

Assessment of Port Site Complications in Laparoscopic Surgery – A Prospective Descriptive Study from Western Odisha

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ABSTRACT

BACKGROUND

Laparoscopic surgery has brought about a paradigm shift in modern surgical care. It has varied applications in gastrointestinal surgery, urological surgery, gynaecological surgery and oncosurgery. Better cosmesis, less post-operative pain, hence reduced need for post-operative analgesia, shorter recovery period and faster return to daily activities are its advantages. However, certain complications like port site infection, hemorrhage, hernia, TB or metastasis are morbid complications that undermine its benefits. In this study, we wanted to identify the various port site complications in patients undergoing laparoscopic surgery for different diseases in our hospital and assess its incidence.

METHODS

This is a prospective descriptive study. 125 patients admitted to the Department of General Surgery from November 2018 to October 2020 who fulfilled the inclusion and exclusion criteria underwent elective laparoscopic surgeries. They were observed post-operatively for various port site complications. All the data was entered into the Microsoft Excel 2007 software and further analysis was done using SPSS software version 24.0 (IBM Inc. Chicago). A P - value of less than 0.05 was considered statistically significant.

RESULTS

Of 125 patients that underwent laparoscopic surgery, 9 patients (7.2 %) developed complications specific to port site upon a follow-up of 3 months. Complications observed were port site infection (n = 4, 3.2 %), port site hemorrhage (n = 2, 1.6 %). Port site hernia, port site tuberculosis (TB), umbilical port site hernia and mild subcutaneous emphysema were observed in one patient each (0.8 %). Scar abnormalities were seen in 3 patients (2.4 %).

CONCLUSIONS

Laparoscopy is associated with minimal complications. However rare these complications are, they take away from the advantages of the laparoscopic surgery and the reputation of the hospital and surgeon alike. Apt patient selection, meticulous surgical technique, proper sterilization of the laparoscopic instruments and effective antibiotics use can further reduce the incidence of complications.

KEYWORDS

Laparoscopy, Port Site Complications, Infection, Hernia, Hemorrhage

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BACKGROUND

Laparoscopic surgery has brought about a paradigm shift in the approach to modern surgical care. It has uses in myriad fields like gastrointestinal surgery, urology, gynaecology and oncosurgery. It is used for both diagnostic and therapeutic interventions in the abdomen and pelvis.¹ Its popularity is due to lesser post-operative pain, better cosmesis, shorter recovery period and earlier return to daily activities. It however has its own set of disadvantages that include port site complications such as infection, hemorrhage, port site hernia, port site TB or metastasis and endometriosis. The overall rate of port site complications is estimated to be 21 per 100,000 populations.² However rare these complications, they add to the morbidity of the patient and take away from the advantages of laparoscopy. Not only that, they spoil the reputation of the surgeon and the hospital.

The aim of our study is to identify the various port site complications in patients undergoing laparoscopic surgeries in our hospital and to assess their incidence.

METHODS

This is a hospital-based procedural prospective descriptive study conducted on 125 patients who underwent laparoscopic surgery from November 2018 to October 2020 and were evaluated for port site complications prospectively at the Department of General surgery at the VSS Institute of Medical Sciences and Research, Burla, Odisha.

Sample Size Calculation

At first the sample size of the study was calculated. Keeping previous studies in mind, the laparoscopic port site complications had a prevalence of 6.4% with an allowable error of roughly 5%, the sample size was calculated using the following formula:

$$n = 4 PQ / E^2$$

Where, P is the prevalence

Q = (100 - P) and

E is the permissible error of P.

Hence n = 96

Taking into consideration the non-responses and missing data during the analysis to be about 20%, the final sample was calculated to be 115. So, a minimum sample of 115 subjects was sufficient to attain the desired power of the study. However, for a better round up, a total of 125 patients were included in the study.

Patients with chronic illnesses like heart diseases, sickle cell disease, chronic obstructive pulmonary disease (COPD) were excluded from the study. Pre-operative demographic characteristics were noted. A thorough history, clinical examination, laboratory investigations and pre-operative anesthetic evaluation was carried out. All surgeries were

performed using general anesthesia and reusable laparoscopic instruments. Conventional laparoscopic techniques were used for the procedures. The port sites were observed for any bleeding intra-operatively. Post-operatively, the port sites were observed for infection, bleeding, hernia or TB. A follow up of 3 months was done.

Statistical Analysis

All the data was entered systematically into Microsoft Excel 2007 software and further analysed using SPSS software version 24.0 (IBM Inc., Chicago). All the categorical variables were expressed in terms of number/frequency and percentages. Bar charts and pie-charts were used for their depiction. The association between two categorical variables was obtained using chi-squared test/ Fischer exact test. All the continuous variables were expressed in terms of mean and standard deviation. Histograms were used to describe the continuous variables. Significance level in comparison of means was obtained by independent sample t-test / Mann-Whitney U test. A P - value of less than 0.05 was considered significant.

RESULTS

125 subjects were included in the final analysis of this hospital based procedural prospective study. None were converted to laparotomies. The mean age of the study participants was 41.93 ± 13.49 years with a minimum of 13 years to a maximum of 75 years. Age group wise distribution suggest that almost equal proportion of the study participants belonged to age group of less than 30 years (22.4 %), 30 to 40 years (28.8 %), 40 to 50 years (22.4 %) and more than 50 years (26.4 %). The mean height was 1.63 metres while the mean weight was 59.41 kg. Average BMI was seen to be 22.29 kg/m^2 . Majority of the subjects were females (64 %) compared to males (36 %). Demographic characteristic analysis showed that maximum patients were educated up to higher-secondary level (56.8 %). Almost three fourth of the study participants belonged to lower socio-economic class (72.0 %), while also 77.6 % belonged to rural area.

Mean pulse rate before surgery was 86.64 ± 8.47 per minute compared to a higher pulse rate of 89.18 ± 8.60 . This difference in pulse rate before and after surgery was statistically significant (P - value = 0.017). Mean SBP before surgery was 116.29 ± 8.74 mm of Hg compared to a lower SBP of 113.20 ± 9.24 . This difference in SBP before and after surgery was statistically significant (P - value = 0.005). Mean DBP among the subjects showed a rise after the surgery by 3 points and this difference was statistically significant (P - value = 0.001). There was a significant fall in the hemoglobin values after the surgery (10.05 g/dL) from before surgery (11.2 g/dL) and this difference was also statistically significant (P - value < 0.001). Pre-operative diabetes status showed that 8 (6.4 %) of the patients had diabetes and rest were non-diabetic.

As majority of the patients had gall bladder pathology, most of the patients underwent laparoscopic

cholecystectomy (72.8 %), followed by appendicectomy (19.2 %). 4 patients underwent hernia repair (3.2 %) while one (0.8 %) patient underwent adhesiolysis. Mean duration of surgery was 56.98 ± 25.58 minutes with a minimum of 25 minutes to a maximum of 135 minutes. Out of all laparoscopic surgeries, 91 (72.8 %) patients were given drains following surgery.

		With Post-Op Complication (n=4)	Without Post-Op Complication (n=121)	P Value
Sex [#]	Age*	57.50 $\pm$ 12.81	41.41 $\pm$ 13.25	0.030
	Female	1 (1.3 %)	79 (98.8 %)	
Socio-economic status [#]	Male	3 (6.7 %)	42 (93.3 %)	0.133
	Lower	4 (4.4 %)	86 (95.6 %)	
Diabetes status [#]	Middle	0 (0 %)	30 (100.0 %)	0.448
	Upper	0 (0 %)	5 (100.0 %)	
Duration of surgery*	BMI*	23.35 $\pm$ 5.67	22.52 $\pm$ 2.31	0.638
	Yes	2 (25.0 %)	6 (75.0 %)	
Drain [#]	No	2 (1.7 %)	115 (98.3 %)	0.020
	Duration of surgery*	66.25 $\pm$ 2.50	56.68 $\pm$ 15.35	0.008
Duration of drain*	Yes	4 (4.4 %)	87 (95.6 %)	0.574
	No	0 (0 %)	34 (100.0 %)	
		42.0 $\pm$ 12.0	24.83 $\pm$ 4.40	0.011

Table 1. Comparison of Participants with or without Post-Operative Complications

*Independent sample t-test
#Fischer exact test

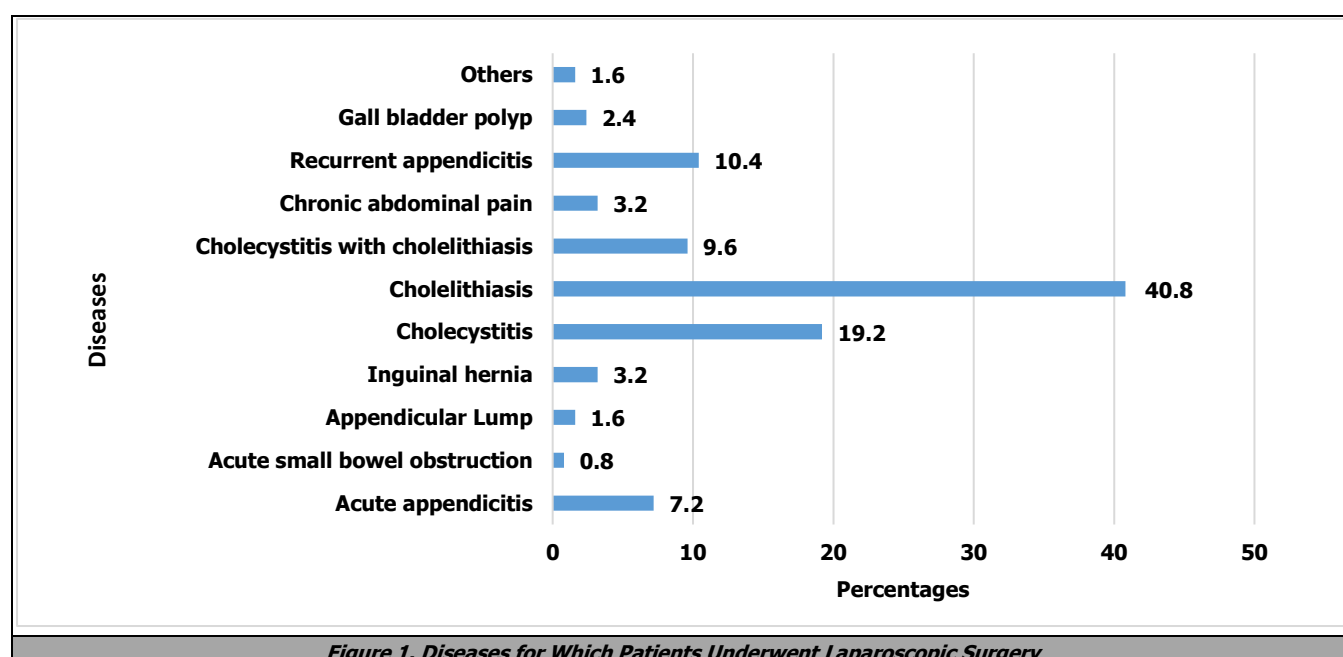
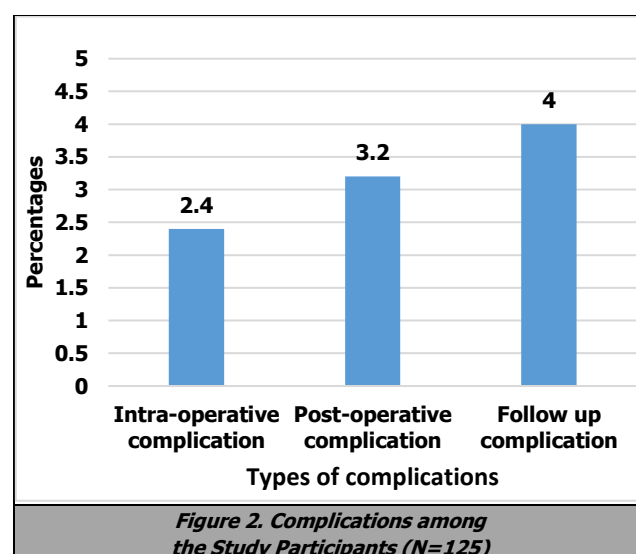
The mean duration of drain insertion was 25.58 ± 5.98 hours with a minimum of 24 hours to a maximum of 48 hours. Intra-operative complication includes right iliac fossa (RIF) port site bleeding (n = 1, 0.8 %), epigastric port site bleeding (n = 1, 0.8 %), and mild emphysema at umbilical port site (n = 1, 0.8 %). Post-operative complications included umbilical port site infection (n = 3, 2.4 %) and epigastric port site infection (n = 1, 0.8 %). Follow up complications were keloid at umbilical port (n = 1, 0.8 %), hypertrophic scar at suprapubic port (n = 2, 1.6 %), umbilical hernia and port site TB were observed in one patient each (0.8 %).

The port site infections (PSIs) observed were superficial infections caused by *Staphylococcus aureus* and managed by wound dressings and antibiotics. The port site TB caused was due to *Mycobacterium chelonae*.

		With Follow Up Complication (n=6)	Without Follow Up Complication (n=119)	P Value
Sex [#]	Age*	45.50 $\pm$ 19.97	41.75 $\pm$ 13.18	0.677
	Female	2 (2.5 %)	78 (97.5 %)	
Socio-economic status [#]	Male	3 (6.7 %)	42 (93.3 %)	0.689
	Lower	4 (4.4 %)	86 (95.6 %)	
Diabetes status [#]	Middle	1 (3.3 %)	29 (96.7 %)	0.821
	Upper	0 (0 %)	5 (100.0 %)	
Duration of surgery*	BMI*	24.06 $\pm$ 2.66	22.20 $\pm$ 2.41	0.069
	Yes	1 (12.5 %)	7 (87.5 %)	
Drain [#]	No	4 (3.4 %)	113 (96.6 %)	0.335
	Duration of surgery*	50.00 $\pm$ 14.83	57.34 $\pm$ 15.20	0.447
Duration of drain*	Yes	3 (3.3 %)	88 (96.7 %)	0.665
	No	2 (5.9 %)	32 (94.1 %)	
		30.0 $\pm$ 12.0	25.38 $\pm$ 5.62	0.531

Table 2. Comparison of Different Parameters of Patients with and without Follow-Up Complications

*Mann-Whitney U-test
#fischer exact test



Patient having post-operative complications had a significantly higher mean age (57.50 ± 12.81 years) compared those without complication (41.41 ± 13.25). This difference in age was statistically significant (P value = 0.030). Among patient with diabetes 25 % suffered from post-operative complication while only 1.7 % in the non-diabetic group suffered from post-operative complication, this difference in proportion was also statistically significant (P value = 0.020). Similarly, longer hours of drain insertion resulted in higher complication compared to shorter hour of drain insertion and difference was statistically significant (P value = 0.011). We did not find any significant association for gender, socio-economic status, drain application and body mass index (BMI) of the participants with post-operative complications. Similarly, patients having follow-up complications had a higher mean age (45.50 ± 19.97 years) compared those without complication (41.75 ± 13.18). This difference in age was not statistically significant

DISCUSSION

Laparoscopy has its own set of unique complications. The overall complications/injuries that occur following laparoscopic surgeries involve gastrointestinal (0.06 %), genitourinary (0.03 %), vascular (0.01 %) and omentum (0.04 %).³ However, other rare complications include pyoderma gangrenosum, metastasis at the port site following laparoscopic oncosurgery.⁴ Complications at the port site include wound infection, dehiscence, bleeding at the port sites and herniation of the omentum or small bowel, recurrence of tumor or tuberculosis at the port site, nerve injury, surgical subcutaneous emphysema. Usually the size of various ports in laparoscopic surgery varies from 5 mm to 12 mm. The camera port is usually 10 mm while the accessory ports maybe single or multiple, each of size 5 mm. It was concluded from the study Neudecker et al.⁵ that port site complications increased with a greater number of ports. These complications were noted in ports of size ≥ 10 mm. Fascial closure is recommended for such ports. This is done to reduce the development of hernia at the port site.⁶ Various instruments have been developed for fascial closure, the benefit of which has yet to be proven. These include Grice® suture needle, Carter-Thomson needle-point suture passer, endoClose™ instrument, Reverdin suture needle.^{7,8}



Figure 3.
Umbilical Port site
Infection

Port site complications can be grouped into access-related complications and post-operative complications and have been reported in all age groups and in both genders. In our study, age groupwise distribution suggest that almost

equal proportion of the study participants belonged to age group of less than 30 years (22.4 %), 30 to 40 years (28.8 %), 40 to 50 years (22.4 %) and more than 50 years (26.4 %). Mean age of the study subjects was around 41 years. Majority of our study participants were females (64 %). According to the study done by Karthik S et al.⁹ the mean age reported was 35.2 while in our study was 41 years which correlates with incidence of gall stone in that age group with patients undergoing laparoscopic surgery which is the most commonly performed surgery in this study.

In the study conducted by Karthik S et al.⁹ the percentage of male & female was 53.8 % and 46.2 % respectively, out of which 7.2 % of males and 10.3 % of females developed port site complications. Similarly, according to study conducted by Mudgal MM et al.¹⁰ the percentage of male & female was 22.67 % and 73.33 % respectively out of which 12.3 % male and 27.3 % female population developed port site complications, which was much lower in our study. The percentage of male & female in a study by Ravindranath G et al.¹¹ was found to be 30.2 % and 69.8 % respectively, out of which 5.1 % male and 7.1 % female population developed port site complications which was similar to our study findings. Female preponderance in our study is attributed to higher incidence of gallstone in female population and those undergoing laparoscopic surgery for gall stones. India being a developing country, where female population neglects their health and don't take rest after surgery which attributes to higher incidence of complications in them. In our study, mean BMI was higher in the patient with complications compared to patients without complications but it was not statistically significant. In other words, patients with higher BMI have more port site complications in relation to those with normal BMI. In the study by Mudgal MM et al.¹⁰ study patients with BMI (>25 kg/m²) had higher complications compared to BMI less than 25 kg/m². Patients with high BMI have higher chances of complications during entry and closure of abdominal wall due to difficulty in accessing abdominal cavity and also, during removal of trocar there are higher chances of omental as well as bowel entrapment. There are higher chances of port site infection as well as port site hernia in obese patients.

Incidence of complications as reported by Karthik S et al.⁹ was 2.98 % whereas Mudgal MM et al.¹⁰ reported a incidence of 8.67 %. These findings were similar to our study findings of 7.2 %. The most common site of infection in Karthik S et al.⁹ study was umbilical port with 8 (47.13 %) cases, followed by epigastric port with 6 (35.25 %) cases, 2 (11.75 %) cases of suprapubic port and 1 (5.87 %) of left iliac port. The most common site of infection in Ravindranath GG et al.¹¹ study was umbilical port with 11 (52.4 %) cases, followed by epigastric port with 8 (38.1 %) cases, 1 (4.76 %) case each of suprapubic port and Palmer's port. The most common site of infection in the present study was umbilical port (n = 7, 5.6 %) followed by epigastric port (n = 2, 1.6 %). Umbilical port is a first access port in most of the laparoscopic surgeries as well as the port for tissue retrieval. Therefore, the most common site of infection. Umbilicus is inverted and acts as nidus for infection if not taken care of pre-operatively.

In our study, port site bleeding was observed in 2 patients (1 each at epigastric site and RIF site) which is comparable to the study by Yadav H et al. (1.6 % vs. 0.45 %).¹² It is also comparable to the 0.7 % incidence observed in the study by Wexner SD et al.¹³ and Karthik S et al.⁹ Similar results were also seen in the study by Quilici et al.¹⁴ Bleeding points can be identified intraoperatively and managed with electrocautery.

In our study, port site hernia was seen in 1 patient (0.8 %). It occurred at the umbilical port site. This was similar to as observed by Chiu et al. (0.33 %).¹⁵ Other such studies showed an overall incidence between 0.02 - 1.6 percent.^{16,17,18} Fascial closure is recommended for ports $\geq$ 10 mm. The fascia is closed with sutures to reduce the risk of developing a port site hernia.

The laparoscopic procedures have a decreased incidence of port site infections as compared with open procedures.¹⁹ Recent studies in the form of Karthik et al.⁹ demonstrated an incidence of only 1.8 %, while other studies showed Mir et al.²⁰ 6.7 %, Yanni et al.²¹ 4 % and Taj et al.²² 5.48 %. In the present study only 3.2 % patients had surgical site infection, in agreement to present study Den Hoed et al.²³ found the incidence to be 5.3 %, Shindholimath et al.²⁴ 6.3 % and Al-Abassi et al. < 2 %.²⁵ However, Voitek et al.²⁶ and Sasmal et al.²⁷ showed slightly higher rate of infections (9 % and 8 % respectively). The infection is usually superficial involving the skin and subcutaneous tissue as corroborated by the study done by Richards C et al.²⁸ We reported one case of port site TB (0.8 %) caused by *Mycobacterium chelonae*. In literature, the common source of transmission is via the improperly sterilised laparoscopic instruments. Recent studies have shown 2 % glutaraldehyde achieves a high level of disinfection and not sterilisation.²⁹ Currently, the practice calls for careful pre-cleaning of the laparoscopic instruments before their immersion in the solution at 25°C for at least 20 minutes. One case (0.8 %) of mild subcutaneous emphysema was noted in our study, the incidence of which is based on present literature varies between 0.43 % and 2.3 %.³⁰ The intra-operative complications are seen commonly in the secondary ports, though overall complications are more frequently seen in the primary or the umbilical port.

CONCLUSIONS

Laparoscopic surgeries are associated with minimal port site complications. The incidence is even lesser in elective surgeries. All the complications were manageable with minimum morbidity. However rare these complications may be, they are a cause for trouble for the patient and the surgeon alike and take away from the advantages of the laparoscopic technique. Therefore, apt patient selection, meticulous surgical technique during entry and exit at all the port sites, strictly abiding by the commandments of cleaning and sterilisation of the laparoscopic instruments with the appropriate cleaning agent, pre-operative antibiotic prophylaxis and ample post-operative care and follow-up may help to further minimize the incidence of these complications.

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