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Morbidity, Mortality and Major Bile Duct Injury in 2296 Patients Undergoing Laparoscopic Cholecystectomy - Review of Literature

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Abstract

Aims: The aims were at the safety of laparoscopic cholecystectomy in the treatment of gallbladder diseases in a series of 2296 patients. Also reports in literature were reviewed.

Materials: Between January 1, 1999 and July 31, 2013, 2296 patients with gallbladder disease undergoing laparoscopic cholecystectomy were recruited. Demographics such as age, gender, indications, associated diseases, conversions, stone types, perioperative morbidity, major bile duct injury and mortality were recorded.

Results: There were 61 conversions. The conversion rate was 2.7%. Indications for laparoscopic cholecystectomy include symptomatic gallstones (2,135, 93%), gallbladder polyps (115, 5%) and others (46, 2%). We found our morbidity rate was 2.18% (50), mortality rate 0.04% (1) and major bile duct injury rate 0.08 (2).

Conclusion: In this observational study, it was found the morbidity, mortality and major bile duct injury rates were lower than those of laparoscopic cholecystectomy reported. The mortality and major bile duct injury rates were also lower than those of open cholecystectomy reported. However morbidity rate of our series was higher than that of open cholecystectomy.

Keywords: Laparoscopic cholecystectomy; Morbidity; Mortality; Safety: major bile duct injury

Introduction

Phillippe Mouret performed the first videoscopic laparoscopic cholecystectomy on a human patient in 1987 [1]. Since then, this new advancement in the history of general surgery has gained wide acceptance and entered daily practice for general surgeons throughout the world [2-8]. With a few exceptional randomized controlled studies [6], most efficacy and safety studies for laparoscopic cholecystectomy were observational and retrospective case controlled studies [9]. Therefore, this study aims at the safety of laparoscopic cholecystectomy as compared among those of reports in the literature and the author's personal series. Safety of open cholecystectomy was also compared.

Materials and Methods

Patients

This is an observational study. Between January 1, 1999 and July 31, 2013, 2296 patients with gallbladder disease were recruited and underwent laparoscopic cholecystectomy by the author at Veterans General Hospital–Taipei and Chung Shan Medical University.

Results

Demographics

The M/F ratio was 1:1.03 for symptomatic gallstones, 1.661:1 for chronic cholecystitis but 1.25:1 for acute and sub-acute

cholecystitis. In acute cholecystitis patients, male predominant was found whereas female predominant was found in chronic cholecystitis patients ($P < 0.0001$). The average age for patients with symptomatic gallstones, chronic cholecystitis and acute cholecystitis are 54±15, 53±15 and 57±17 years old.

Indications for laparoscopic cholecystectomy

These include symptomatic gallstones (2,135, 93%), gallbladder polyps (115, 5%) and others (46, 2%).

Morbidity and mortality

There are 50 operative complications (50/2,296, 2.18%), i.e., common bile duct injury (4, 0.17%), right hepatic duct injury (1, 0.04%), bile leakage (4, 0.17%), hypoxic encephalopathy (1, 0.04%), spontaneous pneumothorax (1, 0.04%), right perihepatic abscess (3, 0.13%), perioperative hemorrhage (3, 0.13%), intestinal perforation (1, 0.04%), wound infection (29, 1.26%) and urinary tract infection (3, 0.13%) (Table 1).

The patient complicated with hypoxic encephalopathy was a 76-year-old male diagnosed with gallstone with acute cholecystitis. Preoperative electrocardiogram did not reveal any cardiac arrhythmia. The operative procedure was uneventful except that it was a relatively long procedure. The operation time was 121 minutes. An episode of bradycardia developed which was followed by a cardiac arrest.

After resuscitation, the patient's heartbeat and respiration returned. However, the consciousness did not return. Glasgow coma scale was 4 (E1V1M2). The patient did not recover from the hypoxic encephalopathy and finally succumbed to consequent pneumonia. This is the only mortality in this series. The patient complicated with spontaneous pneumothorax was a 65-year-old male associated with chronic obstructive pulmonary disease. Intra-operatively, the anesthesiologist noted a drop of oxygen saturation from 98% to 90% at 50% alveolar oxygen concentration. Auscultation revealed decreased breathing sound over right lung field. Emergent insertion of a pigtail drain into right pleural cavity revealed a jet of air emitting out. The operation was completed smoothly. The pigtail was removed 3 days postoperatively and was discharged on 4th postoperative day.

There were 32 surgical infections associated with laparoscopic cholecystectomy in this series (1.39%), including 3 (0.13%) right peri-hepatic abscesses and 29 (1.26%) wound abscesses. The former tended to suffer from spiking fever and right upper abdominal pain 2 weeks after laparoscopic cholecystectomy. Ultrasonography revealed sonolucent fluid collections around peri-hepatic spaces were detected. Ultrasound-guided insertion of pigtail drains and intravenous antibiotics were all that were needed to resolve these conditions. The patients were discharged around 7 days later. The latter were managed by incisional drainage and open wound dressings successfully.

There was one patient who had undergone previous abdominal surgery. This 56-year-old male patient underwent laparoscopic cholecystectomy for gallbladder stone with open laparoscopic technique. A severe small intestinal loop adhesion directly under the umbilicus was found. The procedure was completely. However, on the 3rd postoperative day, profuse yellowish small intestinal contents flew out from the infra-umbilicus trocar wound. The patient underwent immediate re-operation and a 6 cm transverse extension of the infra-umbilicus wound was performed. A small 0.3 cm perforation hole was found at a mid-jejunum loop located immediately below the umbilicus. Primary repair with peritoneal cavity lavage was performed and the wound was closed. The postoperative course was uneventful and the patient was discharged 7 days later.

Three patients suffered from urinary tract infections. They received Foley catheter insertion after general anesthesia because longer operation was expected. Among them, two were from the contracted gallbladder group. Antibiotics and sulfa drugs were all that were needed to resolve the condition (Table 1).

Table 1: Major complications in a series of consecutive 2,296 laparoscopic Cholecystectomies.

Complications	No.	%
Common bile duct injury	4	0.17
Right hepatic duct injury	1	0.04
Bile leakage	4	0.13
Hypoxic encephalopathy	1	0.04
Spontaneous pneumothorax	1	0.04
Right perihepatic abscess	3	0.13
Perioperative hemorrhage	3	0.13
Intestinal perforation	1	0.04
Wound infection	29	1.26
Urinary tract infection	3	0.13
Total	50	2.18

Biliary complication

There were 2 patients with major bile duct injury (patients 1 and 8 in Table 2), 3 patients with minor bile duct injury (patients 5, 6 and 7) and 4 patients' with delayed bile leakage (patients 2, 3, 4 and 9, Table 2).

Major bile duct injury patients required more sophisticated repairing procedures, such as hepato-jejunostomy or choledocho-jejunostomy (patient 1 and patient 8). Their prognosis needs longer periods of follow-up to make sure they are not inflicted with recurrent cholangitis like biliary cripples, as patients 1 and 8 were devoid of these episodes for 6 - 7 years.

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Minor bile duct injury patients required only simpler managements, such as, primary repair with T-tube splinting or simple T-tube insertion would suffice in patients 5, 6 and 7. The prognosis was usually good.

Patients with delayed bile leakage also required only simple management, such as, T-tube insertion, which solved the problem in patients 2, 3, 4 and 9. Their prognosis was uniformly good within 7 days (Table 2).

Table 2: Bile duct injury and bile leakage in laparoscopic cholecystectomy (LC) in a series of 2,296 patients.

No.	Sex	Age	Case no. of LC		Complication	Mechanism	PODE	Risk factor	Management	Outcome
			Surg.'s	Hos.'s						
1	F	70	5	5	CBDA injury	Short cystic duct, axial traction failure of operative cholangiogram	0	Inexperience of surgeon	Primary repair With T-tube splinting Choledocho-jejunostomy	CBD stricture 18 months later Well 6 years later
2	M	65	39	39	Delayed bileleakage	Delayed electrocautery Injuryof cystic-CBD junction	12	Smoky abdomen	Laparotomy + T-tube insertion	Well, remove T-tube 7 days later
3	M	48	89	100	Delayed bileleakage	Electrocautery injuryor pigtail erosion	13	Smoky abdomen	Laparotomy + T-tube insertion	Well, remove T-tube 7 days later
4	M	56	110	160	Delayed bileleakage	Delayed electrocautery Injuryof cystic-CBD junction	14	Smoky abdomen	Laparotomy + T-tube insertion	Well, remove T-tube 12 days later
5	M	54	201	313	RHDB injury	Mistake RHD for CDD	0	obscured anatomy	long arm T-tube stent	Remove T-tube 6 months
6	M	56	301	412	CBD injury	Mistake CBD for CD	0	Contracted gallbladder fibrosed Calot's triangle	long arm T-tube stent	Well 6 months
7	M	56	330	475	CHDC injury	Mistake CHD for CD	0	Contracted gallbladder fibrosed Calot's triangle, obscure anatomy	long arm T-tube stent	Well 2 months
8	F	38	1451	3,765	CBD injury	Mistake CBD for CD	5	Obesity fatty liver an anomaly of posterior branch of cystic artery	Laparotomy + hepatico-jejunostomy+ Roux-en-y jejuno-jejunostomy	Paralytic ileus W'dF infection Well 7years
9	M	67	1502	4,175	Delayed bileleakage	Delayed cystic stump clip loosening	7	Short cystic stump	ENBDG + CT – guided pigtail drainage	Remove pigtail (ENBD) 4(7) days Well 7 years

[A]CBD: common bile duct, [B]RHD: right hepatic duct, [C]CHD: common hepatic duct, [D]CD: cystic duct, [E]: POD: post-operative day, [F]W'd: wound, [G]ENBD: endoscopic naso-biliary drainage.

Discussion

Undoubtedly, laparoscopic cholecystectomy is the greatest arena for laparoscopic surgery. From literature, the overall morbidity and mortality of laparoscopic cholecystectomy are no different from those of open cholecystectomy. From Tables 3 & 4, the average morbidity of laparoscopic cholecystectomy is 5.2% (range 1.2% - 23.3%) whereas that of open cholecystectomy is 0.13% (range 0.76% - 35.2%). The average mortality of laparoscopic cholecystectomy is 0.46% (range 0%-0.8%). The average mortality of open cholecystectomy is 0.27% (range 0.0% - 0.8%). There is a pattern of the incidence of major bile duct injury requiring biliary reconstruction corresponding to the case number of the surgeon. Major bile duct injury is high or none in the surgeon's learning curve period (the first 100 cases to less than 500 cases, Table 3), also as in case 1 of Table 2 in this series. Not with standing the experienced surgeon has past the learning curve period, the incidence of major bile duct

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injury did not fall [10,11]. It looks as if when surgeon passed his first 500 and less than 1,000 cases, he begins handling more complicated cases and major bile duct injury incidence tends to re-appear, i.e., 0.79-1.4%, as case 9 of Table 2 in this series. With further experiences gained with increasing case number beyond 1,000 the surgeon's laparoscopic cholecystectomy-associated incidence begins to descend and level off, i.e., 0.1-0.6% [8,12-13].

In this observational study of 2,296 patients undergoing laparoscopic cholecystectomy, we found our morbidity rate was 2.18% (50/2,296), mortality rate 0.04% (1/2,296) and major bile duct injury rate 0.08 (2/2,296), lower than the average of those of laparoscopic cholecystectomy in the literature: 5.2% (8,072/155,622, Table 3), 0.46% (27,635/6,040,632, Table 3) and 0.22% (16,382/7,559,461, Table 3). In mortality rate and major bile duct injury rate, we found our series are lower than the average of open cholecystectomy in the literature: 0.04% (1/2,296) and 0.08 (2/2,296) vs. 0.27% (158/59,332, Table 4) and 0.55% (30/5,445, Table 4). However, in morbidity rate, our series are higher than the average of open cholecystectomy in the literature: 2.18% (50/2,296) vs. 0.13% (7,608/59,332, Table 4).

In turn, for morbidity rate, the order of lowest rate was: the average of open cholecystectomy in the literature 0.13% (7,608/59,332, Table 4), our series 2.18% (50/2,296) and then laparoscopic cholecystectomy in the literature5.2% (8,072/155,622, Table 3). For mortality rate, the order of lowest rate was: our series 0.04% (1/2,296), the average of open cholecystectomy in the literature 0.27% (158/59,332, Table 4) and then the average of laparoscopic cholecystectomy in the literature 0.46% (27,635/6,040,632, Table 3). For major bile duct injury rate, the order of lowest rate was: our series 0.08 (2/2,296), the average of laparoscopic cholecystectomy in the literature0.22% (16,382/7,559,461, Table 3) and then the average of open cholecystectomy in the literature of open cholecystectomy 0.55% (30/5,445, Table 4).

Table 3: Overall incidences of morbidity, mortality and bile duct injury during laparoscopic cholecystectomy.

Author	Year	No. Of Patient	Overall Morbidity No. (%)	Overall Morbidity No. (%)	Orm[a] No. (%)	Norm[b] No. (%)	Bdi[c] No. (%)	Reference
Spangenberger	1990	100	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	[14]
Smith	1992	486	41(8.4)	1 (0.2)	-	-	-	[15]
Deziel	1993	77,604	931 (1.2)	33 (0.04)	18 (0.02)	15 (0.02)	466 (0.6)	[12]
Calvete	2000	874	-	-	-	-	11(1.4)	[16]
Krähenbühl	2001	12,111	-	-	-	-	36 (0.3)	[13]
Flum	2003	1,570,361	-	-	-	-	7911(0.5)	[17]
Dolan	2005	2,841,186	-	12,785 (0.45)	-	-	4,061 (0.15)	[18]
Halilovic	2011	293	5 (1.7)	0 (0)	0 (0)	0 (0)	0 (0)	[19]
Huang[d]	2011	1468	1468	1 (0.07)	0 (0)	1 (0.07)	2(0.14)[e]	[8]
Grbas	2013	10,317	2,402 (23.3)	0 (0)	0 (0)	0 (0)	25(0.2)	[20]
Sajid	2014	504	16 (3.17)	2 (0.39)	-	-	4 (0.79)	[10]
Fry	2015	64,021	4,624 (7.2)	509 (0.8)	-	-	-	[21]
Worth	2015	3,043,814	-	14,304 (0.47)	-	-	3,866 (0.1)f	[11]
Pooled Data		**No. of Patient**	**Morbidity (%)**	**Mortality (%)**	**BDI (%)**	**Reference**	**Reference**	
		155622	8072 (5.2)	-	-	[8,10,12]	[14-15,19-21]	
		6040622	-	27635(0.46)	-	[8,10-12]	[14-15,18-21]	
		7559461	-	-	16382 (0.22)	[8,10-14]	[16-21]	

[a]operation related mortality [b]non-operation related mortality [c]major bile duct injuryd author's (SMH) personal series, [e]3minor bile duct injuries in which no biliary reconstruction was required were not included, fBile duct reconstructions were associated with 4.4% mortality.

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Table 4: Overall incidence of morbidity, mortality and bile duct injury during open cholecystectomy.

Author	Year	No. Of Patient	Overall Morbidity No. (%)	Overall Morbidity No. (%)	Orm[a] No. (%)	Norm[b] No. (%)	Bdi[c] No. (%)	Reference
Cox	1992	457	161 (35.2)	0 (0)	0 (0)	0 (0)	-	[22]
Smith	1992	486	39 (8)	0 (0)	-	-	-	[15]
Roslyn	1993	42,473	6,2 44 (14.7)	71 (0.17)	-	-	-	[23]
Girard	1993	10,471	614 (6.1)	47 (0.4)	-	-	-	[24]
Cagir	1994	262	2 (0.76)	0(0)	0 (0)	0(0)	1 (0.38)	[25]
Moreax	2001	5,000	525 (10.5)	40 (0.8)	35 (0.7)	5 (0.1)	29 (0.6)	[26]
Halilovic	2011	183	23 (12.5)	0 (0)	0 (0)	0 (0)	0(0)	[19]
Pooled Data		**No. of Patient**	**Morbidity (%)**	**Mortality (%)**	**BDI (%)**	**Reference**	**Reference**	
		59332	7608 (0.13)	-	-	[15,19]	[22-26]	
		59332	-	158(0.27)	-	[15,19]	[22-26]	
		5445	-	-	30 (0.55)	[19]	[25-26]	

[a]operation related mortality [b]non-operation related mortality [c]major bile duct injury.

Conclusion

In conclusion, an observational study was conducted on 2296 patients with gallbladder disease undergoing laparoscopic cholecystectomy. It was found our morbidity, mortality and major bile duct injury rates were lower than those of laparoscopic cholecystectomy reported in the literature. The mortality and major bile duct injury rates were also lower than those of open cholecystectomy reported in the literature. However morbidity rate of our series was higher than that of open cholecystectomy.

Authors Contribution

A. Study concept and design: Huang SM, Huang NL, Huang SD and Pan H. Acquisition of data: Huang SM and Huang SD. Analysis and interpretation of data: Huang SM, Huang SD, Huang NL, and Pan H.

B. Drafting of the manuscript: Huang SM, Huang NL, Huang SD, and Pan H.

C. Critical revision of the manuscript for important intellectual content: Huang SM, Pan H and Huang NL.

D. Statistical analysis: Huang SD. Obtained funding: Huang SM, Pan H. Administrative, technical and material support: Pan H. Study supervision: Pan H.

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