A biliary leak represents an uncommon complication after a LC. The origin of biliary leak is multifactorial, and may arise from the gallbladder bed, cystic duct, or an injury to the common bile duct. Bile leaks are reported in approximately 2% of LC.[17] There were 14 (1.4%) bile leaks recorded of which seven patients required reintervention.

BDI is a feared complication of LC and its incidence has been high since LC has become the standard compared to open cholecystectomies (OC). BDI incidence rates are reported to be 0.2–1.5% with LC and accepted to be 0.1–0.2% with OC.[4,6] Despite the completion of the learning curve and the recognition of preventive manoeuvres to avoid ductal injury during LC, the incidence rate of BDI remains unchanged.[18] This study reported a BDI rate of 0.4%.

Multiple factors are implicated in BDI and are often attributed to disease related pathology, structural misidentification and improper techniques.[19,20] The most common mechanism of such injuries involves the misidentification of the CBD or the common hepatic duct (CHD) as the cystic duct or the misidentification of the hepatic artery as the cystic artery.[21]

Readmissions post LC are more commonly due to surgical complications than non-surgical complications. A quality standard of less than ten per cent readmission rate after cholecystectomy within the 30-day post-operative period has been recommended.[22] After any medical or surgical treatments, hospital readmission has been regarded as a measure of hospital and surgical quality of care.[23,24] Obesity, the number of coexisting diseases, conversion to open surgery, the development of intraoperative complications, the use of drain, and length of hospital stay > 1 day were significantly associated with higher readmission rates.[25] Our study reported a readmission rate of 3.8%.

In a retrospective review by Rana et al., 56% of patients were readmitted with surgical complications.[6] In our series, 92% of patients were readmitted with surgical complications. This is significantly higher than other reported data.[6] A vast majority of the readmissions were as a result of biliary complications namely bile leak, intra-abdominal collections and retained stones. In the US, the adoption of laparoscopic cholecystectomy has been accompanied by a 33% decrease in overall operative mortality per procedure, however cholecystectomy-related deaths have not fallen because of a 28% increase in the total rate of cholecystectomy.[26] Mortality rates in published data ranges from 0.05–0.14%.[6] This study had a mortality of 0.3%. Mortality post-LC is often related to patient confounding factors. There remains a paucity of data on whether mortality is directly related to surgery.

Limitations

Limitations of this study include the retrospective nature, although the data were extracted from a securely maintained prospective database. Furthermore, a large portion of this study was conducted during the COVID-19 pandemic which resulted in a global reduction in LC as described in the CHOLECOVID study.[17] This data series has no follow-up beyond 30 days and we recommend that an extended follow-up period be evaluated in a further study. Furthermore, this study has focused on descriptive analysis of outcomes, but a more detailed analysis of the available data could be evaluated on future studies.

The strength of this study includes the large population across a surgical hospital complex which included four hospitals and a complete 30-day follow-up period.

Conclusion

This data series is the largest reported series in Africa. LC remains the standard of care for gallstone disease and while there is a higher rate of BDI our data support the contention that the procedure is safe. The outcomes reported in our series are similar to that of other internationally published data despite the resource limited setting.

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Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

Ethical approval was obtained from the University of Cape Town Research Ethics committee (Ref: 430/2021).

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