

Original Research Article

Comment [U1]:

1
2 **A Study of a prevalence of port site infections in laparoscopic surgery in a tertiary care**
3 **centre in the rural set up.**

4 **Abstract:**

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

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

14 **Material and Methods:** Patients of all age groups and both sexes undergoing Laparoscopic
15 surgeries during a period of 1 year between June 2013 to June 2014 were followed up and
16 included in the study. Port sites were meticulously examined for any infections, and if
17 suspected, swabs were sent for culture and sensitivity. Patients undergoing Laparoscopic
18 surgeries were documented and studied against set parameters to evaluate the prevalence as
19 also to ascertain the factors affecting the chances of PSI. Regular swab sticks were used to
20 send swabs of those port sites where the infection was suspected.

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

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

28 **Keywords:** Port site infection, Laparoscopic surgery, Port contamination

29 Introduction

30 Skin is a natural barrier against infection¹, so any surgical wound can be a potential source of
31 infection since it will cause a break in the continuity of the epithelium and this can lead to a
32 postoperative infection. The goal of modern wound care has shifted from prevention of
33 infection to timely restoration of the body to its previous state of normal form and function. It
34 is this very goal that has leads to the development of laparoscopic surgery. Laparoscopic
35 surgery has come a long way to be integrated into to the mainstream field of surgery. The
36 advantages offered by laparoscopic surgery are vast, like decreased postoperative pain,
37 quicker return to normal activity, and less post-operative complications². It is probably
38 because of a smaller incision, faster mobilization, reduction of post-operative and better
39 preservation of immune system function with a limited inflammatory response to tissue
40 injury. It has been observed that metabolic complications due to surgical injury are less in
41 laparoscopic surgery as compared to open surgery. However, laparoscopic surgery is
42 associated with unique complications related to gaining access to the peritoneal cavity. Port
43 site infection is an infrequent complication. Sometimes these infections become protracted
44 and recurrent and pose a dilemma for the surgeon and become distressing for the patients.

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

48 The surgical infection is defined as, “infection which occurs within 30 days of the surgical
49 procedure.” The centre for Disease Control (CDC), USA, classifies surgical site infections
50 into three categories.

51 1. Superficial.

52 2. Deep.

53 3. Organ/Space.

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

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

60 It has been observed that metabolic response to surgery is less after a laparoscopic surgery
61 than open surgery. The fact that laparoscopic surgeries are associated with fewer surgical site
62 infections (SSI's) intuitively makes sense as laparoscopy access ports are short in length and
63 only a fraction of the length of incision used in open laparotomy. The elective laparoscopic
64 approach has a low risk of infection, but many surgeons still use prophylactic antibiotics³.

65 For safer surgery on the target organ and to have control on its vascular supply the surgeon
66 has to make an incision large enough to provide the clear view of the target organ as well as

67 its blood supply. The wound sustains additional trauma from retractors, whether metallic or
68 human. The operative wound is cause for morbidity including pain, bleeding, wound
69 infections, nerve entrapment, and herniation⁴. The post-operative pain at the wound site
70 precludes the patient from early mobility and deep respiration especially true for upper
71 abdominal incision.

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

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

84 Atypical mycobacteria have been reported at the port site in the literature. They are
85 collectively indicated as M.Fortuitum complex. Primary or secondary antitubercular
86 treatment is required in such cases^{7,8}. Many refractory cases required debridement and
87 excision of sinus tract followed by antitubercular or antibacterial treatment⁹.

88 Vijayaraghavan et al. reported an outbreak of laparoscopic PSIs due to *M. chelonae* at their
89 centre. They had 145 PSIs in 35 patients in a period of 6 wk¹⁰.

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

92 Methodology

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

94 Recruitment procedure

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

97 Inclusion Criterion:

- 98 • All ages
- 99 • Both sexes
- 100 • All patients undergoing laparoscopic surgery (Cholecystectomy, Appendicectomy, Hernia
101 repair, etc.)
- 102 • All elective and emergency surgeries

103 Exclusion Criterion:

- 104 • All laparoscopic surgeries getting converted to open surgeries.

105

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

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

110 Patients will be promptly followed by laparoscopic surgeries.

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

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

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

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

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

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

123 The following parameters were evaluated:

124 • Age

125 • Sex

126 • Duration of Surgery (<30mins, 30-60mins, >60mins)

127 • Procedure was done (Cholecystectomy, Appendectomy, and Hernia repair)

128 • Type of Surgery (Elective or Emergency)

- 129 • Co-Morbidities (Diabetic or Non-Diabetic)
- 130 • Port Site contamination (clean or contaminated)
- 131 • Duration of hospital stay (<3days, 4-6 days, >7days)

132

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

134 Aim:

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

137 Results

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

140 62% patients are male, and 38% patients are female

141 49% patients had a stay in hospital between 4-6 days, only 7% had a >7 days stay .44% had a
142 <3 day stay. Hospital stay include total number of days in the hospital not only post operative

143 days

144 67% cases were done on the elective basis, and 33% were done on the emergencybasis. Out of
145 33% done on emergency, 32% were acute appendicitis and 1% of acute cholecystitis

146

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

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

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

152 5% patient had diabetes

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

155

156

157 The port site was contaminated while operating in 2 % cases. It is due to spillage of bile
158 while retrieving gallbladder during surgery. We did not use retrieval bag for specimen
159 removal even in acute condition.

160

161 Port site infection does not have the predilection for a particular age group. The association
162 between age of the patients and chances of having port site infection is not significant.²
163 patient had a port site infection. One at the age group of 41-50 and other in the age group of
164 61-70 years. Chi- square value (5.285) and p- value (0.65) were not statistically significant at
165 5% level.

166 There is no predilection for a particular sex. Our study enrolled 38% female and 62% males.

167 The association was not significant (P=0.524)

168 Table 6: Association of PSIs with hospital stay

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

171 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		

172

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

175 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			

Lap.cholecystectomy	44	2	46	2.396	0.302	Not
Lap.hernioplasty	20	0	20			
Total	98	2	100			

176

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

180 Table 3: Association of PSIs with port site contamination

	PSIs		Total	Fisher's exact test p value	Significance at 55 level
	No	Yes			
Presence of infection					
No	98	0	98	0.000	Yes
Yes	0	2	2		
Total	98	2	100		

181

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

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

186 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		

187

188 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			

1-2 hours	76	2	78	0.576	0.75	Not
>2 hours	14	0	14			
Total	98	2	100			

189

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

194 There was no correlation either between PSIs and duration of the surgery (p=0.750)

195 Application of Fisher exact test where the 2x2 contingency table, any one cell <5, otherwise

196 Pearson's chi- square test.

197 DISCUSSION

198 No surgical incision is immune to infection. Wounds are classified as clean, clean –

199 contaminated, contaminated and dirty. Most laparoscopy wound belongs to either clean or

200 clean-contaminated case. The incidence of port site complications following laparoscopic

201 surgery is around 21 per 100,000 cases¹¹. The risk factors for port site infections (PSIs)

202 includes: preoperative hospital stay > 2days¹², operative duration >2 hours¹², other

203 immunocompromised condition like diabetes, steroid use, preoperative blood transfusion,

204 etc^{13, 14}. Preoperative colonization of nares with *Staphylococcus aureus* is also considered to

205 be risk factor for port site infections (PSIs). Obesity, preoperative antibiotics, and drains do

206 not have any association with port site infections (PSIs) in laparoscopic
207 cholecystectomy¹⁵. The number of the port is also an important risk factor for port site
208 complications¹⁶. The fascial closure is recommended for more than 10 mm port size to reduce
209 the incidence of port site hernia.

210 Port site complications can develop at the time of entry, or post-operative complication. It can
211 be early (within weeks) or delayed. The delayed presentation is usually because of
212 mycobacterial infection. Care must be taken during placement of trocars to align their axes as
213 needed for the procedure¹⁷. Infections with atypical mycobacteria have been reported after
214 laparoscopic procedures and are associated with increased in C-reactive protein without
215 leucocytosis and normal differential count¹⁸.

216 The presence of pain, erythema and wound discharge with a week usually indicates
217 nonmycobacterial fresh wound infection. They are the superficial infection and associated
218 with low-grade fever. Gram positive and negative bacteria are the most common offending
219 agents¹⁹. Delayed infection usually develops after 3-4 weeks and poorly responsive to usual
220 antimicrobial agents²⁰

221 .A 10 min cycle of autoclaving or 3 min flash sterilization for instrument contaminated or
222 dropped during the laparoscopic surgery helps in reducing port site complications²¹

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

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

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

231 A vital and pertinent reason for this might be the fact that maintaining asepsis is high on the
232 priority list in our institute. Surgical hand wash protocols are rigorously followed. Painting
233 and draping the patient is done very carefully.

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

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

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

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

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

246 34% patients underwent appendectomy while 46% underwent cholecystectomy and 20%
247 underwent hernia repair.

248 2% patients had port site infections subsequently while the remaining 98% patients' sites
249 healed normally without any infection.

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

Study	Types of surgery	Number of patients	Frequency
Sharma et al(2013) ²²	Laparoscopy in general	851	1.02%
Mir et al(2013)	cholecystectomy	675	6.7%
Yanni et al(2013)	laparoscopic cholecystectomy	100	4%
Taj et al(2012)	Laparoscopic cholecystectomy	492	5.48%
Shindholimath et al(2003)	Laparoscopic cholecystectomy	113	6.3%
den Hoed et al(1998)	Laparoscopic cholecystectomy	189	5.3%
Present study	Laparoscopy in general	100	2%

253

254 Our results are comparable with other studies. Most research in the literature reviewed
 255 laparoscopic cholecystectomy except few studies which include conventional laparoscopy
 256 surgeries²². Our study also based on traditional laparoscopic surgery

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

259 5% patients had diabetes in our sample. Diabetes is major risk factor increased chances of
 260 infections. DM has been associated with reduced response of T cells, neutrophil function, and
 261 disorders of humoral immunity²³. Consequently, DM increases the susceptibility to
 262 infections, both the most common ones as well as those that almost always affect only people
 263 with DM(e.g. rhino-cerebral mucormycosis)²⁴. In spite of a strong physiological rationale,

264 diabetes mellitus as a factor causing increased incidence of wound complications in surgical
265 wounds is not entirely supported by the literature. It was shown by a study done by
266 Mangrulkar et al. wherein they compared data from 489 surgical cases with diabetes and
267 could not find a correlation between infected surgical wound and diabetes²⁵. In present study,
268 out of 2 infected cases, no patients had diabetes.

269 Of the total 78% were operated between 1-2 hrs. 8 % required less than an hour time and
270 14% required more than 2 hours.

271 2% patients had port site contamination of the total sample. Also, both the patients that had
272 port site contamination did go on to have port site infection.

273 It was found in the statistical analysis that port site infection (PSI) rate did not have the
274 precise prediction for any particular age group. There was no significant association between
275 age of the patient and the occurrence of port site infections ($p=0.625$). Hence, age of the
276 patient is not a risk factor for port site infections. A study was done by Karthik et al. showed
277 similar results, that port site complications were not dependent on the age of the patient²⁶. In
278 their study of all the complications, port site infections were the highest at 1.8% but did not
279 show an increased rate in a particular age group.

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

283 We also tried to find out if the port site infections varied depending on the duration of
284 hospital stay. Nosocomial infections would happen with a longer length of the hospital stay is
285 a common notion. But as far as laparoscopic surgeries are concerned a study by Gunnarsson
286 C et al showed that nosocomial infection rate reduced in institutions where there were more

287 laparoscopic surgeries²⁷. They demonstrated that laparoscopic surgeries reduced the overall
288 medical bills due to the sharp reduction in nosocomial infection rate. In our study also the
289 duration of hospital stay did not have a significant association with Port site infections
290 (p=0.923).

291 Also, and maybe surprisingly, port site infection was not associated with particular type
292 surgery. Although there are few pieces of evidence by S. Karthik of increased chances of port
293 site complications with cholecystectomy²⁶, the association in our study was not significant.
294 Infection seen in the two cases had also undergone laparoscopic cholecystectomy, but the
295 association was not significant (p=0.302).

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

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

306 Conclusion

307 Port site infection although a possibility is very rare in patients undergoing laparoscopic
308 surgeries. The likelihood of infection is not affected by the nature, type, duration of surgery.

309 Also, the age, sex, length of hospital stay doesn't have an impact on the risk of port site
310 infections. The chances of having port site infections are significant if there is contamination
311 of the site during the procedure.

312

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