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Original Research Article

Complications of laparoscopic surgery in general surgical practice and their management

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ABSTRACT

Background: Any new technique is associated with the development of new complication. Laparoscopic surgery has gained popularity over last 20 years, owing to many advantages for patients in terms of smaller scar, less post-operative pain and quicker recovery. Despite the relative safety of laparoscopic techniques, inadvertent serious injuries to bowel, bladder and vascular structures do occur. Therefore, the need has arisen to study the various complications and their management inherent in this technique. The objective was to determine percentage of complications in laparoscopic surgeries of abdomen and also to study their management.
Methods: Inpatients of Ramaiah hospitals undergoing abdominal laparoscopic surgeries from October 2014 to October 2015 who are above 14 years of age and undergoing elective or emergency surgeries or diagnostic laparoscopy for acute/chronic appendicitis, cholelithiasis and inguinal hernia repair. Demographic information, clinical findings, intra operative and postoperative findings will be noted. Follow up of the patient is done for 4 weeks.
Results: Out of the 272, 134(49.3%) were male patients and 138 (50.7%) were female patients, age group ranging between 31-40 years. Four patients (1.4%) showed CBD injury, three patients (1.1%) showed bowel injury, twelve (4.4%) showed bile leak, all these 9 (3.3%) patients were managed by converting the laparoscopic cholecystectomy into open cholecystectomy. Sixteen patients (5.9%) had laparoscopy converted into open procedure due to the intraoperative complications. Statistically significant impact was noted on the outcome of surgery due the complication that patient underwent during the study.
Conclusions: Laparoscopy is a safe, effective and well tolerated procedure if conducted in the skilled and experienced hands. The morbidity and mortality are dependent on age, general condition, presence/ absence of comorbidities and hence preoperative thorough work up is imperative. Large proportions of these complications occur during the initial learning curve of the inexperienced laparoscopic surgeon.

Keywords: Laparoscopic surgery, Management

INTRODUCTION

Laparoscopic surgery has revolutionized the field of surgery over last 20 years, owing to many advantages for patients in terms of smaller scar, less post-operative pain and quicker recovery. In 1901, George Kelling performed the first laparoscopy by introducing a cystoscope into a dog's abdominal cavity. Semm performed the first laparoscopic appendectomy in 1980 and world's first laparoscopic cholecystectomy was done by Erich Muhe

(1985). This ended the era of "big surgeon- big incision".[1]

Minimally invasive surgery received early criticism owing to higher incidence of complications encountered during the early learning phase of each surgeon's experience. Increased incidences of complications have been documented during the surgeon's first 50 cases. Therefore, emphasis should be on proper training and credentialing of laparoscopic surgeons.[2] The operative morbidity and mortality are 4% and <0.1%, respectively.[3]

Hence, traditionally performed open surgery has been widely replaced by laparoscopy, with advantages being quicker recovery, decreased length of hospital stay, decreased pain and improved cosmesis.[4]

The problems encountered during laparoscopy include:

- Pneumoperitoneum related problems
- Anaesthesia related problems
- Procedure related problems

METHODS

Study design

It was a prospective descriptive study.

Source of data

In-patients of Ramaiah Medical College and Hospitals undergoing abdominal laparoscopic surgeries from October 2014 to October 2015.

Inclusion criteria

- Patients >14 years
- All elective and emergency cases of acute and chronic appendicitis, cholelithiasis, umbilical and inguinal hernia repair and others
- Cases undergoing diagnostic laparoscopy

Exclusion criteria

- Acute and chronic appendicitis, cholelithiasis, umbilical and inguinal hernia repair presenting with generalized peritonitis
- Laparoscopic gynecology and urology procedures
- Penetrating and blunt abdominal trauma
- Previous abdominal surgeries
- Hemodynamic instability
- Deranged coagulopathy

Methodology

After obtaining ethical clearance and taking informed consent, demographic information, clinical manifestations, physical examination findings, associated co morbidities, intra and post-operative findings were entered in the proforma. Routine protocol for performing laparoscopic surgery followed. Follow up of patients after 4 weeks either by in-person / telephone was done.

Routine investigations

- CBC
- Coagulation profile
- LFT
- Serum electrolytes
- X-ray abdomen and chest
- USG abdomen and pelvis

Special investigations

CT or MRI abdomen and pelvis.

Authors performed laparoscopy as follows:

Pre- anesthetic checkup was done in each case.

- Under GA
- Supine with table position according to area of examination
- Open technique with Hasson's cannula/ closed technique with Veress needle to create pneumoperitoneum with CO_2 at 12-14mm Hg.
- Camera port- 10mm placed intra, supra or sub-umbilically. 2-3 working ports of 5mm inserted as required.
- 00 telescope was used to put secondary ports under vision and for the rest of the procedure.
- A systematic examination of the intra-abdominal organs was then performed to assess normalcy and planned procedure was executed.
- If laparoscopy was not feasible, it was converted to open procedure.
- Ports removed under vision and port site closed using vicryl.

RESULTS

This prospective descriptive study was conducted in the Department of Surgery, M. S. Ramaiah Hospitals, Bengaluru- 560 054, Karnataka, India, during the year October 2014-October 2015. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups and non-parametric setting for Qualitative data analysis. Data obtained was tabulated and analyzed as Tables 1-8.

Out of 272 samples, 134 (49.3%) were males and 138 (50.7%) were females with Mean age of 40.14±15.36 years as depicted in Figures 1-3.

The samples which met inclusion criteria are as described in Table 1- acute appendicitis (n=80) and recurrent (n=2)

appendicitis, acute cholecystitis (n=17) and chronic (n=6) cholecystitis and acalculouscholecystitis (n=2), cholelithiasis (n=133), hernia (n=17), ascites under evaluation (n=2), ITP (n=3) and Feeding jejunostomy (n=1). Cholelithiasis formed the bulk of present study accounting for 48.9%.

Table 1: Diagnosis.

Diagnosis	Gender		Total (n=272)
	Male (n=134)	Female (n=138)	
Appendicitis	46 (34.3%)	34 (24.6%)	80 (29.4%)
Recurrent appendicitis	1 (0.7%)	1 (0.7%)	2 (0.7%)
Acute cholecystitis	8 (6%)	9 (6.5%)	17 (6.3%)
Chronic cholecystitits	4 (3%)	2 (1.4%)	6 (2.2%)
Cholelithiasis	55 (41%)	78 (56.5%)	133 (48.9%)
Acalculouscholecystitis	0 (0%)	2 (1.4%)	2 (0.7%)
Hernia	11 (8.2%)	6 (4.3%)	17 (6.3%)
Ascitis under evaluation	1 (0.7%)	1 (0.7%)	2 (0.7%)
Idiopatic thrombocytopenic purpura	1 (0.7%)	2 (1.4%)	3 (1.1%)
Feeding jejunostomy	0 (0%)	1 (0.7%)	1 (0.4%)

Diabetes, hypertension and bronchial asthma were for the comorbidities seen in the samples accounting for 4.4%, 4.4 % and 2 % respectively (Table 2).

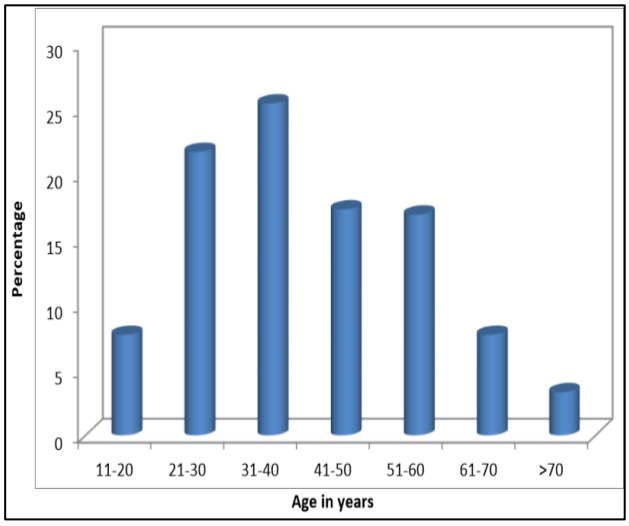

Figure 1: Age distribution of patients studied.

Table 2: Co-morbid conditions.

Condition	Gender		Total (n=272)
	Male (n=134)	Female (n=138)	
Diabetes	5 (3.7%)	7 (5.1%)	12 (4.4%)
Hypertension	8 (6%)	4 (2.9%)	12 (4.4%)
Bronchial asthma	1 (0.7%)	1 (0.7%)	2 (0.7%)
Others	1 (0.7%)	1 (0.7%)	2 (0.7%)

Closed method of creation of pneumoperitoneum was performed in 209 cases (76.8%) and open method in 63 patients (23.2%) (Table 3). Most common procedure underwent by patients during this study (Table 4) was laparoscopic cholecystectomy, n=140 (51.5%), followed by laparoscopic appendectomy in 81 cases (29.8%).

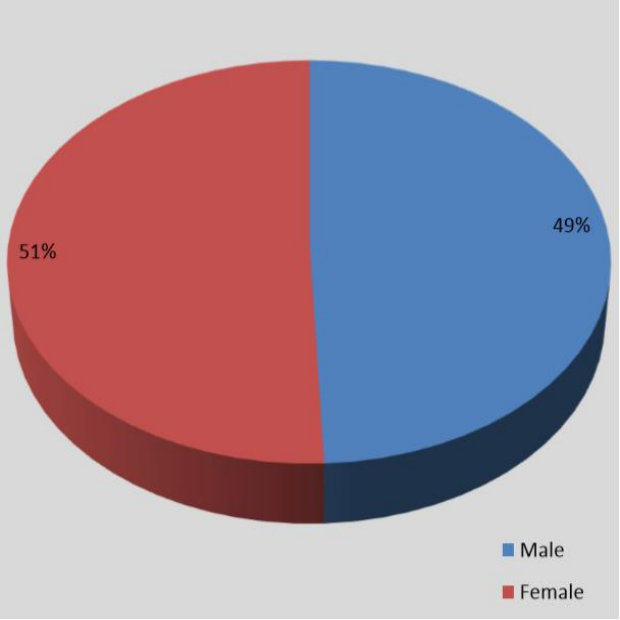

Figure 2: Gender distribution of patients studied.

Table 3: Method of pneumoperitoneum.

Method of pneumo-peritoneum	Gender		Total
	Male	Female	
Closed	102 (76.1%)	107 (77.5%)	209 (76.8%)
Open	32 (23.9%)	31 (22.5%)	63 (23.2%)
Total	134 (100%)	138 (100%)	272 (100%)

A total of 16 patients were converted to open surgery (5.8%). Intraoperative complications were seen in 58 patients (18.75 %) which included (**Table 5**): port site bleeding noted in 16 cases, cystic artery injury in 2 cases, 4 cases each of CBD injury and clip slippage, omental insufflation in 7, bowel injury in 3, adhesions in 22 patients and 2 with small bowel perforation during laparoscopic adhesiolysis, spillage of stones into peritoneal cavity- 2, surgical site infection- 6, Port site hernia- 1 and Seroma- 3.

Statistical significance noted with complications like bleeding (5.9%), CBD injury (1.5%), Bile leak (4.4%), bowel injury (1.1%) and infection (2.2%) with a p value of <0.001 with respect to the outcome which led to laparoscopic conversion to open procedure.

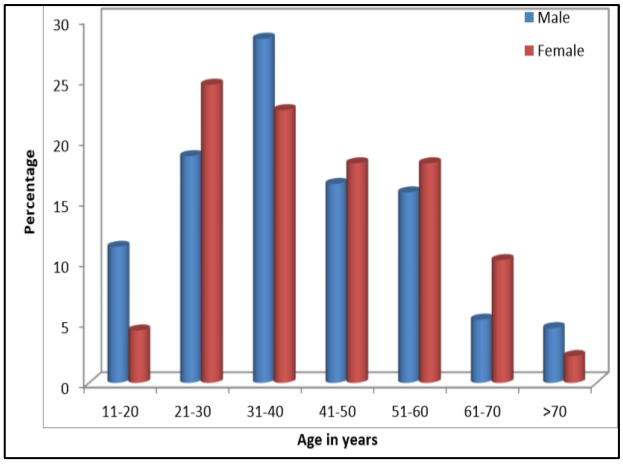

Figure 3: Age-sex distribution of patients studied.

Table 4: Operative procedures.

Operative procedures	Gender		Total (n=272)
	Male (n=134)	Female (n=138)	
Laparoscopic appendicectomy	43 (32.1%)	38 (27.5%)	81 (29.8%)
Laparoscopic cholecystectomy	62 (46.3%)	78 (56.5%)	140 (51.5%)
Laparoscopic hernia repair	9 (6.7%)	5 (3.6%)	14 (5.1%)
Diagnostic lap	2 (1.5%)	5 (3.6%)	7 (2.6%)
Laparoscopic splenectomy	1 (0.7%)	0 (0%)	1 (0.4%)
Feeding jejunostomy	0 (0%)	2 (1.4%)	2 (0.7%)
Laparoscopy into open appendicectomy	1 (0.7%)	4 (2.9%)	5 (1.8%)
Laparoscopy into open cholecystectomy	6 (4.5%)	3 (2.2%)	9 (3.3%)
Laparoscopy into open hernia	0 (0%)	2 (1.4%)	2 (0.7%)
Exploratory lap	2 (1.5%)	0 (0%)	2 (0.7%)

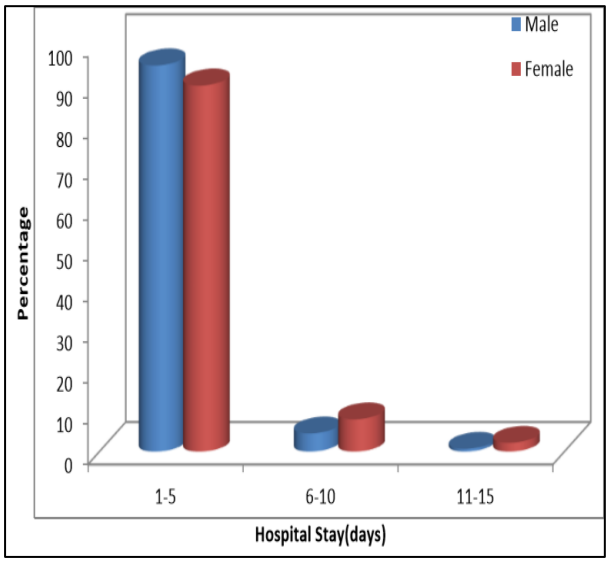

Figure 4: Hospital Stay in days.

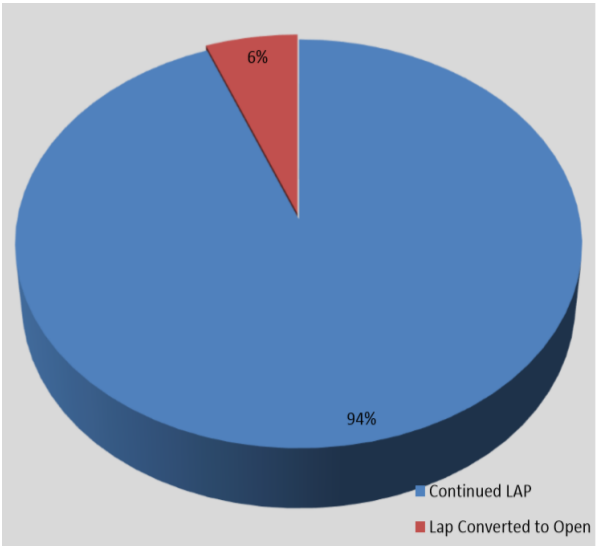

Figure 5: Comparative analysis of proposed surgery and executed surgery.

Table 5: Complications of patients studied.

Complications	Gender		Total (n=272)
	Male (n=134)	Female (n=138)	
Bleeding	10 (7.5%)	6 (4.3%)	16 (5.9%)
CBD injury	3 (2.2%)	1 (0.7%)	4 (1.5%)
Clip slippage	2 (1.5%)	2 (1.4%)	4 (1.5%)
Bile leak	7 (5.2%)	5 (3.6%)	12 (4.4%)
Omental sufflation	1 (0.7%)	6 (4.3%)	7 (2.6%)
Bowel injury	1 (0.7%)	2 (1.4%)	3 (1.1%)
Adhesions	11 (8.2%)	11 (8%)	22 (8.1%)
Spillage of stones	2 (1.5%)	0 (0%)	2 (0.7%)
Infection	3 (2.2%)	3 (2.2%)	6 (2.2%)
Recurrence of hernia	0 (0%)	0 (0%)	0 (0%)
Post site hernia	0 (0%)	1 (0.7%)	1 (0.4%)
Seroma	2 (1.5%)	1 (0.7%)	3 (1.1%)
Mortality	0 (0%)	0 (0%)	0 (0%)

The outcome of surgery was not altered by age or sex, as evidenced from Table 6 and Table 7 respectively with p=0.27 indicating no statistical significance.

Table 6: Age distribution of patients studied in relation to outcome of surgery.

Age in years	Surgery		Total
	Continued LAP	Lap converted to open	
11-20	21 (8.2%)	0 (0%)	21 (7.7%)
21-30	56 (21.9%)	3 (18.8%)	59 (21.7%)
31-40	65 (25.4%)	4 (25%)	69 (25.4%)
41-50	46 (18%)	1 (6.3%)	47 (17.3%)
51-60	41 (16%)	5 (31.3%)	46 (16.9%)
61-70	18 (7%)	3 (18.8%)	21 (7.7%)
>70	9 (3.5%)	0 (0%)	9 (3.3%)
Total	256 (100%)	16 (100%)	272 (100%)

P=0.247, Not significant, Fisher Exact test.

Table 7: Gender distribution of patients studied in relation to outcome of surgery.

Gender	Surgery		Total
	Continued LAP	Lap converted to open	
Male	127 (49.6%)	7 (43.8%)	134 (49.3%)
Female	129 (50.4%)	9 (56.3%)	138 (50.7%)
Total	256 (100%)	16 (100%)	272 (100%)

Table 8: Complications of patients studied in relation to outcome of surgery.

Complications	Surgery		Total (n=138)	P value
	Continued lap (n=256)	Lap converted to open (n=9)		
Bleeding	7(2.7%)	9(56.3%)	16(5.9%)	<0.001**
CBD injury	1(0.4%)	3(18.8%)	4(1.5%)	0.001**
Clip slippage	3(1.2%)	1(6.3%)	4(1.5%)	0.216
Bile leak	6(2.3%)	6(37.5%)	12(4.4%)	<0.001**
Insufflation	6(2.3%)	1(6.3%)	7(2.6%)	0.349
Bowel injury	1(0.4%)	2(12.5%)	3(1.1%)	0.009**
Adhesions	14(5.5%)	8(50%)	22(8.1%)	<0.001**
Spillage of stones	1(0.4%)	1(6.3%)	2(0.7%)	0.114
Infection	3(1.2%)	3(18.8%)	6(2.2%)	0.003**
Recurrence of hernia	0(0%)	0(0%)	0(0%)	-
Port site hernia	0(0%)	1(6.3%)	1(0.4%)	0.059+
Seroma	2(0.8%)	1(6.3%)	3(1.1%)	0.167
Mortality	0(0%)	0(0%)	0(0%)	-

Chi-Square test/Fisher Exact test.

The Figure 4 depicts average length of stay, which most commonly ranged between 3-5 days.

DISCUSSION

A total of 272 patients were included in the study of which 134 were male and 138 female from 15-80 years. 81 patients underwent laparoscopic appendicectomy, 140- laparoscopic cholecystectomy, 14- laparoscopic hernia repair, 7- diagnostic laparoscopy, 1 laparoscopic spleenectomy and 2l aparoscopic feeding jejunostomies.

Pneumoperitoneum was established by the open method in 63 patients and by closed method in the remaining 209. Comorbidities seen in 28 patients.

Intraoperative complications were noted in 58 patients (18.75 %) and are as follows:

- Port site bleeding- 14
- Cystic artery injury- 2
- CBD injury- 4
- Clip slippage- 4
- Omental insufflations- 7
- Bowel injury- 3
- Adhesions in 22 patients and 2 with small bowel perforation during laparoscopic adhesiolysis
- Spillage of stones into peritoneal cavity- 2
- Surgical site infection- 6
- Port site hernia- 1
- Seroma- 3

The following instances led to conversion to open procedure:

- Two patients had Cystic Artery injury with bleeding despite using clips and cautery resulting in abandoned laparoscopy.

- Four patients had CBD injury:

    1. Of these, one had CBD stent insitu with injury by cautery.

    2. Primary repair was done using vicryl 2 0 round body and a subhepatic drain was placed. Cholangiogram was performed on post-operative day 5.

In present study, fourteen patients had port site bleeding which in most of the situations controlled by cautery and laparoscopic suturing with vicryl was done in one patient. A study conducted by Boswell WC et al, showed that abdominal wall haemorrhage occurs in 0.05-2.5% of cases and mostly manifests as oozing externally around an operating port or dripping along the shaft of the cannula into the peritoneal cavity.[5] In their study, they also concluded that the source of bleeding is usually the inferior epigastric artery or one of its branches. The abdominal wall haemorrhage can be controlled with a variety of techniques including application of direct pressure with the operating port, laparoscopic suture or tamponade with a Foley's catheter inserted into the peritoneal cavity.

Rastogi V et al, presented their experience with 20 patients of port site bleeding by plugging the port site hole with surgiseal for controlling port site bleeding.[6]

In present study two patients had spillage of gall stones into the peritoneal cavity during dissection. Stones were picked by laparoscopic bowel grasper and delivered out through the ports. Peritoneal wash was given with saline and drain was placed in the subhepatic place. In a study conducted by David C et al, concluded that intraperitoneal spillage of gallbladder contents during laparoscopic cholecystectomy is associated with an increased risk of intraabdominal abscess.[7] Attempt should be made to irrigate the operative field to evacuate spilled bile and to retrieve all gall stones spilled during the operative procedure.

In yet another study conducted by Irkorucu O et al concluded in their study saying that stones left in the abdominal cavity or trapped in trocar sites after laparoscopic cholecystectomy can cause serious late complications requiring repeated surgical interventions.[8] Every effort should be made in order to avoid spillage of stones during dissection of the gall bladder and cystic duct and during retrieval of the gall bladder through the abdominal wall. In another study by Hashimoto et al, reported three patients with intra-abdominal abscesses developed as a result of dropped stones during laparoscopic cholecystectomy.[9]

Author also had one patient who developed a jejunal perforation during adhesiolysis while doing laparoscopic appendicectomy. The procedure was converted to an open procedure and primary closure of the perforation was done. The jejunal perforation developed probably due to the thermal injury caused during laparoscopic adhesiolysis. In a study conducted by Ress et al, with their experience of 22 patients of various intra operative complications during laparoscopic surgeries.[10] The most common site of injury was a fatal jejunal perforation which was managed by converting to open and primary closure was done.

CONCLUSION

Laparoscopy is a safe, effective and well tolerated procedure if conducted in the hands of a skilled and experienced operator. The reported mortality varies from 0-0.3%. The mortality and morbidity depend on general condition of the patient, age, associated comorbities and history of previous surgeries. The common complications are trivial in nature, but a few are life threatening. Large proportion of these complications occurs during the initial learning curve of the inexperienced surgeon. The reported intra operative complications of laparoscopic surgeries based on several long-term trials are about 4-5%. However, in present study, the intra operative complication rate was found to be 21.32%

This could be attributed to the fact that Ramaiah hospital is a tertiary care centre, more patients with more risk factors and more complicated cases are likely to come here and hence the higher intra operative complication rate as compared to the ones presented in the literature which is due to this confounding bias. Most of the complications (n= 32) were seen during laparoscopic cholecystectomies. Also, as the learning curve of the operating surgeon reaches a stable phase, the complication rate will also decline. Proper detection and control of co-morbid conditions, through investigation of the patient pre-operatively, are some of the measures recommended to decrease the chance of intra- operative complication.

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