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Injuries Presentations in Laparoscopic Versus Open Cholecystectomy

Mohamed Salah Abdelhamid[1], Ahmed Mohamed Sadat[1], Ayman Hamdi Abouleid[1], Amr Mohamed Aly Mohamed[1], Mahmoud Ahmed Negida[2]

[1]Surgery department, Bani-Suef faculty of medicine, Bani-Suef university, Bani -Suef, Egypt
[2]Surgery department, Kasr Elaini faculty of medicine, Cairo university, Cairo, Egypt

Email address:

Mohamedsalah_2000@hotmail.com (M. S. Abdelhamid), Ahmed_sa3d752012@yahoo.com (A. M. Sadat), Ayman_abouleid@hotmail.com (A. H. Abouleid), Amrbachet@yahoo.com (A. M. A. Mohamed), Dr.negida@yahoo.com (M. A. Negida)

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Abstract: The wide acceptance of LC in the early 1990s was based on several case series rather than randomized controlled trials. Community awareness that a minimally invasive procedure could dramatically reduce postoperative pain and improve recuperation made it impractical to conduct trials that might have better refined the technique. This study was to recognize the actual complication risk associated with cholecystectomy. Included in the study were 1486 patients operated upon between Feb. 1999 and April. 2014. Open cholecystectomy done in 292 (19.6%) mostly in patients with contra-indications for laparoscopy, 1194 (80.4%) initiated laparoscopically, 1086[91%] completed laparoscopically and 108 (9%) converted to open procedure. There were eighteen (1.2%) patients with bile duct injury. One patient (0.3%) in the open procedure and seventeen (1.4%) in the laparoscopic procedure. Nine cases presented with intra-operative injury, two with early post operative jaundice, two with late post operative jaundice, five with post operative leak. The patients with recognized intra-operative injury were significantly not higher in the laparoscopic group of patients ($P<0.3$) than in the open procedure. The post operative jaundice was significantly high in the laparoscopic group of patients ($P<0.045$). The post operative leak was significantly higher in the laparoscopic group of patients than in the open procedure ($P<0.028$). In general post operative morbidity was high in the laparoscopic group of patients than in the open procedure ($P<0.01$). On the other hand, the post operative mortality were four times more in the open procedure and was statistically significant ($P<0.04$). Conclusion: The risk of complications after cholecystectomy was slightly higher than that found in literature; Laparoscopic cholecystectomy was associated with a higher incidence of CBD injuries, leak, jaundice and technical factors leading to failure to recognize injuries when they occur.

Keyword: Cholecystectomy, Open, Laparoscopic, Complications

1. Introduction

Acute BDI results in short-term complications such as biloma, bile peritonitis, sepsis, multiple organ dysfunction syndrome, external biliary fistula, cholangitis, liver abscess, and others. These complications if not properly managed may be associated with mortality as high as 5%(1)

In the majority of cases (more than 60%), the biliary injury is unrecognized at laparoscopic cholecystectomy (2)

The worldwide acceptance of laparoscopy as the preferred approach to cholecystectomy was based on anticipated reductions in post operative pain and recuperative time associated with minimal access. Soon after its introduction, it became clear that laparoscopic cholecystectomy was associated with more complications compared with the open approach [3]. Early reported rates of common bile duct injury were 2 to 15 times greater than those identified in historic series [4]. As the procedure has become increasingly common, surgeons have tended to cite a rate of injury of 1:300. However, despite the broad experience of surgeons with laparoscopic cholecystectomy during the past decade, rates of as high as 1.4% have recently been reported [5].

Laparoscopic cholecystectomy remains the greatest

source of biliary injuries with an estimated incidence of 0.6%. Moreover the proximal bile duct is at greater risk for injury than it had been before laparoscopy [6]. There are several established iatrogenic injury patterns identified in laparoscopic cholecystectomy, the most prevalent type of injury involves mistaking the common bile duct for the cystic duct, this occurs just distal to the common hepatic duct, the common bile duct is clipped and divided, then gall bladder retracted up taking with it the common hepatic duct until it is divided again closer to the base of the liver, at the end there is distal common bile duct clipped, upper hepatic transected. The second most common occurs when the distal clips are placed on common bile duct and the proximal clips on the cystic duct, the end is a cystic duct stump leak with distal common duct obstruction. The third and least prevalent variant is due to tenting of the common duct from excessive retraction, the cystic duct is identified and clipped, then the tended common duct is clipped and divided, the result is the excision of the short segment of common duct with the cystic duct and gall bladder, in this case the patient present with either biliary leak or obstruction, depending on clip placement [7]. Right hepatic ductal injury occurs with and without anatomic variation. In case of normal anatomy overzealous superior retraction leads to misinterpretation of the right hepatic for the cystic. In case the cystic from the right, both clipped and divide, then gall bladder removal lead to excision of portion of right ductal system [8].

2. Patients and Methods

Between February 1999 and April 2014, 1486 cholecystectomies were done by 5 surgeons. The main indication for cholecystectomy was gall bladder stones. The main indications for open cholecystectomy were, any cardio pulmonary insufficiency, associated gall bladder mass and complicated acute cholecystitis. all patients were subjected to U/S abdomen, CXR, in some plain x-ray abdomen L.F.T. and R.F.T. All the procedures were performed in general endotracheal anesthesia.

2.1. The Operative Procedures

A. Laparoscopic cholecystectomy started by pneumoperitoneum with the use of veruss needle, introducing Co2 to peritoneal cavity and maintaining the intraabdominal pressure at 12-14mmHg. Four trocars were used. It was not routine to use intra-operative cholangiography prior to start dissection, it was done via the gall bladder in most of the cases subjected to intra-operative cholangiography in others it was done via catheter inserted through the cystic duct.
B. Open cholecystectomy through right paramedian incision or right subcostal incision, then the patients subjected to general and local exploration.

2.2. Statistical Analysis

The data obtained were statistically analyzed using fisher's test to obtain the Z value and from the standardized table. The degree of probability is obtained [9].

3. Results

A total of 1486 cholecystectomies were operated upon. 292 (19.6%) were open cholecystectomis from the start mostly due to cardio pulmonary insufficiency, with contraindications to abdominal insufflations, others due to associated pancreatitis, cholangitis or complicated acute cholecystitis. 1194 (80.4%) were laparoscopic cholecystectomies of which 1086 (91%) could be completed laparoscopically, only 108 (9%) converted to open cholecystectomy (table 1). Out of the 292 open cholecystectomy, only one (0.3%) reported to have intra-operative injury to the common bile duct, no reported post operative jaundice nor post operative bile leak (table 2). Out of the 1086 laparoscopically completed cholecystectomies, there were four (0.4%) cases with post operative jaundice, two of them reported within three months post operatively. In the same group there were also four cases (0.4%) with post-operative bile leak manifested as abdominal pain, sub diaphragmatic collection, port site leak (table 3). Within the converted patients, there were eight (7.4%) recognized intra operative injury. In the converted group there was only one case (0.9%) of bile leak through the abdominal drain (table 4).

The total cases started laparoscopic cholecystectomies were 1194 patients. There were eight cases (0.7%) of recognized intra-operative injury (R.I.O.I) that were included before in the converted group of patients. The four cases of post operative jaundice had an incidence of 0.35% in the total Laparoscopic group that was 0.4% among those ended laparoscopically (table 3, 5). The post operative leak was five (0.4%) patients, four in the laparoscopic group (table 3) and one in the converted group (table 4).

There was one case of R.I.O.I in the open patients (0.3%), and the difference was non significant ($P < 0.3$) (table 6).

Regarding the post operative jaundice, there were four (0.35%) cases in the laparoscopic group of patients, and no reported cases in the open cholecystectomy patients and this difference was statistically ($P<0.045$) significant (table 7).

The post operative bile leak was evident in the laparoscopically operated patient, as there were five (0.4%) cases, on the other hand no reported post operative bile leak in the open cholecystectomy patient. The difference ($P<0.028$) was statistically significant (table 8).

Generally there was only one reported complication in the open cholecystectomy patients (0.3%), with seventeen (1.4%) cases of morbidity in the laparoscopic cholecystectomy patients (table 9) this difference in morbidity ($P<0.01$) was significant statistically.

The reported mortalities were two cases, one in each goup, the one reported in the open group was due septic complications, the other one was reported in the converted group with a statistically significant difference ($P<0.04$).

Table 1. *Cholecystectomy approach.*

CHOLECYSTECTOMY	OPEN	LAP	CONVERTED
1486	292 (19.6%)	1194 (80.4%)	108 (9%)

Table 2. *Open cholecystectomy complications.*

OPEN	R.I.O.I.	POST OP JAUNDICE	POST OP LEAK
292	1 (0.3%)	-	-

Table 3. *Laparoscopically completed cholecystectomy complications.*

LAP	R.I.O.I.	POST OP JAUNDICE	POST OP LEAK
1086	-	4 (0.4%)	4 (0.4%)

Table 4. *Converted group complications.*

CONVERTED	R.I.O.I.	POST OP JAUNDICE	POST OP LEAK
108	8 (7.4%)	-	1 (0.9%)

Table 5. *Laparoscopic cholecystectomy complications.*

LAP	R.I.O.I.	POST OP JAUNDICE	POST OP LEAK
1194	8 (0.7%)	4 (0.35%)	5 (0.4%)

Table 6. *Comparison of recognized intra-operative injury.*

APPROACH	NO	R.I.O.I	STATISTICS
Open	292	1 (0.3%)	Z = 1.05
Laparoscopic	1194	8 (0.7%)	P < 0.3 NS

Table 7. *Comparison of post-operative jaundice.*

APPROACH	NO	POST OP JAUNDICE	STATISTICS
Open	292	-	Z = 2.05
Laparoscopic	1194	4 (0.35%)	P < 0.045 S

Table 8. *Comparison of post- operative leak.*

APPROACH	NO	POST OP LEAK	STATISTICS
Open	292	-	Z = 2.22
Laparoscopic	1194	5 (0.4%)	P < 0.028 S

Table 9. *Morbidity significance.*

APPROACH	NO	MORBIDITY	STATISTICS
Open	292	1 (0.3%)	Z = 2.75
Laparoscopic	1194	17 (1.4%)	P < 0.01 S

Table 10. *Mortality significance.*

APPROACH	NO	MORTALITY	STATISTICS
Open	292	1 (0.3%)	Z = 2.05
Laparoscopic	1194	1 (0.08%)	P < 0.04 S

4. Discussion

Laparoscopic cholecystectomy has became the standard treatment for patients with symptomatic gallbladder disease. However, there is a substantial proportion of patients in whom laparoscopic cholecystectomy cannot be successfully performed, and conversion to open surgery is required because of technical difficulties or complications [10]. The wide acceptance of LC in the early 1990s was based on several case series rather than randomized controlled trials. Community awareness that a minimally invasive procedure could dramatically reduce postoperative pain and improve recuperation made it impractical to conduct trials that might have better refined technique [1].

A high index of suspicion is essential to recognize biliary injury (leak or transaction of CBD) in the early postoperative period. In a study of 207 patients with postoperative bile duct leak who underwent ERCP, the most common site of leak included cystic duct stump (78%), a peripheral right hepatic duct (Luschka 13%), and other sites like common bile duct and T tube insertion point (9%) (11) The leak could either be low grade (LG) where the leak is noted only after the opacification of the intrahepatic biliary radicles with contrast following ERCP or a high-grade leak (HG) when the leak is observed fluoroscopically before intrahepatic duct opacification [11]. The later is considered more significant as the spillage of contrast occurs with minimal injection pressure and before the opacification of the ductal system. Patients with LG leak are effectively managed by sphincterotomy alone or placement of nasobiliary tube or stent placement, and it could achieve reduction in pressure gradient and allow closure of leak in >90% [11]. HG leak however would require stent placement with probably bridging the site of leak-like cystic duct stump leak. Decision of stent placement is however determined by the severity of leak rather than site of leak [11].

Iatrogenic injuries to the bile ducts are uncommon entities in clinical practice that have been encountered more frequently after the advent of laparoscopic surgery. The pattern of bile duct injuries occurring during laparoscopic cholecystectomy seems to differ from those injuries sustained during an open procedure; many occur in a more proximal location and the resultant strictures are more extensive. The fact that as many as 15% of such operative repairs for bile duct injuries had to be revised underscores the complexity of these injuries and the need for long-term follow-up [12].

If there is no bile leak, the patients may not have any symptoms and signs in the early postoperative period and may develop jaundice after an uneventful discharge from the hospital. Therefore, a follow-up visit approximately 1 to 2 weeks after cholecystectomy is desirable. Some BDIs especially ischaemic may present several months or even years after cholecystectomy(13).

Out of 1486 cholecystectomy included in the study, 292 (19.6%) were open operations, 1194 (80.4%) were initiated laparoscopically, 108 (9%) of these converted to open technique, these were in accordance with Buanes et al [10] who had 20% open operation 79.8% were initiated laparoscopically, and 10.2% converted to open technique. The main indications to open operations were, cardio pulmonary contraindications to abdominal insufflations, associated cholangitis, pancreatitis, common bile duct stones,

complicated acute cholecystitis, these also reported by Pineres et al [11]. Conversion to open operations took place due to complication such as bleeding, suspected injury, or in ability to proceed after a time, difficulty to delineate anatomy, in some cases due to technical difficulties, these were reported by Tokumura et al [8] and by Giuliante et al [12] who reported conversion rate of 5.2% in patients with simple symptomatic cholelithiasis and rate of 37.5% in patients with acute or sub acute cholecystitis.

Extra hepatic bile duct may be injured both during laparoscopic and open surgery. This complication accounts for approximately 0.7% of patients subjected to cholecystectomy [13]. In the current study 18 (1.2%) patients were injured, one (0.3%) in the open operations, seventeen in (1.4%) the laparoscopic operations. In the current study the incidence for injury for open and laparoscopic was 1.2% while it was 0.7% in the work done by Paczynski et al [17] in the same time it was observed with a frequency of 0.2% to 0.4% with Mercado et al [18]. It was reported in the current study that the incidence of bile duct injury was 0.3% in the open operations this is accordance with Murr et al [9] who reported 0.2% to 0.4% in the open operations, they also reported an incidence of 0.5% to 0.8% injury in the laparoscopic patients while it was 1.4% in the current study and it was 0.59% in the work done by Mahatharadol [19] but Calvete el al [5] reported like us rates of injury as high as 1.4%. This wide variation in the rates of bile duct injury mostly could be attributed to variation in the experience, how many surgeon included in the study, instrumentations used, for how long the patients were symptomatizing, the incidence of anatomical variations and whether the surgeon was using intraoperative cholangiogram routinely or selectively like its use in the current study when the anatomy was unsured. Supporting this wide variation is the study of Buanes et al [14] who reported 0.8% injuries after open cholecystectomies while in the current study it was 0.3% only.

Out of the eighteen injuries observed in the current study, nine (50%) were detected during the operations, one(3%) during the open cholecystectomy and eight (47%) during laparoscopic operations, this goes hand in hand with that of Mercado et al [18] who stated that less than half of these injuries are recognized during the operation. Statistically speaking there was no significant difference between cases of recognized injury in the open and laparoscopic patients ($P<0.3$). There were four cases (0.35%) of post operative jaundice in the laparoscopic group with no cases in the open operation with significant difference ($P<0.045$). Regarding the post operative leak, recorded in the current study to be zero% after open operations, 0.4% after laparoscopic operations and 0.9% after converted operations with a statistically significant ($P<0.028$) difference between bile leak post open operation and bile leak post laparoscopic operations, these records were not in accordance with Buanes et al [14] who reported much high incidence of bile leak after their cholecystectomies as they report 2.4% after open while in ours 0.4% also 4.2% after converted while in ours 0.9%. The morbidity following laparoscopic operation was much more that in the open operation and that difference was statistically (<0.01) significant, but on the other hand mortality was higher in the open operations with significant difference ($P<0.04$), this goes hand in hand with the result of Buanes et al [14} who found it to be significant (0.01), in our study death still occured approximately 4 times more frequently after open operations while it is 10 times more with others [20,21], however this is partly due to selection of high risk cardiopulmonary cases to open technique.

However biliary leakage may be difficult to diagnosis on physical examination, shock can occur from severe chemical peritonitis when diagnosis is delayed. This can be followed by septic shock from bacterial overgrowth within a period of hours to days; however, a dilmma can happenwith minimal biliary leakage, shock may not occur and abdominal signs may be absent.

Jaundice is usually observed 3-5 days after injury, along with the passage of acholic stools and dark-colored urine.Increasing abdominal girth accompanied by signs of dehydration and low-grade sepsis may be observed during the first week after surgery and the patient feeling unwell.

Diagnosis of extrahepatic biliary tract injury may be made during laparoscopy by direct observation of bile emanating from the suspected area or, if suspected, by contrast leak during an intraoperative cholangiogram. Notably, however, only less than 25% of iatrogenic biliary injuries are discovered at the time of cholecystectomy.Extrahepatic biliary injury may also be determined by patient complaints of pain, nausea, repeated un explained vomiting or increasing abdominal discomfort, occurring during the first week after laparoscopic cholecystectomy.Jaundice may also be present. Symptoms of cholangitis may be present in patients with delayed common bile duct stricture related to operative trauma.

5. Conclusion

The risk of complications after cholecystectomy was slightly higher than that found in literature; Laparoscopic cholecystectomy was associated with a higher incidence of CBD injuries, leak, jaundice and technical factors leading to failure to recognize injuries when they occur.

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