Innovative Journal of Medical and Health Science

IJMHS 10 (05), 809–819 (2020) ISSN (O) 2277:4939 | (P) 2589:9341

PORT – SITE COMPLICATIONS FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

Dheeraj Yadav[1]*, Anurakshat Gupta[2], Garima Yadav[3], SK Manwatkar[4]

[1]*Department of Surgery, 3 Air Force Hospital, Amla.*

[2]*Department of Surgery, Command Hospital Air Force, Bangalore.*

[3]*Department of Surgery, 3 Air Force Hospital, Amla.*

[4]*Department of Surgery, 7 Air Force Hospital, Kanpur*

DOI: https://doi.org/10.15520/ijmhs.v10i03.285

Accepted 01/05/2020; Received 15/04/2020; Publish Online 07/05/2020

INTRODUCTION

For more than 100 years open cholecystectomy was the effective treatment for both acute and chronic cholecystitis. After the introduction of Laparoscopic Cholecystectomy (LC) by Philippe Mouret in France in 1987, this became the gold standard treatment for acute/chronic cholecystitis (1), (2). Laparoscopic Cholecystectomy ended attempts for non invasive management of gall stones and offers cure for gall stones with minimally invasive procedure, minimal pain and scarring, and early return of full activity (3).

Various studies confirm that wound infection rates are considerably lower following Laparoscopic Cholecystectomy than those for an open procedure (4).

Due to different modality of creating ports and various approaches in closing the port site leads to variety of results in healing of wounds at that site. This leads on into many complications in some patients. The most common of which are port site infections, hematoma, bilioma and rarely port site hernia. The CDC (Centre of Disease Control) classification of surgical site infection (SSI) includes incisional, which may be "superficial" involving skin and sub cutaneous tissue or "deep" involving fascia and muscles and organ space infections (5). The study published in 2008 in JPMI shows that SSI rate following Laparoscopic Cholecystectomy is 5.78% of which epigastric port involvement is seen in 88% of cases and umbilical port site involvement is seen in 12% (6). These complications are descriptively studied here and assessed such that the best modality could be followed uniformly to prevent complications. We have tried to evaluate different port site complications, their aetiologies, rate at which they occur, in respect to method of port formation, timing of surgery, intra-op difficulties, surgeons experience and patient co-morbidities.

AIMS AND OBJECTIVES

To study about various port-site complications following Laparoscopic Cholecystectomy. To evaluate incidence rate of such complications and correlate their occurrence with BMI, Co-morbidities, Methods of Port formation, Operative time and Intra-operative findings.

MATERIALS AND METHODS

All cases of Symptomatic Gall stone disease admitted and operated over the period of 2 yrs in our hospital were studied.

Inclusion Criteria:

• All patients of Symptomatic Gall Stones Disease posted for Laparoscopic Cholecystectomy (including emergencies).

Exclusion Criteria:

• Uncontrolled Diabetes

• Patients on Immunosuppressive agents

• Laparoscopic surgery converted to open surgery

• History of previous laparoscopic surgery/ hernia surgeries

• Port formation at previous operative scar site

Patients who overcome the exclusion criteria were included in the study. They were admitted for Laparoscopic Cholecystectomy after pre-op preparation. They all underwent standard Laparoscopic Cholecystectomy and port sites were closed in two layers with Vicryl 2-0 for sub cutaneous tissue and fascia and Nylon 3-0/Skin staplers for skin.

Image 1: Atypical Mycobacterial Infection (Umbilical port) – Nodule (4 wks)

Image 2: Atypical Mycobacterial infection (Umbilical port) – Sinus formation (6 wks)

Image 3: Hematoma with super added bacterial infection (Epigastric port).

Statistical Analysis

Data analysis was done by using statistical software SPSS (Statistical package for social sciences) Version 17.0. Two independent sample t-test, Chi-square test, Fisher's exact test and Mann Whitney U test were used, p – value less than 0.05 is taken as significant.

RESULTS

Total 300 patients, 214 (71%) females & 86 (29%) males were included in the study. Following Laparoscopic Cholecystectomy 29 (9.6%) patients developed port-site complications (Table 1 & Figure 1)

Table 1: Incidence rate of complications that occurred among patients in study.

COMPLICATIONS 9.6%(29 cases)	Atypical Mycobacterial	Gram Positive/Negative	Port site Hematoma	Port site Hernia
	16 (5.33%)	12 (4.0%)	1 (0.3%)	0

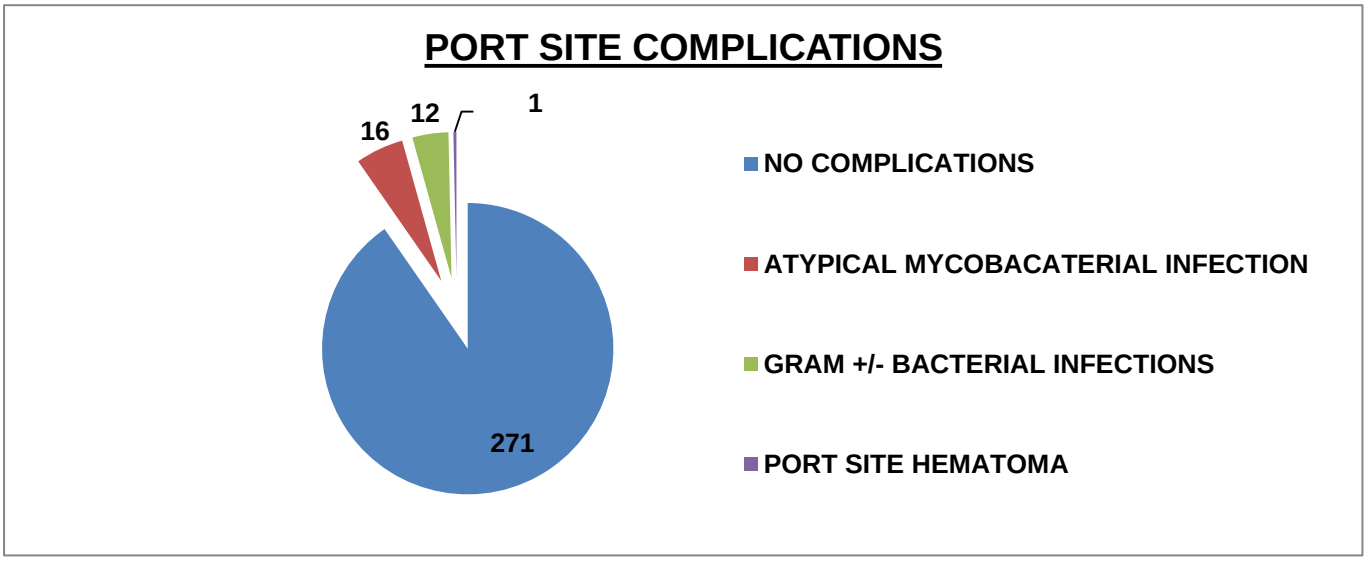

Figure 1: Incidence of different port-site complications

Out of 29 patients who developed complications 04 (13.7%) patients have complications at umbilical port, 16 (55.17%) patients developed complications at epigastric port, 07 (24.3%) patients developed complications at umbilical as well as epigastric port and 02 (6.8%) patients developed complication at all four ports (Figure 2)

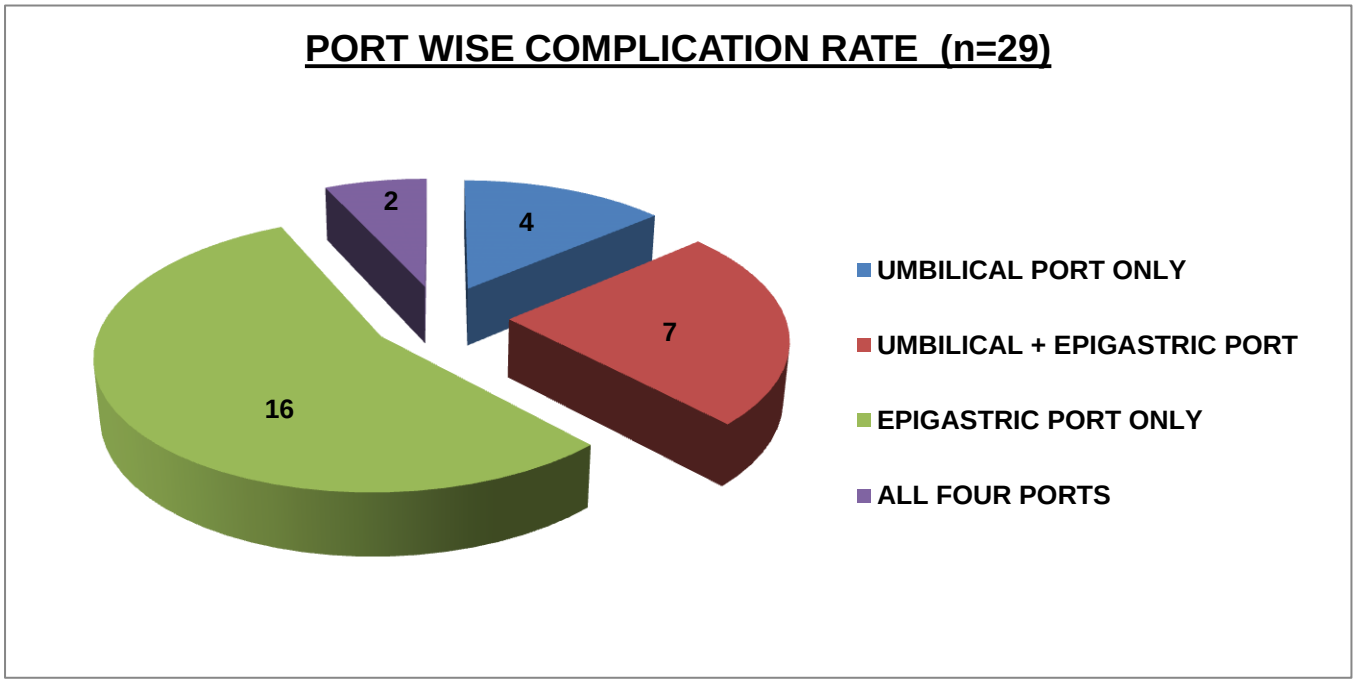

Figure 2: Port wise complication rate.

(a) Influence of gender in causing port site complications:

9 out of 86 males and 20 out of 214 females developed port site complications. There was no statistical difference between males and females (p-value = 0.6) in development of port site complications.

(b) Influence of co-morbidities in causing port site complications

Among 300 patients 38 (12.6%) were suffering from Diabetes mellitus (DM)/ Hypertension/Chronic Obstructive pulmonary disease. 20 (6.7%) have DM, 26 (8.7%) have Hypertension which includes 18 (5.4%) patients who have both DM and Hypertension and 01 (0.03%) who have all three co-morbidities (Table 2). After analysing the data it was evident that co-morbidities play a significant role in causing port site complications (p-value = 0.001).

Table 2: Occurrence of port-site complications in patients with co-morbidities.

Co-morbidities	COMPLICATIONS			No Complications	Total	p-value
	Atypical Mycobacteria	Bacterial Gram +/-	Hematoma			
Yes	08	07	00	23	38	0.001
No	08	05	01	248	262	0.001
Total	16	12	01	271	300	

(c). Influence of intra-op findings in causing port site complications

Three criterions of intra-op findings were taken into account which may lead on to port site complications post operatively (Table 3, Figure 3 & 4).

(i). Frozen calot's triangle (Difficult cholecystectomy with adhesions which takes >70 min of operative time).

(ii). Minimal adhesion in calot's triangle (Cholecystectomy with adhesions which takes <70 min of operative time).

(iii). No adhesions at all.

Table 3: Influence of intra-op findings in causing port site complications

Intra-op Findings	COMPLICATIONS			No Complications	Total	p-value
	Atypical Mycobacteria	Bacterial Gram +/-	Hematoma			
Frozen Calot's	06	03	00	00	09	0.001
Minimal Adhesions	02	01	01	09	13	0.001
No Adhesions	08	08	00	262	278	0.6
Total	16	12	01	271	300	

It is evident from the above mentioned findings that intra-op difficulty in the form of Frozen calot's or adhesions has a great influence in causing post-op Port site complications with significant p value – 0.001 (<0.05).

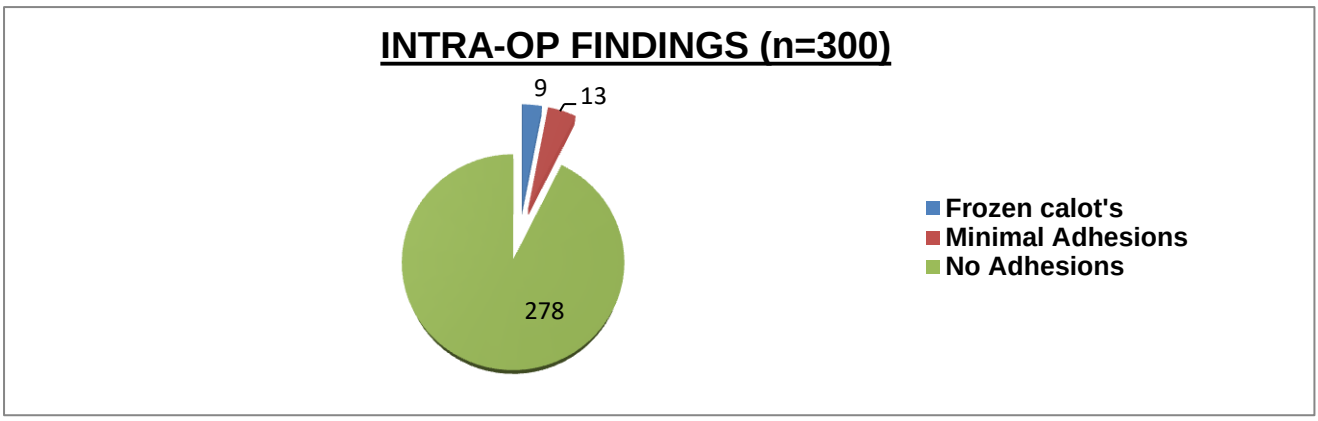

Figure 3: Intra-operative findings

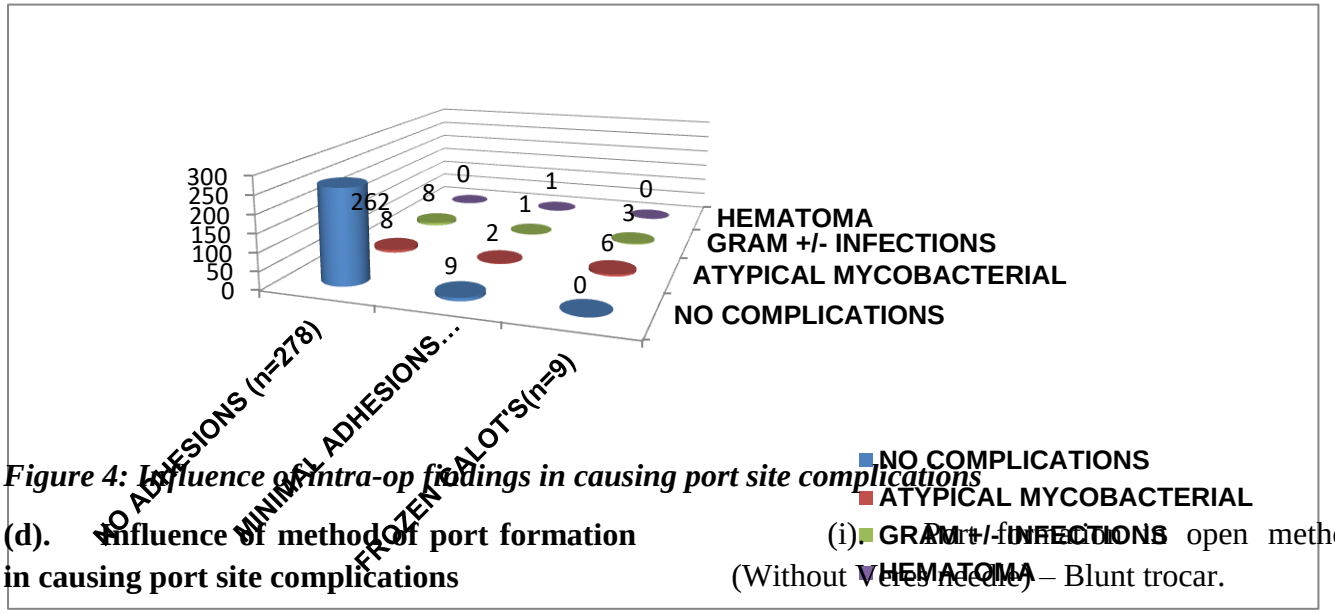

Figure 4: Influence of intra-op findings in causing port site complications

(d). Influence of method of port formation in causing port site complications

Two criterions of method of port formation were taken into account to find out their influence on causing port site complications (Table 4, Figure 5 & 6):

(i). Port formation in open method (Without Veres needle) – Blunt trocar.

(ii). Port formation in closed method (With Veres needle) – Sharp trocar.

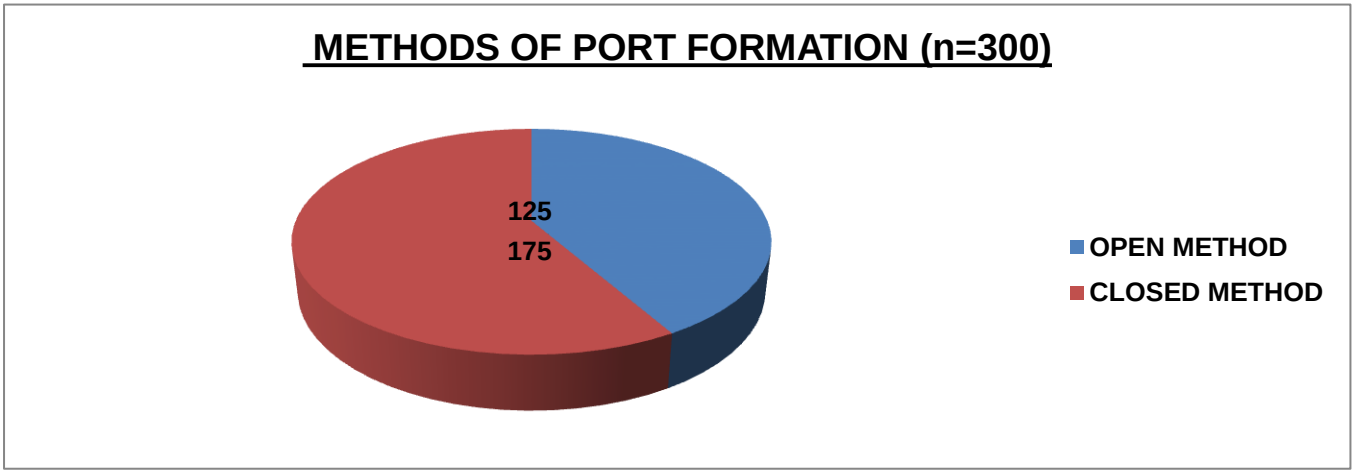

Figure 5: Different methods of port formation

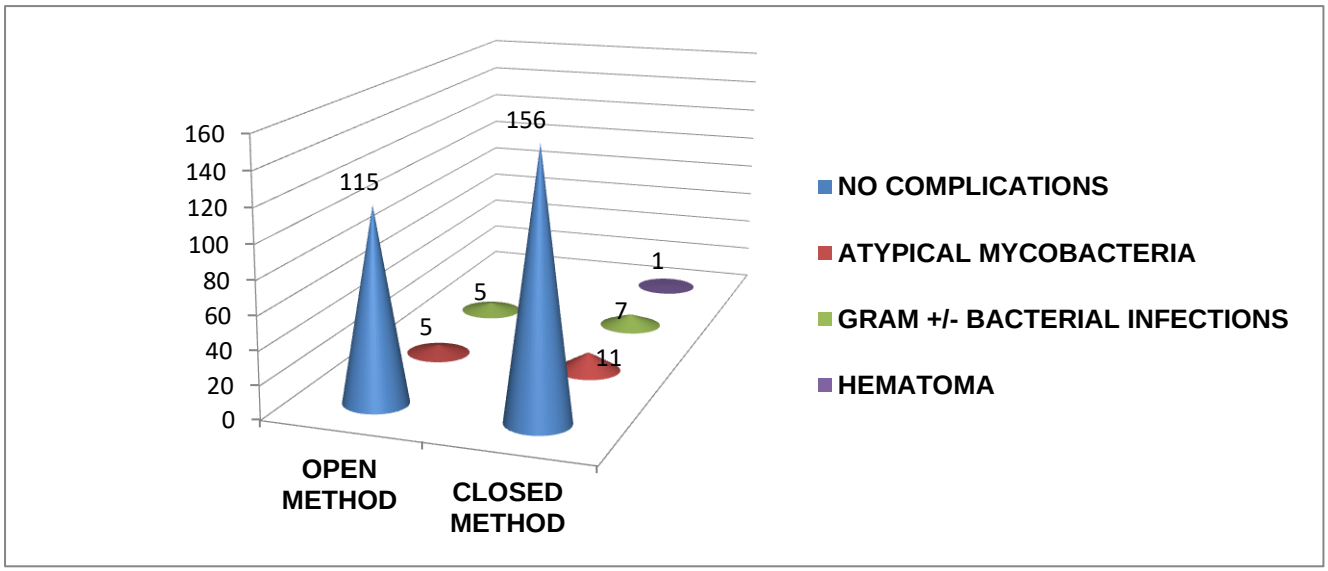

Figure 6: Influence of different methods of port formation in causing port-site complications.

From the below mentioned table it is evident that the method of port formation has no role in creating port site complications (p value is not significant) >0.05

Table 4: Influence of different methods of port formation in causing port-site complications.

Method of Port formation	COMPLICATIONS			No Complications	Total	p-value
	Atypical Mycobacteria	Bacterial Gram +/-	Hematoma			
Open Method	05	05	00	115	125	0.659
Closed Method	11	07	01	156	175	0.651
Total	16	12	01	271	300	

(e). Influence of BMI (body mass index) in causing port site complications.

Patients were divided into two groups as per their BMI to find out the effects of BMI in causing port site complications (Table 5, Figure 7 & 8).

(i) BMI 30 Kg/m^2 and above
(ii) BMI < 30 Kg/m^2

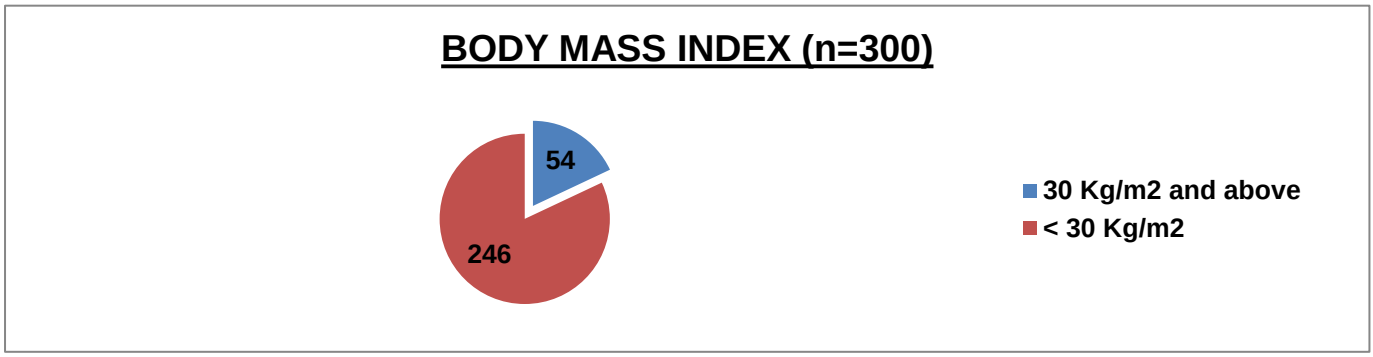

Figure 7: Different groups of patients as per Body Mass Index

From the below mentioned table it is evident that patients having BMI 30 or more are prone to develop port site complications following Lap Cholecystectomy with significant p value of 0.001 (<0.05).

Table 5: Influence of BMI in causing port-site complications

BMI	COMPLICATIONS			No Complications	Total	p-value
	Atypical Mycobacteria	Bacterial Gram +/-	Hematoma			
30 Kg/m^2 and Above	10	06	00	38	54	0.001
< 30 Kg/m^2	06	06	01	233	246	0.001
Total	16	12	01	271	300	

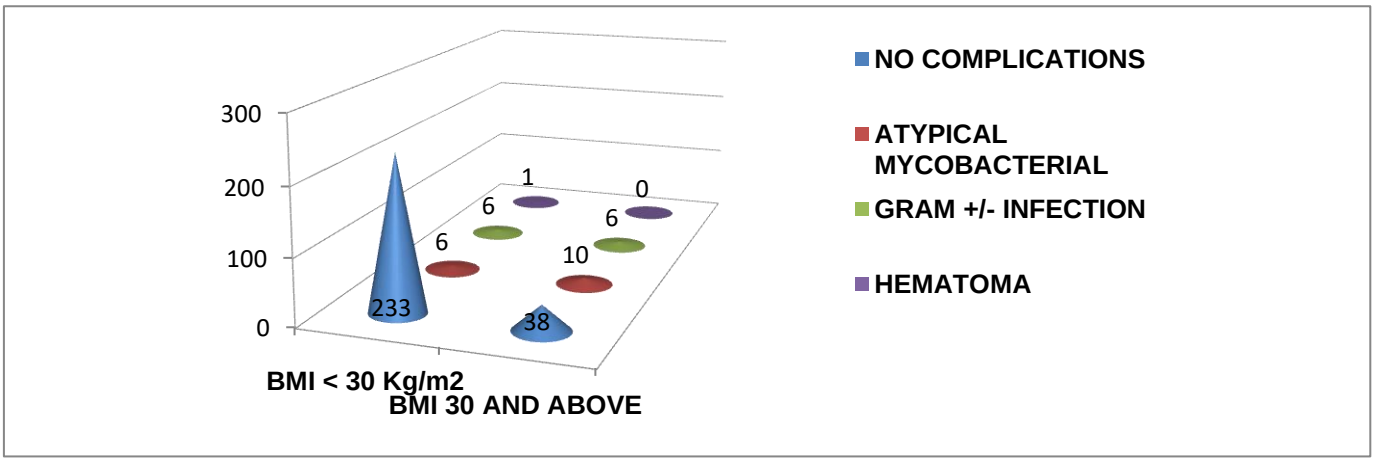

Figure 8: Influence of BMI in causing port-site complications

(f). Influence of duration of surgery (operative time) on causing port site complications.

Here we discuss about the influence of duration of surgery in creating port site complications/infections. It has been divided into two categories (Table 6, Figure 9 & 10):

(i). Operative time 70 min and above.

(ii). Operative time < 70 min

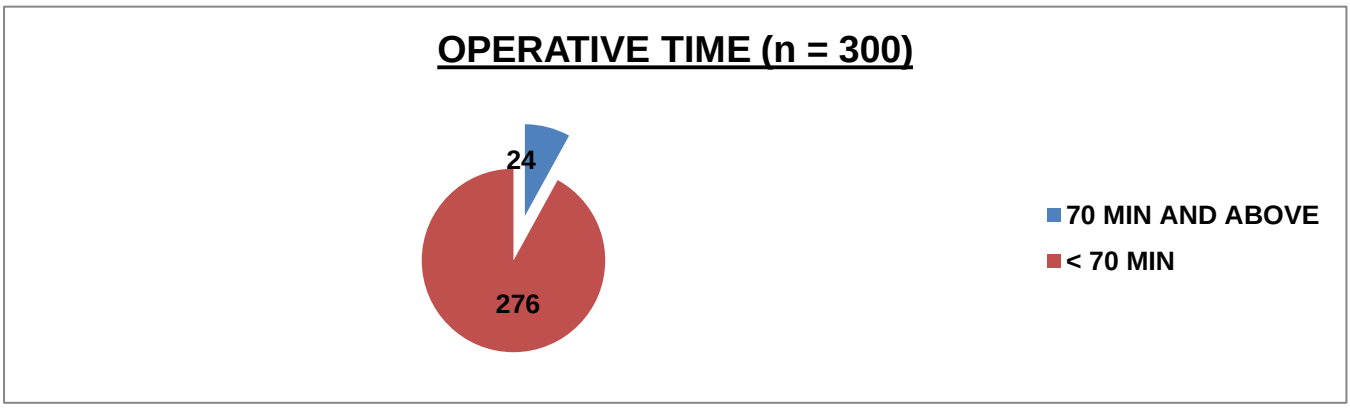

Figure 9: Duration of surgery (in minutes).

Table 6: Influence of duration of surgery in causing port-site complications.

Duration of Surgery	COMPLICATIONS			No Complications	Total	p-value
	Atypical Mycobacteria	Bacterial Gram +/-	Hematoma			
70 min or More	09	04	00	11	24	0.001
< 70 min	07	08	01	260	276	0.001
Total	16	12	01	271	300	

From the above mentioned table it is evident that operative time of 70 minutes or more has significant impact on causing port site complications (p value 0.001)

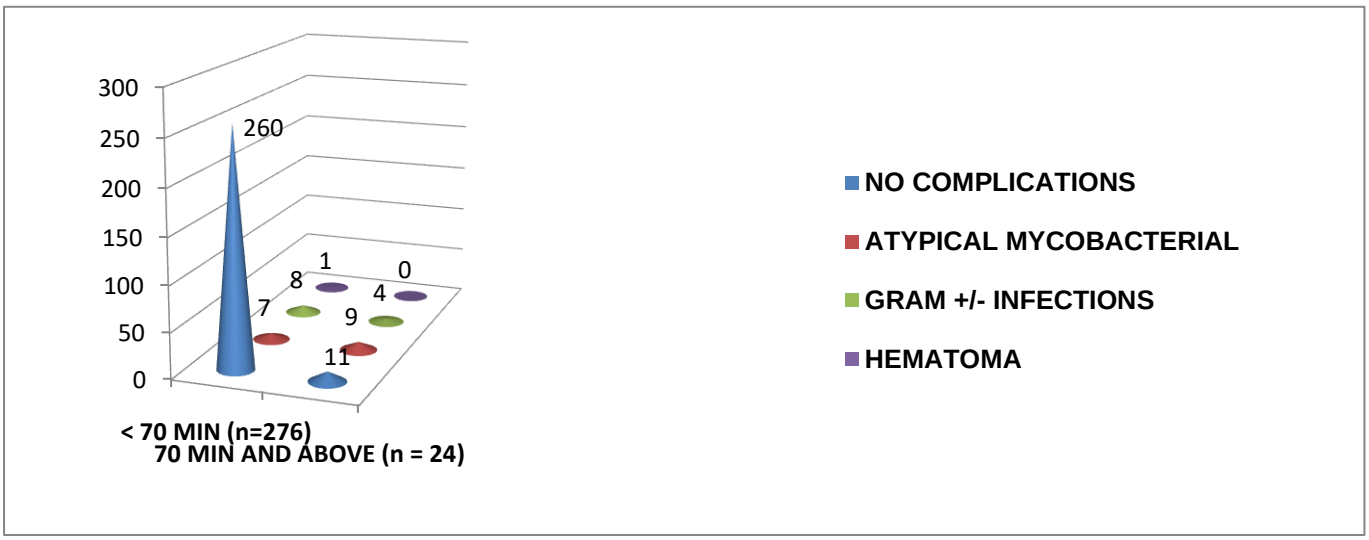

Figure 10: Influence of duration of surgery in causing port-site complications.

DISCUSSION

Since Laparoscopic Cholecystectomy is considered as Gold standard treatment for symptomatic gall stone disease, a lot of attention is given for prevention of the port site complications. These port site complications are disturbing complication which can cause loss of work days and might require hospital admissions too.

In this study 300 patients were included who underwent elective Laparoscopic Cholecystectomy. All patients underwent conventional 4 port surgery. In all patients, gall bladder is extracted through epigastric port only. The data analysis was done using Chi-Square test and Linear – by – linear association.

Port Site Infection

This study reveals that prevalence of symptomatic gall stone disease is more in females (71.33%) as compared to males (28.66%). The complications seen at port site among these patients are mostly infections in the form of Gram +/- bacterial infections and atypical mycobacterial infections. One patient had hematoma and none had port site hernia (Table 1 & Figure 1). The maximum number of complications in the form of infection occurred

at Epigastric port site (55%). 7 patients (24.13%) had infection at both Umbilicus and Epigastric port site. 4 patients (13.79%) had only Umbilical port site infection. 2 patients (6.8%) had all 4 port sites infection (Figure 2).

Total infection rate was 9.6%. Out of these 16 patients (5.33%) had Atypical mycobacterial infection. These patients were diagnosed by AFB staining of discharge and Histopathological examination of aspirate from indurations. All these cases were presented at end of 2nd or beginning of 3rd post-op week with indurations and nodule formation at the port site wound (Image 1 & 2). 12 patients (4%) got infected with Gram +/- organisms. The organisms isolated were (Staphylococcus, Enterococcus, Pseudomonas and E.coli). These patients presented with redness, pain and discharge by the end of 1st post-op week (Image 3). Sample of discharge was taken from the port site wound for culture and sensitivity to confirm type of infection.

The presence of peri-incisional erythema and wound drainage may indicate infection. Wound infection is prevented by appropriate administration of antibiotic prophylaxis, sterile technique and use of specimen bag for extraction (7). This infection of atypical mycobacteria particularly affects countries with budgets devoted to the health sector lower than in developed ones (8).

Port site infection by mycobacterial organisms, however, is an unusual complication and reported in developing countries in many centres. The genus Mycobacterium has more than 100 species. Of these, non-tuberculous mycobacteria (NTM) have been increasingly recognised to cause serious infections. From the different types of NTM, Mycobacterium fortuitum causes pyogenic infections in the soft tissue, while Mycobacterium chelonae abscess complex is well known cause of wound infection (9, 10). Mycobacterial contamination may occur during instrumental wash, because some strains of mycobacterium can colonize in PVC pipes even in sterile distilled water (10, 11).

Port Site Hernia

Port site herniation is also one of the common complications in Lap Cholecystectomy. Herniation is due to inadequate closure of musculo-aponeurotic layer of abdominal wall. The incidence of Port site hernia ranged from 0.38% to 5.4% with an overall incidence of 1.7% (12). However, in our study port site hernias were not found in any case. The difference can be due to the fact that all our cases were done by experienced surgeons. Port site hernias are most common in umbilical port (13, 14). It is also noticed that gender (male/female) has no influence/association in causing port site infection (p value = 0.64).

Comorbidities and Intra-operative findings

Among the patients who underwent surgery 38 patients (12%) had co-morbidities in the form of DM/HTN/COPD/CKD. These patients were taken up for surgery after proper pre-operative optimization. However, incidence rate of port-site complications with respect to co-morbidities were calculated and found to be significant with p value of 0.001.

Intra-operative findings (adhesions/frozen calot's) and their correlation with port-site complications were also studied. Three criteria's were formulated: (a) No adhesions in calot's triangle (b) Minimal adhesions in calot's triangle (total operative time is less than 70 minutes in presence of adhesions) and (c) Frozen Calot's (total operative time is more than 70 minutes in presence of adhesions. Based on these criteria's, 9 patients who developed port site complications have frozen calot's. Statistical analysis reveals that intra-operative adhesions play a significant role in causing port-site complications with p-value of 0.0001.

Method of Port Insertion

Initial port formation is through the Periumbilical region in all 300 cases. Two methods of port formation were used. Open method using blunt trocar and cannula in 125 cases and Closed method using Veress needle in 175 cases. Statistical analysis showed that the method of port formation has no impact on causing port-site complications. The p value obtained was 0.65 (>0.05) and is insignificant (Table 4 & Figure 5 & 6).

Body Mass Index (BMI)

Obesity is associated with increased morbidity related to various factors like need for longer trocar, thick abdominal wall, need for larger skin incision and limitation in mobility of instrument due to increased subcutaneous tissue (15). Based on BMI, patients were categorized into two groups. One having BMI <30 Kg/m^2 and other having BMI of 30Kg/m^2 and above. Out of 300 patients 54 patients had BMI 30Kg/m^2 and above and 246 patients had BMI <30Kg/m^2.

16 patients with BMI of 30Kg/m^2 and above and 13 patients with BMI of <30Kg/m^2 out of 54 and 246 respectively had port-site complications (Table 5 and Figure 7 & 8). Statistical analysis showed that patients with BMI of 30Kg/m^2 and above are at higher risk of developing port site complications following surgery with statistically significant P value (0.001).

Operative Time

Another factor taken into consideration for port-site complications is Operative time. Patients were categorized into two groups. First group (24 patients) is with operative time of 70 minutes and above, and second group (276 patients) is with operative time of less than 70 minutes. 13 patients in first group and 16 patients in second group developed port-site complications (Table 6 and Figure 9 & 10). Similar study done by DenHoed Pt et al in 1998 found incidence of port site infection is 5.3%. Study done by Shindolimath showed 6.3% of complications in Lap cholecystectomy. An Israeli study conducted in 1997 showed incidence of infections is 2% (15). A national study published in India in 2006 showed complication rate of Lap cholecystectomy is 2 % and that of open is 6% (17, 18).

On statistical analysis it was found that first group with operative time of 70 minutes and above is at high risk of developing port-site complications with significant p-value (0.001).

CONCLUSION

Laparoscopic Cholecystectomy is the gold standard treatment for symptomatic gall stone disease. Port-site complications following Laparoscopic Cholecystectomy are influenced by patients as well as technical factors like Co-morbidities, Body Mass Index (> 30 Kg/m^2), Intra-operative adhesions, Operative time (>70 minutes)

Among the port-site complications, infections are the most common complications with overall incidence of 9.6% and port-site hernia and hematoma are rare with overall incidence of less than 1%. Infections by atypical mycobacteria and Gram +/- organisms can be curtailed by practicing proper sterilization techniques and post op wound care.

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