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## Laparoscopic Port Site Complications: A Multicentre Prospective Descriptive Study from North India

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### Abstract

**Background:** The laparoscopic port site complications are less common. Mainly, they include infections, bleeding, port site hernia and metastasis. Aim of this study is to determine the morbidity associated with port-site and to identify risk factors for complications. It is setting and design- prospective descriptive study.

**Material and method:** In the present study, a total of 656 patients who underwent laparoscopic surgeries for various ailments between Sept 2013 and Sept 2016 at three tertiary institutes, from North India, were observed for port site complications prospectively and the complications were reviewed. Descriptive statistical analysis was carried out. The SPSS 13.0 was used for the analysis of the data.

**Results:** Of the 656 patients undergoing laparoscopic surgery, 31 (4.72%) had developed complications specifically related to the port site during a minimum follow-up of three months; port site infection was the most frequent (n = 21, 3.2%), followed by port site bleeding (n = 4, 0.6%), omentum-related complications (n = 1; 0.15%), and port site metastasis (n = 2, .30%). One patient had port site tuberculosis. 13(1.98%) patients developed hypertrophic scar also.

**Conclusions:** Laparoscopic port site complications are less. In our multicentre study, most complications are easily manageable except in metastasis and can be further minimized with meticulous surgical techniques

**Keywords:** Laparoscopy, ports ,port-site hernia

### Introduction

Worldwide, Laparoscopic surgery takes the advantages over conventional open surgery for Abdominal surgeries [1,2]. These advantages have increased the utilization and acceptability

of laparoscopy for last many years. In India, there is a recent surge in laparoscopic surgery among general and specialty surgeons adopting the technique for different conditions. As the number of minimal access surgeries increases so the complications are also coming up including port-site complications [3, 4, and 5].

Laparoscopic ports creation are also taken as intraoperative complications such as bleeding and puncture injuries to abdominal viscera [6]. Postoperatively, infections and its sequelae, hernia formation and port site metastasis are

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commonly reported [7]. The occurrence and frequency of these complications vary widely in many series depending on the type, location, and size of ports created, as well as the types of material employed in creating them [8,9].

This multicentre prospective study aims to assess various types of morbidity associated with port-site complications of laparoscopic surgery in our hospitals. Also we aim to find out associated risks and their treatment plan.

### Patients and Methods

We prospectively evaluated the port sites of all patients undergoing laparoscopic procedures in the department general surgery of the 1-Govt. Medical College, Azamgarh, 2-G.S.V.M. Medical College, Kanpur, U.P. 3-Hind Institute of Medical sciences, Barabanki, U.P. between September 2013 and September 2016. Patients were excluded when their procedures were converted to open laparotomy. Preoperative demographic data of each patient were recorded. All procedures were carried out under general anesthesia and preoperative antibiotics were administered. We generally employed the Veress needle for carbon dioxide insufflations except in those who have had laparotomies. We operated all patients with re-

usable trocar and cannulae. Conventional laparoscopy was performed in all planned surgeries. The port wounds were observed intra-operatively for bleeding and on completion of the procedure; the cannulae were removed under direct vision with closure of fascia in ports 10 mm or more. Postoperatively, all port sites were examined for bleeding, infection, herniation, metastasis and or chronic pain. Data generated were entered in a proforma made by extensive works by our team members. The level of statistical significance was  $P < 0.05$ .

### Results

A total of 679 patients had laparoscopic procedures over the study period. We excluded 23 patients whose procedures were converted to open laparotomy and so the remaining 656 patients in our analysis. There were 452 (68.7%) females and 204 (31.3%) male patients. Total 2456 laparoscopic ports were created giving an average of 3 ports per procedure. Of the 656 procedures, 63 (26.7%) were cholecystectomies, 62 (26.3%) 49 (20.8%) appendectomies, 22 (9.3%) adhesiolysis, 11 (4.7%) diagnostic procedures, 8 (3.4%) groin and ventral hernia repairs, 6 (2.5%), and 11 (4.7%) other varied procedures. We used transcutaneous sutures for closure of the ports in 41 (17.4%), subcuticular suture in 151 (64.0%) patients, skin staples in 38 (16.1%) and cyanoacrylate glue in 6 (2.5%) others.

Patients' mean age was 33.5 years (range = 17-79 years), mean weight was 56.2 kg (range = 32.5-96 kg) and mean body mass index was 26.0 (range = 21.1-31.4).

At a median follow-up duration of 14.6 months (range 4-32 months), port site complications had occurred in 31 (4.72%) patients. This includes port site infections (PSIs) in 22 ports occurring in 21 patients (3.2%). One patient had PSIs of two different ports [Figure-1]. Of these, 15 were superficial infections and 6 were deep infections [Table-3]. The infections involved the umbilical port in nine cases, epigastric port in ten patients and right upper quadrant port in one patient [Table 1]. Occurrence of wound infection was not significantly associated with the type of procedure ( $P = 0.34$ ), its duration ( $P = 0.84$ ) or

**Table 1-Various laparoscopic procedures performed and demography of the patients**

| No. | Laparoscopic procedure performed | Patients' number | Gender<br>Male/Female |
|-----|----------------------------------|------------------|-----------------------|
| 1   | Cholecystectomy                  | 238              | 159/79                |
| 2   | CBD Exploration                  | 12               | 9/3                   |
| 3   | Appendectomy                     | 121              | 79/32                 |
| 4   | TAPP/TEP hernia                  | 66               | 54/12                 |
| 5   | Ventral Hernia repair            | 21               | 17/04                 |
| 6   | Adhesiolysis                     | 84               | 57/29                 |
| 7   | Hystrectomy                      | 16               | 16/0                  |
| 8   | Oophorectomy                     | 11               | 11/0                  |
| 9   | Diagnostic                       | 76               | 49/27                 |
| 10  | Variculosectomy                  | 7                | 0/7                   |
| 11  | Adrenectomy                      | 2                | 1/1                   |

**Table 2: Occurrence of complications in laparoscopic port sites**

| Laparoscopic Procedures      | Numbers of Patients | Umbilical | Epigastric | Lateral | Supra-pubic | others |
|------------------------------|---------------------|-----------|------------|---------|-------------|--------|
| Cholecystectomy              | 238                 | 4         | 5          | 1       | -           | -      |
| Common Bile Duct Exploration | 12                  | 1         | 1          | 1       | -           | -      |
| Appendectomy                 | 121                 | 2         | -          | 1       | -           | 1      |
| Adhesiolysis                 | 84                  | 1         | 1          |         | 1           |        |
| TAP/TEPP hernia repair       | 66                  | 1         | -          | -       | 1           | -      |
| Ventral hernia repair        | 21                  | 1         | 1          | -       | -           | -      |
| Other diagnostic procedures  | 76                  | 1         | -          | 1       | -           | 1      |
| Hystrectomy                  | 16                  | 1         | -          |         | -           | -      |
| Oophrectomy                  | 11                  | 1         | -          | -       | 1           | -      |
| varicocelectomy              | 7                   | -         | -          | -       | -           | 1      |
| adrenectomy                  | 2                   | -         | -          | -       | -           | -      |
| total                        | 656                 | 13        | 8          | 4       | 3           | 3      |

the closure technique employed ( $P = 0.06$ ). A statistically significant association was however found between occurrence of wound infection on one hand and the site of the ports ( $P = 0.004$ ) as well as the class of wound created ( $P = 0.036$ ) on the other hand [Table 2] [Table-3].

**Port site hernia** occurred in 4 patients (0.60%). All occurred in 10 mm ports. One at epigastric port and three at umbilical port. Facial closure was done in two in above four patients [Figure-2 & 3].

**Port site bleeding** occurred in 3 patients (0.45%). Two occurred at lateral ports and one at epigastric port.

Port site metastasis is seen in one patient (0.15%) following laparoscopic cholecystectomy [Figure 4]. The histopathology of gall bladder was poorly differentiated adenocarcinoma.

**Port site tuberculosis** occurred in one patient (0.15%). The infection was *Mycobacterium chelonae*.



Figure 1-photograph showing port-site infection



Figure 2&3-Photographs showing port-site herniation

**TABLE 3-Types of complications (both specific and Non- specific) and associated risk factors**

| Type of complication                  | Number of port affected | Port-size |        | Obesity | Diabetes | >60 yrsAge | Closure done /or5 not |
|---------------------------------------|-------------------------|-----------|--------|---------|----------|------------|-----------------------|
|                                       |                         | 5mm       | ≥10 mm |         |          |            |                       |
| Port-site infections                  | 21                      | 3         | 18     | 10/21   | 6/21     | 11         | 14                    |
| Bleeding                              | 3                       | 0         | 3      | 1/3     |          |            |                       |
| Hernia                                | 4                       | 0         | 4      | 2/4     |          | 1/4        | 4/4                   |
| Omental related                       | 1                       | 0         | 1      | 1       | 1        |            |                       |
| metastasis                            | 1                       | 1         | 1      | -       |          |            |                       |
| tuberculosis                          | 1                       | 0         | 1      | -       |          | 1          | 1                     |
| Hypertrophic scar/keloid(nonspecific) | 13                      | 2         | 11     | 3       | 2        | 4          | 5                     |
| Chronic pain port site(nonspecific)   | 10                      | 1         | 9      | 7       | 1        | 2          | -                     |

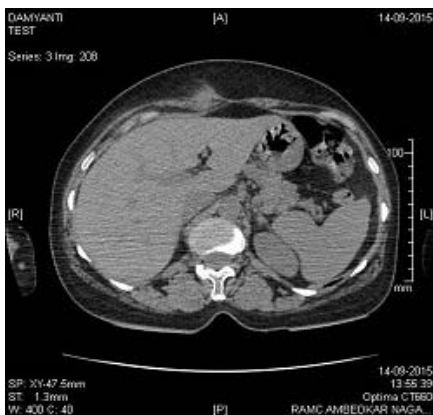
Other non -specific port site complications recorded includes hypertrophic scars in 4 (0.60%) patients. Two of these occurred at the epigastric port following laparoscopic cholecystectomy, one occurred at the umbilicus following cholecystectomy and one at the supra-pubic port following appendectomy.

The superficial port infections were managed with wound dressings and this was combined with antibiotics therapy in patients with deep infections. All port-site Hernias were operated by conventional open method. In one patient of

umbilical port we had to use a polypropelene mesh. Port-site bleeding was controlled by suturing the bleeding port-site wall. Port site tuberculosis needed wide local excision and followed by anti-tubercular treatment with azithromycin.

Port-site metastasis is needed wide local excision and further treatment with adjuvant chemotherapy.

The hypertrophic scars were managed with topical steroid application, while the patient with port site metastasis had a wide local excision biopsy after initial fine-needle aspiration cytology confirmed presence of malignant cells.



**Figure4-CECT abdomen revealing mass at epigastric port-site- a case of metastatic deposition of carcinoma gall bladder**

**Discussion**

Overall, wound complications were observed at laparoscopic port sites wounds on 4.72% of patients in this study. This is high compared with 3% patients recorded by Karthik *et al.* in India who however included a larger sample size and we are hopeful that the rate in our centers will be less with increasing number of laparoscopic procedures.

The majority, 21 of 31 (67.7%) of the complications were PSIs. These rates are comparable to that of many studies published earlier[1,10,11,12]. We have included a number



of contaminated and dirty wounds in this analysis as we adopted laparoscopy for treatment of gallbladder empyemas and mucoceles as well as a number of ruptured appendixes with localized abscesses.

The majority of PSIs (16 of 21, 76.1%) recorded were superficial and involved the umbilical wound. This is similar to findings in previous studies [1, 10, 11, 13, and 14]. With more patients in early year complication, this observation led us to use routine antiseptic used for preoperative skin, we have observed a marked reduction in the PSI rate particularly with the umbilical wound since then. Our results are comparable with many other studies. Den Hoed *et al.* found the incidence to be 5.3% [20], Shindholimath *et al.* 6.3% [18] and Colizza *et al.* <2% All PSIs were superficial, involving only the skin and subcutaneous tissue. Superficial skin infection is more common and has been reported by another study [19, 21].

So, wound infections are prevented by appropriate administration of antibiotic prophylaxis, sterile techniques, and the use of specimen bags during specimen extraction. Once present, infections are treated with drainage, packing, and antibiotics as appropriate.

As for as port-site hernia is concerned, Chiu *et al* in a series of 732 patients operated for laparoscopic bariatric surgeries noted that use of Surgical plug into muscular layer of trocar wound reduces incident of incisional hernia to 0.33% [17]. Alternatively, tangential insertion of trocar through the abdominal wall is effective in reducing the size of fascial defect.

In the present study, out of 656 patients, 4 patients reported incisional hernia (2 at umbilical port, 2-epigastric port) during the study period. Incidence occurred between age group of 40-60yrs. Post-op wound infection (25%), obesity (50%) and spontaneously (25%) were noted as a causative factor for incisional hernia in our study. We found two patients, where fascial closure was not done.

So, Fascial closure is recommended for ports  $\geq 10$  mm; the fascia are closed with sutures to reduce the risk of developing a port site

hernia. [14]. Re-approximation of the fascia can be accomplished in a variety of ways. Ideally, the fascia is directly visualised with the aid of retractors. The fascial edges are grasped and the sutured closed with interrupted or continuous suture. A number of specialized instruments have been devised for fascial closure at the port site (e.g., Grice® suture needle, Carter-Thomson needle-point suture passer, Endo Close™ instrument, Reverdin suture needle). [15,16] The benefit of these devices is yet to be proven. The technique of closure of the rectus sheath had no influence [1].

Port site metastasis occurred in one of 71 (1.4%) patients who had laparoscopy for malignant conditions in this study. A nodular swelling was felt at the extraction site 12 weeks after surgery, while she was on chemotherapy. A wide local excision was carried out. Histopathology confirmed metastatic adenocarcinoma and the excision margins were free of malignant cells. She continued chemotherapy and had developed secondary liver metastasis after 3 months follow-up. In recent years, after laparoscopic oncological procedures, several reports of trocar site recurrence have been published [22,23]. The exact mechanism of development of metastasis of the abdominal wall is unknown. However, various explanations are given in the literature. Studies show that recurrence of tumour at the port site probably can be avoided by the use of plastic bags or wound protectors to avoid direct contact between the tumour and the wound. It is also essential that extraction of the specimen is done through an abdominal incision wide enough to allow easy passage of the specimen

Incidence of port site bleeding was found to be 0.7%. Our results are comparable with other studies [21]. There was undue bleeding from one port site during a diagnostic laparoscopy and biopsy of an intra-abdominal mass. In addition to visually inspecting the access site upon its creation, the site should also be inspected during and following removal of the port. Bleeding points can usually be identified and managed with electrocautery. On occasion, the skin incision may need to be enlarged to control the bleeding. If persistent bleeding continues, a Foley catheter can also be inserted, inflated, and

gentle traction applied to tamponade the site. Also, U-stitches can be placed into the abdominal wall under direct laparoscopic visualization using a suture passer with absorbable braided sutures. A number of specialized instruments

Have been devised for fascial closure at the port site and these may also be useful for managing abdominal wall bleeding. This necessitated wound exploration and ligation of the bleeding vessel. Other complications such as gastrointestinal or genitourinary injuries and port site hernia were absent in this cohort.

There were no omentum related complications as well. Several studies have attributed the occurrence of hernias to the use of large size trocars [9,18]. Perhaps, our scanty use of such trocars and the routine adoption of closure of all 10 mm ports led to the absence of hernias in our patients.

Hypertrophic and keloidal scars are fairly common complications of abdominal wounds in our practice [15]. It is hence, not surprising that four patients presented with hypertrophic scars. Two of these occurred in the epigastric port and one of these patients had been treated for keloidal scars 2 years earlier. All four patients were managed conservatively by the plastic surgery unit with topical agents and the scars regressed in all instances between 5 and 19 months of follow-up. Port-site Pain from placement of trocars is expected, but can be minimized by using the least number of ports required to perform the procedure safely [19]. Important co-morbidity and risk factors are obesity, diabetes and longer operative duration.

## Conclusion

This study and its findings have certain limitations. We have also included a wide range of cases and the location and number of ports differs with the procedures carried out. We however minimized this limitation by using the same technique for each procedure. Finally, our primary objective was port site complications including immediate and long-term complications but our period of follow-up may

be too short for certain long-term complication like incisional hernia from extraction site.

Laparoscopic port site complications are rare in elective laparoscopic surgeries and can be further reduced by proper selection of patients, and strictly following basic principles of sterilization and prevention apart from meticulous surgical technique during entry and exit at all the port sites.

## Conflict of Interests

None

## Ethical Considerations

None

## Funding

None

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