



## **A Study of a Prevalence of Port Site Infections in Laparoscopic Surgery in a Tertiary Care Centre in the Rural Set Up**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author NG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors JBR and VDY managed the analyses of the study. Author VDY managed the literature searches and critically analyses the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Port site infections though rare, shall be evaluated and studied so as to improve the quality of healthcare. The advantages of laparoscopic surgery are well known, but the question is, is it totally free of complications like port site infections? Does performing laparoscopic surgery guarantee, post-operative period free of infections? Port site complications are known to happen. We, in our study, intend to find out the prevalence of port site infections in patients undergoing various laparoscopic surgeries like Cholecystectomy, Appendectomy, Hernioplasty.

**Aims:** To study the prevalence & nature of port site infections (PSIs) in cases of laparoscopic surgeries in all age groups in a tertiary health care centre in the rural setup.

**Materials and Methods:** Patients of all age groups and both sexes undergoing Laparoscopic surgeries during a period of 1 year between June 2013 to June 2014 were followed up and

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included in the study. Port sites were meticulously examined for any infections, and if suspected, swabs were sent for culture and sensitivity. Patients undergoing Laparoscopic surgeries were documented and studied against set parameters to evaluate the prevalence as also to ascertain the factors affecting the chances of PSI. Regular swab sticks were used to send swabs of those port sites where the infection was suspected.

**Results:** Out of the total sample size of 100, two patients had port site Infections. Both patients' portsite was contaminated during the procedure. The rate of PSI was not affected by age, sex, nature of procedure or duration of hospital stay in our study. Neither did the type of surgery or co-morbidities affect the same. Statistical analysis used: Chi-square test.

**Conclusions:** Port site infection is a rare complication of Laparoscopic surgery. The advent of laparoscopy has reduced the rate of postoperative morbidity. Chances of PSI were found to be significant though if the port site was accidentally contaminated.

*Keywords: Port site infection; laparoscopic surgery; port contamination.*

## 1. INTRODUCTION

Skin is a natural barrier against infection [1], so any surgical wound can be a potential source of infection since it will cause a break in the continuity of the epithelium and this can lead to a postoperative infection. The goal of modern wound care has shifted from prevention of infection to timely restoration of the body to its previous state of normal form and function. It is this very goal that has leads to the development of laparoscopic surgery. Laparoscopic surgery has come a long way to be integrated into to the mainstream field of surgery. The advantages offered by laparoscopic surgery are vast, like decreased postoperative pain, quicker return to normal activity, and less post-operative complications [2]. It is probably because of a smaller incision, faster mobilization, reduction of post-operative and better preservation of immune system function with a limited inflammatory response to tissue injury. It has been observed that metabolic complications due to surgical injury are less in laparoscopic surgery as compared to open surgery. However, laparoscopic surgery is associated with unique complications related to gaining access to the peritoneal cavity. Port site infection is an infrequent complication. Sometimes these infections become protracted and recurrent and pose a dilemma for the surgeon and become distressing for the patients.

Since port site infections have not been given much attention in the medical literature, the objective of this study is to assess the influence and determine the association of laparoscopic surgery and port site infection.

The surgical infection is defined as, "infection which occurs within 30 days of the surgical

procedure." The centre for Disease Control (CDC), USA, classifies surgical site infections into three categories.

1. Superficial.
2. Deep.
3. Organ/Space.

In this context, a superficial surgical site infection (S.S.S.I) is defined as an infection of the skin or subcutaneous tissue which discharges purulent material spontaneously or is opened to drain the same by the surgeon.

Organisms have to be isolated from an area of infection, and the surroundings show typical signs of inflammation like pain, redness, swelling, etc. The wound infection rates fell dramatically after the advent of antibiotics.

It has been observed that metabolic response to surgery is less after a laparoscopic surgery than open surgery. The fact that laparoscopic surgeries are associated with fewer surgical site infections (SSI's) intuitively makes sense as laparoscopy access ports are short in length and only a fraction of the length of incision used in open laparotomy. The elective laparoscopic approach has a low risk of infection, but many surgeons still use prophylactic antibiotics [3].

For safer surgery on the target organ and to have control on its vascular supply the surgeon has to make an incision large enough to provide the clear view of the target organ as well as its blood supply. The wound sustains additional trauma from retractors, whether metallic or human. The operative wound is cause for morbidity including pain, bleeding, wound infections, nerve entrapment, and herniation [4]. The post-

operative pain at the wound site precludes the patient from early mobility and deep respiration especially true for upper abdominal incision.

In laparoscopic surgery, the creation of pneumoperitoneum is essential for establishing a working space in which surgeon has to access the target organ and its blood supply. The pneumoperitoneum is created by the insufflation of carbon dioxide gas in the peritoneal cavity and lifting the abdominal wall gently with force being diffuse and evenly distributed resulting in minimal trauma to the abdominal wall [5,6]. The patient experiences less pain and other wound-related complications. Even when there is port site infection, it is far less in severity and easily controlled by local means in the majority of cases. Wound disruption and herniation are far less if the Z technique is used during insertion of trocar and cannula and if proper port site closure is employed primarily in 10mm port sites.

The causative organisms are generally those which more prevalent in institute e.g.; *Staph aureus*, *E. coli*. These types of infections are easily treated with antibiotics which are most commonly prescribed in the Institute.

Atypical mycobacteria have been reported at the port site in the literature. They are collectively indicated as M. Fortuitum complex. Primary or secondary antitubercular treatment is required in such cases [7,8]. Many refractory cases required debridement and excision of sinus tract followed by antitubercular or antibacterial treatment [9].

Vijayaraghavan et al. [10] reported an outbreak of laparoscopic PSIs due to *M. chelonae* at their centre. They had 145 PSIs in 35 patients in a period of 6 wk.

This study will test the prevalence and the rate of port site infections in patients undergoing various laparoscopic surgeries.

## 2. METHODOLOGY

This clinical study was carried out after the consent of the Hospital Ethics Committee.

### 2.1 Recruitment Procedure

Patients of all age groups admitted in the tertiary care centre in rural set up from June 2013 to June 2014 undergoing laparoscopic surgery after prior informed written consent.

#### 2.1.1 Inclusion criterion

- All ages
- Both sexes
- All patients undergoing laparoscopic surgery (Cholecystectomy, Appendicectomy, Hernia repair, etc.)
- All elective and emergency surgeries

#### 2.1.2 Exclusion criterion

- All laparoscopic surgeries getting converted to open surgeries.

All patients undergoing laparoscopic surgeries will be included in this study after an informed written consent.

Infection at the port site will be clinically assessed and if required will be confirmed by swab test, after testing culture and sensitivity.

Patients will be promptly followed by laparoscopic surgeries.

All patients will be followed post-operatively till suture removal, after one month post operatively.

All patients would be categorized into two groups those having infections and those not having the infection at the port site.

The criterion to decide presence of infection would be based on the definition:

The superficial surgical site infection (S.S.S.I) is defined as an infection of the skin and subcutaneous tissues which discharge the purulent material or is opened to drain the same by the surgeon.

Organisms have to be isolated from the material, and the area shall show the classical signs of inflammation like pain, redness, swelling, etc.

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The following parameters were evaluated:

- Age
- Sex
- Duration of Surgery (<30mins, 30-60 mins, >60 mins)
- Procedure was done (Cholecystectomy, Appendectomy, and Hernia repair)

- Type of Surgery (Elective or Emergency)
- Co-Morbidities (Diabetic or Non-Diabetic)
- Port Site contamination (clean or contaminated)
- Duration of hospital stay (<3 days, 4-6 days, >7 days)

Data of post-operative results will be charted and assessed using appropriate statistical test.

## 2.2 Aim

To study the prevalence & nature of port site infections in cases of laparoscopic surgeries in all age groups in a tertiary health care centre in a rural setup.

## 3. RESULTS

Maximum 20% of the patients are in 21-30 years of age group and minimum 3% below 10 years but the patient's maximum age group up to 80 years

62% patients are male, and 38% patients are female.

49% patients had a stay in hospital between 4-6 days, only 7% had a >7 days stay .44% had a <3 day stay. Hospital stay include total number of days in the hospital not only post operative days.

67% cases were done on the elective basis, and 33% were done on the emergency basis. Out of 33% done on emergency, 32% were acute appendicitis and 1% of acute cholecystitis.

Of the total 34% underwent the laparoscopic appendectomy, 46% underwent laparoscopic cholecystectomy, and 20% underwent laparoscopic hernioplasty.

Only 2% patients there was a presence of infection while 98% wound was healthy

In 2 patients were infection was seen .the swabs of the infected site were sent. One patient had an *E. coli* while other had a *Klebsiella* infection.

5% patient had diabetes.

As many as 78% cases were done within 1-2 hours, 8% were finished within 1 hour and 14% cases took more than 2 hours.

The port site was contaminated while operating in 2 % cases. It is due to spillage of bile while

retrieving gallbladder during surgery. We did not use retrieval bag for specimen removal even in acute condition.

Port site infection does not have the predilection for a particular age group. The association between age of the patients and chances of having port site infection is not significant. 2 patient had a port site infection. One at the age group of 41-50 and other in the age group of 61-70 years. Chi- square value (5.285) and p- value (0.65) were not statistically significant at 5% level.

There is no predilection for a particular sex. Our study enrolled 38% female and 62% males. The association was not significant (P=0.524)

Table 6 Association of PSIs with hospital stay.

In our study, the duration of stay did not have a significant association with the risk of PSIs (P=0.923).

In this study, nature of the procedure did not have a significant impact on PSI (P=1.000).this might be attributed to the stringent aseptic protocols followed in our institute.

The evidence is there in literature that there is an increased rate of infection with gallbladder surgery, especially with open surgery. We found that type of surgery did not significantly affect the PSI rate (P=0.302).

In this study, there is a strong correlation between port site contamination and PSI (P=0.000).

The two patients who developed PSIs were nondiabetic; it indicates that in this particular study, Diabetes is not associated with increased risk of PSIs. For both cases culture sent which revealed infection with *E.coli* in one case and *Klebsiella* in another case.

Although diabetes is a known risk factor for wound infection, in our study, we could not find an association between diabetes and PSIs. A plausible explanation for this finding is all our patients were evaluated thoroughly, and strict glycaemic controlled is maintained peri-operatively.

There was no correlation either between PSIs and duration of the surgery (p=0.750) Application of Fisher exact test where the 2x2 contingency table, any one cell <5, otherwise Pearson's chi-square test.

**Table 1. Association of PSIs with nature of procedure**

Elective/Emergency	PSIs		Total patients	Fisher's exact test P- value	Significance at 5% level
	No	Yes			
Elective	66	1	67	1.000	Not
Emergency	32	1	33		
Total	98	2	100		

**Table 2. Association of PSIs with surgery performed**

Surgery	PSIs		Total patients	Chi Sq. value	P value	Significance at 5% level
	No	Yes				
Lap. Appendectomy	34	0	34	2.396	0.302	Not
Lap. cholecystectomy	44	2	46			
Lap. hernioplasty	20	0	20			
Total	98	2	100			

**Table 3. Association of PSIs with port site contamination**

Presence of infection	PSIs		Total	Fisher's exact test p value	Significance at 5% level
	No	Yes			
No	98	0	98	0.000	Yes
Yes	0	2	2		
Total	98	2	100		

**Table 4. Association between PSIs and diabetes**

Diabetes	PSIs		Total patient	Fisher's exact test	Significance at 5% level
	No	Yes			
No	93	2	95	1.000	Not
Yes	5	0	5		
Total	98	2	100		

**Table 5. Association between PSIs and duration of surgery**

Duration of surgery	PSIs		Total patient	Chi sq value	P value	Significance at 5% level
	No	Yes				
<1 hour	8	0	8	0.576	0.75	Not
1-2 hours	76	2	78			
>2 hours	14	0	14			
Total	98	2	100			

#### 4. DISCUSSION

No surgical incision is immune to infection. Wounds are classified as clean, clean – contaminated, contaminated and dirty. Most laparoscopy wound belongs to either clean or clean-contaminated case. The incidence of port site complications following laparoscopic surgery is around 21 per 100,000 cases [11]. The risk factors for port site infections (PSIs) includes: preoperative hospital stay > 2 days [12], operative duration >2 hours [12], other immunocompromised condition like diabetes, steroid use, preoperative blood transfusion, etc

[13,14]. Preoperative colonization of nares with *Staphylococcus aureus* is also considered to be risk factor for port site infections (PSIs). Obesity, preoperative antibiotics, and drains do not have any association with port site infections (PSIs) in laparoscopic cholecystectomy [15]. The number of the port is also an important risk factor for port site complications [16]. The fascial closure is recommended for more than 10 mm port size to reduce the incidence of port site hernia.

Port site complications can develop at the time of entry, or post-operative complication. It can be early (within weeks) or delayed. The delayed

presentation is usually because of mycobacterial infection. Care must be taken during placement of trocars to align their axes as needed for the procedure [17]. Infections with atypical mycobacteria have been reported after laparoscopic procedures and are associated with increased in C-reactive protein without leucocytosis and normal differential count [18].

The presence of pain, erythema and wound discharge with a week usually indicates nonmycobacterial fresh wound infection. They are the superficial infection and associated with low-grade fever. Gram positive and negative bacteria are the most common offending agents [19]. Delayed infection usually develops after 3-4 weeks and poorly responsive to usual antimicrobial agents [20].

A 10 min cycle of autoclaving or 3 min flash sterilization for instrument contaminated or dropped during the laparoscopic surgery helps in reducing port site complications [21].

It is every surgeon's desire that after dressing the wound, irrespective of its size, nature or anatomical position, should heal without any complications. Successful wound dressing should keep the wound healthy and devoid of any infection, maceration or allergic reactions.

Laparoscopy has helped us to limit the chances of intraoperative and post-operative complications like excessive bleeding, infection, reducing the morbidity, pain, duration of hospital stay, etc.,

Although the rate is very less, the laparoscopic port site is not completely safe when it comes to the risk of getting infected.

A vital and pertinent reason for this might be the fact that maintaining asepsis is high on the

priority list in our institute. Surgical hand wash protocols are rigorously followed. Painting and draping the patient is done very carefully.

In our study, we followed up all the patients undergoing various laparoscopic procedures like cholecystectomy, appendectomy, hernioplasty. Patients from all age groups, both sexes, emergency as well as elective ones, diabetic and nondiabetic individuals were followed up and monitored for port site infections.

It was found that there was almost an equal distribution of patients based on age group undergoing laparoscopic surgeries.

In the sample, 62% were male patients, and 38% were female patients undergoing laparoscopic surgeries.

Most of the patients had to stay in the hospital for approximately 4-6days i.e. 49%, 44% patients hospital stay was less than three days, and only 7% patients undergoing laparoscopic procedures had a more than seven-day stay in the hospital.

Of the total 100% patients, 67% were elective cases while 33% were emergency cases.

34% patients underwent appendectomy while 46% underwent cholecystectomy and 20% underwent hernia repair.

2% patients had port site infections subsequently while the remaining 98% patients' sites healed normally without any infection.

Our results are comparable with other studies. Most research in the literature reviewed laparoscopic cholecystectomy except few studies which include conventional laparoscopy surgeries [22]. Our study also based on traditional laparoscopic surgery.

**Table 6. Studies showing frequency of PSIs following laparoscopic various laparoscopic surgeries**

Study	Types of surgery	Number of patients	Frequency
Sharma et al. [22]	Laparoscopy in general	851	1.02%
Mir et al. [23]	cholecystectomy	675	6.7%
Yanni et al. [24]	Laparoscopic cholecystectomy	100	4%
Taj et al. [25]	Laparoscopic cholecystectomy	492	5.48%
Shindholimath et al. [26]	Laparoscopic cholecystectomy	113	6.3%
den Hoed et al. [27]	Laparoscopic cholecystectomy	189	5.3%
Present study	Laparoscopy in general	100	2%

The swab was sent off these 2% infected patients, one had an *E. coli*, and one had a Klebsiella infection.

5% patients had diabetes in our sample. Diabetes is major risk factor increased chances of infections. DM has been associated with reduced response of T cells, neutrophil function, and disorders of humoral immunity [28]. Consequently, DM increases the susceptibility to infections, both the most common ones as well as those that almost always affect only people with DM(e.g. rhino-cerebral mucormycosis) [29]. In spite of a strong physiological rationale, diabetes mellitus as a factor causing increased incidence of wound complications in surgical wounds is not entirely supported by the literature. It was shown by a study done by Mangrulkar et al. wherein they compared data from 489 surgical cases with diabetes and could not find a correlation between infected surgical wound and diabetes [30]. In present study, out of 2 infected cases, no patients had diabetes.

Of the total 78% were operated between 1-2 hrs. 8 % required less than an hour time and 14% required more than 2 hours.

2% patients had port site contamination of the total sample. Also, both the patients that had port site contamination did go on to have port site infection.

It was found in the statistical analysis that port site infection (PSI) rate did not have the precise prediction for any particular age group. There was no significant association between age of the patient and the occurrence of port site infections ( $p=0.625$ ). Hence, age of the patient is not a risk factor for port site infections. A study was done by Karthik et al. [31] showed similar results, that port site complications were not dependent on the age of the patient. In their study of all the complications, port site infections were the highest at 1.8% but did not show an increased rate in a particular age group.

Also, there was no association between sex of the patient and the infection rate. Although both the infections were in male patients, the association was not robust enough to establish a relationship between the two ( $p=0.524$ ). Our study had 67% males as against 33%females.

We also tried to find out if the port site infections varied depending on the duration of hospital stay. Nosocomial infections would happen with a

longer length of the hospital stay is a common notion. But as far as laparoscopic surgeries are concerned a study by Gunnarsson C et al. showed that nosocomial infection rate reduced in institutions where there were more laparoscopic surgeries [32]. They demonstrated that laparoscopic surgeries reduced the overall medical bills due to the sharp reduction in nosocomial infection rate. In our study also the duration of hospital stay did not have a significant association with Port site infections ( $p=0.923$ ).

Also, and maybe surprisingly, port site infection was not associated with particular type surgery. Although there are few pieces of evidence by S. Karthik of increased chances of port site complications with cholecystectomy [26], the association in our study was not significant. Infection seen in the two cases had also undergone laparoscopic cholecystectomy, but the association was not significant ( $p=0.302$ ).

We also considered port site contamination as a parameter. The port site was contaminated at the time of retrieval of the specimen. It is due to spillage of bile while retrieving gall bladder specimen. We documented cases where the port site contaminated during the procedure but cleaned before suturing. We found that the association was significant, meaning that port site contamination was a major contributor to subsequent port site infection ( $p=0.000$ ). In both the infected patients the port was contaminated. We did not use retrieval bag for removal of specimen even in acute cases.

On comparing the risk of infection in the port site with the duration of surgery, we did not find a significant association to prove that duration of surgery was directly proportional to the chances of infection.

## 5. CONCLUSION

Port site infection although a possibility is very rare in patients undergoing laparoscopic surgeries. The likelihood of infection is not affected by the nature, type, duration of surgery. Also, the age, sex, length of hospital stay doesn't have an impact on the risk of port site infections. The chances of having port site infections are significant if there is contamination of the site during the procedure.

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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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