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Port site complications following laparoscopic surgeries

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Abstract
Introduction: Laparoscopic surgery (LS), also termed minimal access surgery, has brought a paradigm shift in the approach to modern surgical care. Early postoperative recovery, less pain, improved aesthesis and early return to work has led to its popularity both amongst surgeons and patients. Its application has progressed from cholecystectomies and appendectomies to various other fields including gastrointestinal surgery, urology, gynecology and oncosurgery. However, LS has its own package of complications. Port site infection (PSI), although infrequent, is one of the bothersome complications which undermine the benefits of minimal invasive surgery. Not only does it add to the morbidity of the patient but also spoils the reputation of the surgeon.
Material & Methods: A hospital based comparative study was conducted at Department of Surgery of a tertiary care hospital. A total of 120 eligible cases of laparoscopic surgeries were included in the study.
Conclusion: Port site complications are minimal that includes wound infection, dehiscence, herniation of small bowel, entrapment of the omentum, bleeding, recurrence of tumour, and so on. Cautious insertion of trocar, use of safety trocar, closure of sheath with port closure needle and proper surgical techniques can minimize these complications further.

Keywords: Laparoscopic surgery, port site infection, atypical mycobacteria, sterilization

Introduction
Laparoscopic techniques have revolutionized the field of surgery. Rapid growths in health care technology have given the surgeon the power of not only treating diseases surgically but also limiting surgical invasiveness. The greatest example is minimal access surgery also commonly termed laparoscopic surgery or keyhole surgery, which has caused a paradigm shift in the approach to modern surgery, by limiting the access related morbidities. Laparoscopic Surgery involve the use of reusable metallic or disposable plastic trocars inserted through small skin incisions or ports made on the skin away from the site of surgery. These reports from the portal of entry to perform the surgical procedure by means of specially devised instruments and telescope. It has gained popularity due to better aesthesis, lesser pain, early ambulation and discharge from the hospital with early return to work, minimizing the financial burden to the patient. Ever since Philips Mouret reported the first laparoscopic cholecystectomy in 1987, the approach has been adopted for many other surgical procedures including appendectomy, herniorrhaphy, colonic surgery, gastric surgery, urological and gynaecological surgeries [1-5]. This is because of the combination of advancement in technology with the increasing acceptance of Minimal Access Surgery by patients, which has led to the expansion of the horizon of Laparoscopic Surgery. Benefits of Minimal Access Surgery include decreased postoperative pain, quicker return to normal activity, and less postoperative complications. Laparoscopic Surgery, however, has its package of unique complications. Inadvertent bowel injury or major vascular injury are uncommon but potentially life-threatening complications, usually occurring during initial access. [6, 7]. The overall rate of major complications following a laparoscopic procedure is approximately 1.4 per 1,000 procedures [8]. One such complication, which is preventable although, is the port site infection (PSI). Port Site Infection soon erodes the advantages of Laparoscopic Surgery, with the patient becoming worried with the indolent and nagging infection and losing confidence on the operating surgeon. There occurs a significant increase in the morbidity, hospital stay and financial loss to the patient. The whole purpose of Minimal Access Surgery to achieve utmost cosmesis is turned into an unsightly wound, and the quality of life of patients is seriously affected. However, the incidence of port site complications

following laparoscopic surgery is considered to be around 21 per 100,000 cases [9]. And it has shown a proportional rise with the increase in size of the port site incision and trocar [10, 11]. The overall complications/injuries that occur following laparoscopic surgeries involve, gastrointestinal (0.6 per 1,000), genitourinary (0.3 per 1000), vascular (0.1 per 1,000), and omentum (0.4 per 1,000). [12, 13]. However, the rarer complications include pyoderma gangrenosum [14], metastasis at the port site following laparoscopic oncosurgery [15, 16], and port site infections (PSIs). [17]. In this study we reviewed the current literature regarding the incidence, clinical presentation, etiopathogenesis, management and methods of prevention of Port Site Infection in Laparoscopic Surgery.

Materials and Method

Study site: Dhiraj hospital, SBKSMIRC, Pipariya
Study design: Prospective study
Sample size: 120 patients.
Study period: September 2017-September 2018

Inclusion criteria

1. All the patients coming to the outpatient department referred to or admitted under the department of general Surgery or gastro or urology department undergoing laparoscopic surgery for any aetiology.

Exclusion criteria

1. Patient not willing for study.
2. Patient with immuno-compromised status, co-morbid factors like cardiac / respiratory diseases, organ failure were excluded

Method of study

On admission history will be collected and thorough physical examination will be done. Data collection on admission including age, address and clinical presentation with respect to aetiology will be done. History of previous episodes and co-morbidities will be noted. Family history for similar complains will be extracted. Clinical examination of abdomen will be done with respect to the aetiology. Routine investigations like complete hemogram, Blood urea, Written and Informed Consent would be obtained for taking part in study and for operative procedure. Blood sugar, Serum electrolytes and Serology will be carried out. Ultrasonography of abdomen and pelvis will be done as the primary investigation. X- ray abdomen standing and X-ray KUB shall also be done if required. Further CECT Abdomen or Ct-IVP shall also be done if required. Laparoscopic intervention will be done for the etiology. The 10 mm ports were closed in two layers. The rectus sheath was closed with polyglactin (No. 1) suture while the skin was closed with monofilament polyamide (2-0) suture. The 5 mm ports were closed in single layer. Only the skin was closed with monofilament polyamide (2-0). Most of the patients were discharged on third or fourth postoperative day. The patients were observed for any port-site complication during operation and in the immediate and remote postoperative period. For this, the patients were asked to come for weekly follow-up at OPD for the first month postoperatively and subsequently once every month for at least three months. Any complication found was noted down and the data gathered was analysed. All the data were analysed using IBM SPSS ver. 20 software. Data were expressed as number and percentage. Frequency distribution was used to tabulate the data. Level of significance was assessed at 5%.

Results and Discussion

Laparoscopic surgeries have its package of unique complications. Inadvertent bowel injury or major vascular injuries are uncommon but potentially life-threatening complications, usually occurring during initial access. Minimally invasive surgeries such as laparoscopic surgeries have become the order of the day for many surgical diseases. Laparoscopic surgery became the standard procedure for many gynecological and surgical conditions with documented benefits and excellent outcome. The main reason for preference of laparoscopic surgeries to abdominal surgeries is the low cost, less pain and scarring, faster convalescence and lesser hospital stay. Major complications are access related such as major vascular injury or inadvertent bowel injuries, which may be life threatening. These complications are by far very rare [18, 19]. The rapid advancement in science in CCD cameras and the flexible light sources have made the laparoscopic surgery more affordable and widely available. As a result, the use of laparoscopy has expanded to more sophisticated surgeries as well as management of malignancies [20].

The overall rate of major complications following a laparoscopic procedure is approximately 1.4 per 1,000 procedures [21]. However the incidence of port site complications following laparoscopic surgery is considered to be around 21 per 100,000 cases and it has shown a proportional rise with the increase in size of the port site incision and trocar [22-24]. The overall complications/injuries that occur following laparoscopic surgeries involve, gastrointestinal (0.06%), genitourinary (0.03%), vascular (0.01%) and omentum (0.04%) [25, 26]. However, other rare complications include pyoderma gangrenosum, metastasis at the port site following laparoscopic oncosurgery and port site infections (PSIs) [27-29].

1) Age comparision

>50% of the cases in present study were between 31-40 years of age with 6.7% and 1.7% cases between 51-60 years and above 60 years of age. Mean age of the study subjects was 37.1 ± 10.97 years.

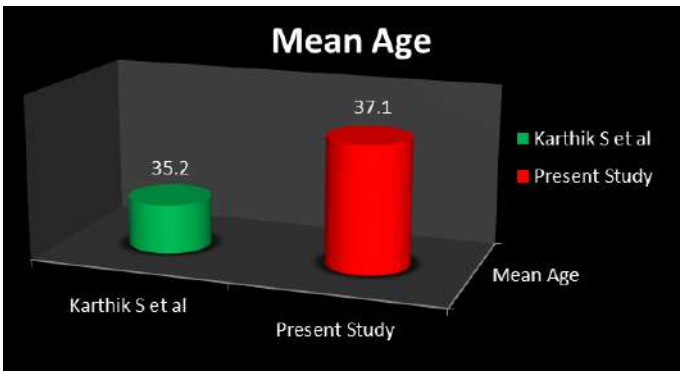

Fig 1: Graph showing mean age comparison

According to the study done by Karthik S *et al.* [30]. The mean age of in his study was 35.2 while in our study was 37.1 which correlates with incidence of gall stone in that age group with patients undergoing laparoscopic surgery which is commonly performed surgery in this study.

2) Gender comparision

Female predominance was seen in present study with 65% females to 35% males.

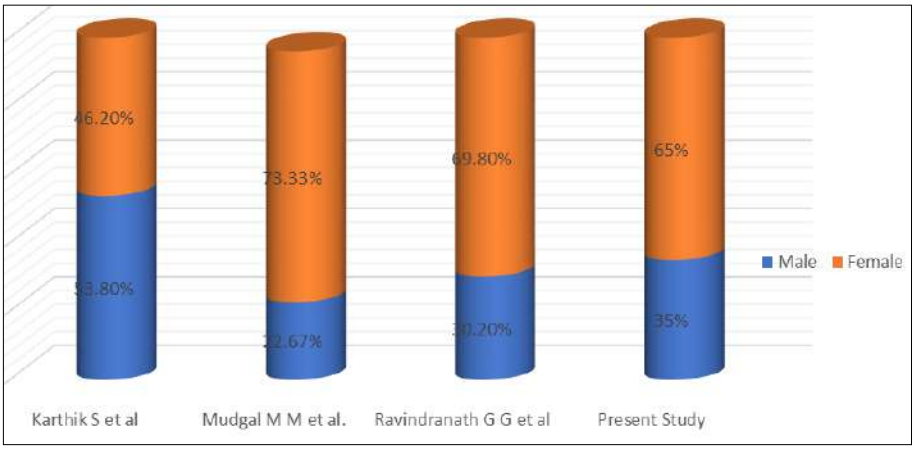

Fig 2: Graph Showing Gender Comparision (Total)

- The percentage of Male & female in Karthik S *et al.* [30]. Was 53.8% v/s 46.2% out of which 7.2% of male and 10.3% of female developed port site Complication.
- The percentage of Male & female in Mudgal MM *et al.* [31]. Was 22.67% v/s 73.33% out of which 12.3% male and 27.3% female population developed port site complications.
- The percentage of Male & female in Ravindranath GG *et al.* [32]. Was 30.2% v/s 69.8% out of which 5.1% male and 7.1% female population developed port site complications.
- In present study percentage of Male & female was 25% (30 patients) v/s 75% (90 female) out of which 6.6% (8) male and 10%(12) female population developed port site complications.

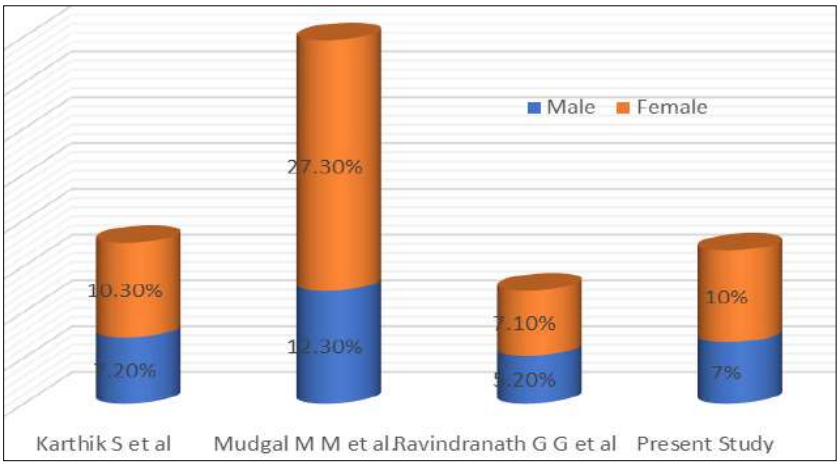

Fig 3: Graph Showing Complication Rate Gender Wise

- 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 developing country female population neglects their health and don't take rest after surgery which attributes to higher incidence in them.
- Also, these populations due to repeated deliveries their abdominal wall musculature becomes weak making them prone for complications.

3) Basal metabolic index (BMI)

Table 1: Comparision of BMI

BMI	Mudgal M.M. *et al.*[31]		Present study	
	Total patient	Complications	Total patient	Complications
<18.5 Kg/m^2	13%	0%	20%	2%
18.5-25 Kg/m^2	53.33%	4.5%	49.43%	2.6%
25-30 Kg/m^2	23.33%	15.3%	12.57%	4%
>30 Kg/m^2	10.3%	12.7%	18%	8%

- Most of the patients in our study as well as Mudgal M.M. *et al.* [31]. Were having BMI 18-25 Kg/m^2.

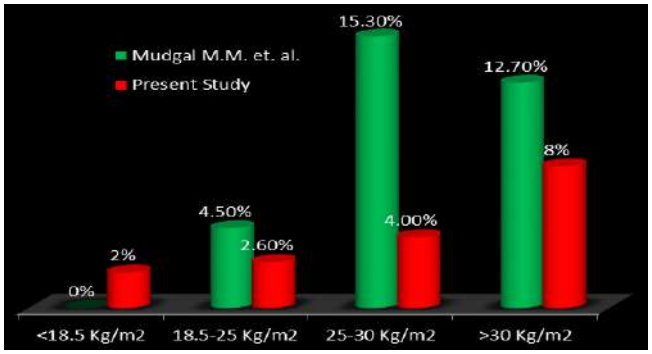

Fig 4: Graph showing comparason of complication according to BMI

- India being developing country we have more number of patients in having low BMI.
- Like every coin has 2 sides India also has patient having BMI > 30 Kg/m^2 due to junk food.
- In Mudgal M. M. *et al.* [31]. study patients with BMI >25 Kg/m^2 (15.3% and 12.7%) had complications compaired to BMI <25 Kg/m^2 which is comparable to our study in which there are 4% and 8% complications with BMI > 25 Kg/m^2 compared to 2% and 2.6% in patients with BMI < 25 Kg/m^2.
- Patients with high BMI have higher chances of complications during entry and closing 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 patient.

4) Association of diabetes mellitus

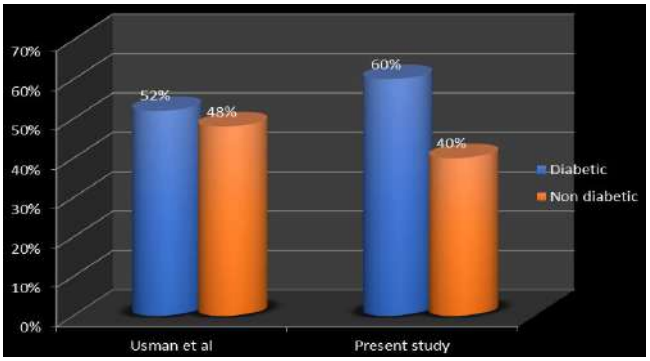

Fig 5: Graph showing comparision of diabetes mellitus in patients

- In present study out of 120 patient 60% (72) patients were diabetic out 40% non-diabetic which is comparable to Usman *et al.* [33]. Study in which there were 52% diabetic and 48% non diabetic.

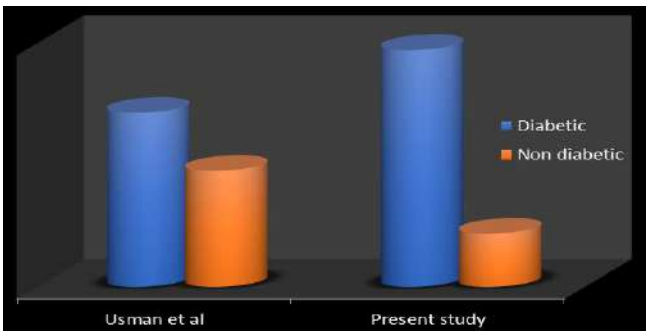

Fig 6: Graph showing comparision of complication in relation with diabetes mellitus

- In Usman *et al.* [33]. Study 10% of diabetic patient developed PSSI and 6.67% of non-diabetic developed PSSI. In present study 13.6% of diabetic patient developed PSSI and 3.06% of non-diabetic developed PSSI.
- Diabetes Mellitus increases risk of PSSI due to microangiopathy and neuropathy leading to increase in colonization of staphylococcus aureus.

5) Method used for creating pneumoperitoneum

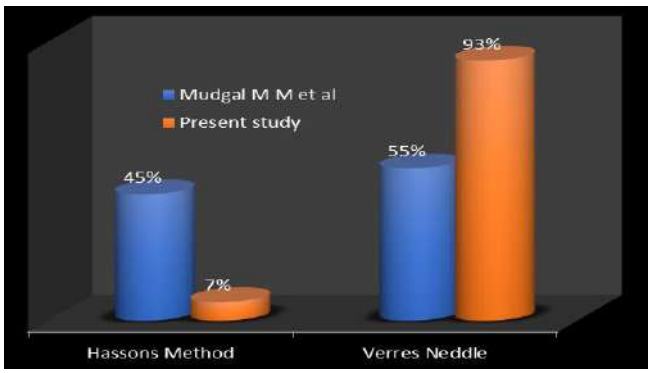

Fig 7: Graph Showing Comparison of Method Used for Creating Pneumoperitoneum

- In Mudgal M. M. *et al.* [31]. Study out of 300 patients, Verres needle was used for creating pneumoperitoneum in 164 (54.66%) patients and Hasson's (Open) method was used in 136 (45.33%) patients.
- In present study out of 120 patients, Verres needle was used for creating pneumoperitoneum in 112 (93.33%) patients and Hasson's (Open) method was used in 8 (6.67%) patients.

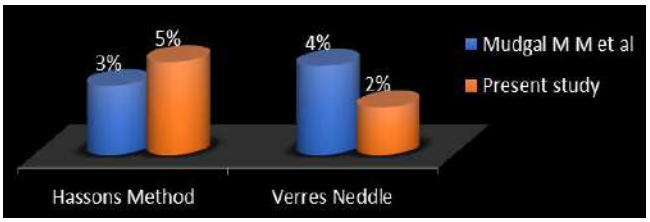

Fig 8: Graph Showing Comparison of Method Used for Creating Pneumoperitoneum and Complications

- In Mudgal M. M. *et al.* [31]. Study out of 164 patients of Verres needle 4.3% patient developed complications compaired to 3.34% of Hasson's (Open) method.
- In present study out of 112 patients of Verres needle 2.3% patients developed complications compaired to 0.5% of Hasson's (Open) method.
- Complications resulting from Verres needle and trocar insertion include injuries to major retroperitoneal vessels and to bowel, which are associated with significant morbidity and mortality. Other more minor complications resulting from Verres needle and trocar insertion include abdominal wall hematoma, wound infection, and fascial dehiscence and herniation.
- In Jansen *et al.* study [34]. Complication associated with Verres needle or trocar insertion was approximately 0.3%. While Nuzzo *et al.* [35]. Presented a series of 330 patients in which the open technique was used exclusively with no incidence of injury to a major vessel or to bowel with trocar insertion.
- Hasson's method involves visual access to peritoneum

compared to blind verres procedure thereby increasing risk of complications. Also, it depends on experience of operating surgeon.

6) Incidence of Complications

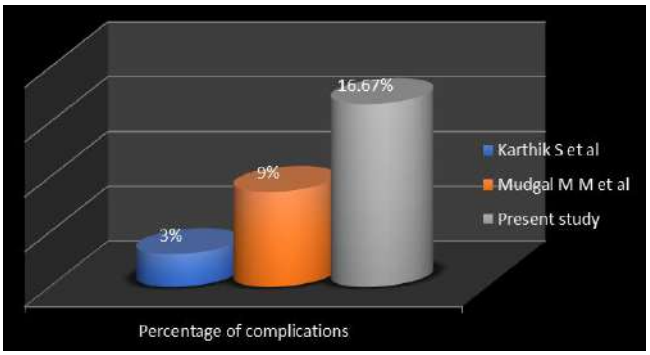

Fig 9: Graph Showing Comparision of Incidence of Complications

- Incidence of complication in Karthik S *et al.* [30]. Study was 2.98% whereas in Mudgal MM et at. [31]. Study was 8.67% compared to 16.67% in present study.
- Total number of study population was 570 and 300 in Karthik S *et al.* [30]. And Mudgal MM *et al.* [31]. Study compared to 120 in present study which may attribute to higher rate of complication.

7) Commonest Port Involvement

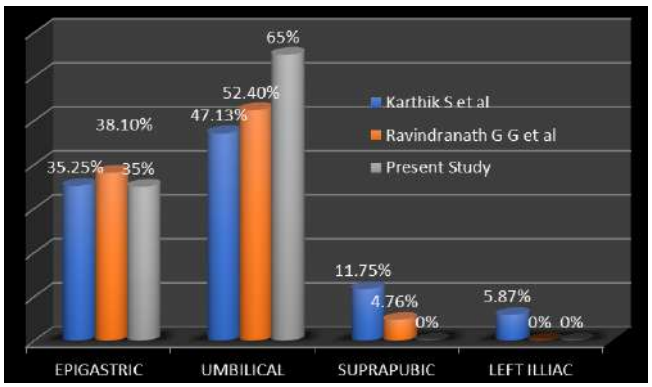

Fig 10: Graph Showing Comparision of Common Port Involved

- The most common site of infection in Karthik S *et al.* [30]. 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 illac port.
- The most common site of infection in Ravindranath GG *et al.* [32]. 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 Present Study was umbilical port with 13 (65%) cases, followed by epigastric port with 7 (35%) cases.
- Umbilical port is a first access port in most of laparoscopic surgeries as well as tissue retrieval is also done through this port therefore most common site of infection.
- Umbilicus is inverted and acts as nidus for infection if not taken care preoperatively.

8) No. Of Port and Complication

Table 2: Comparison of No of Port and Complication

No. of Port	Karthik S *et al.*[30]	Present Study
1	0 (0%)	0 (0%)
3	6 (1.05%)	14 (11.66%)
4	10 (1.75%)	2 (1.66%)
5	1(0.17)%	0 (0%)

- Port site complications were significantly increased with increased number of ports with 14 (11.66%) in three port access v/s 2 (1.66%) in four port in our study compared to 6 (1.05%) v/s 10 (1.75%) in Karthik S *et al.* study [30].
- No complications occurred in single port access.
- Most of laparoscopic surgeries require three port access and four port access thereby increasing chance of complications.

9) Comparison of Port Size and Complications

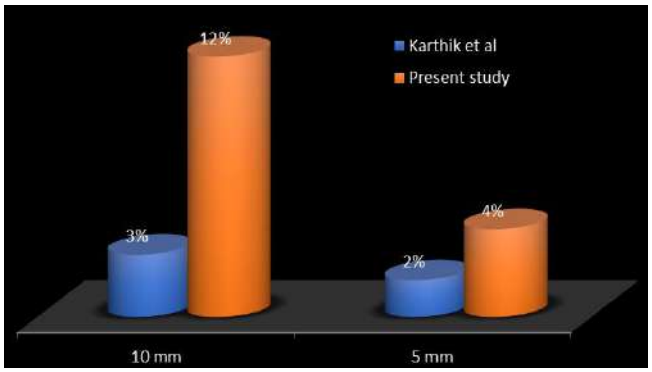

Fig 11: Graph Showing Comparision of Port Size and Complications

- Port site complications were significantly increased with increased in size 12.47% in our and 2.98% in Karthik S *et al.* [30]. Study in 10mm port compared to size 4.2% in our and 1.75% in Karthik S *et al.* [30]. Study in 5mm port.
- Retrieval of specimen is done through 10mm port with extension of incision required sometimes attributes to increase in chance of infection in 10 mm port.
- Also during retrieval chances of spillage of bile (in cholecytectomy) or infective material increase in complications.
- Most of laparoscopic surgeries require three port access and four port access thereby increasing chance of complications.

10) Comparison of complications

Table 3: Comparison of Complications

Complications	Karthik S *et al.* [30]. (N=17)	Mudgal M.M *et al.* [31] (N=26)	Present Study (N=20)
Port site infection (psi)	10 (58.82%)	8 (30.76%)	15 (75%)
Port site bleeding	4 (23.5%)	6 (23.07%)	4 (20%)
Immediate Omental entrapment	2 (11.8%)	0 (0%)	1 (5%)
Late herniation(3 months post-surgery)	0 (0%)	4 (15.38%)	0 (0%)
Port site metastasis	1 (5.88%)	0 (0%)	0 (0%)
Other: visceral injuries/ hypertrophic scar/emphysema	0 (0%)	8 (30.76%)	0 (0%)

- Most common complication in our as well as other stud was PSI (Port site infection).
- PSI was present in 15 (75%) patients while it was 10 (58.82%) in Karthik S *et al.* [30]. and 8 (30.76%) in Mudgal M. M. *et al.* [31]. Which was managed by antibiotics and dressing.
- Port site bleeding occurred in 4 (20%) patients in present study and 4 (23.5%) in Karthik S *et al.* [30]. compared to 6 (23.07%) in Mudgal M. M. *et al.* [31]. which was managed my cauterization.
- Omental entrapment was reported in 2 (11.8%) in Karthik S. *et al.* [30]. While only 1 patient had omental entrapment which was managed conservatively.
- Karthik S. *et al.* [30]. Reported port site metastasis in 1(5.88%) which was not present in our study as we didn't operate any tumor case.
- In Mudgal M M *et al.* [31]. Viseral Injury was reported in 1 (3.84%) patient, hypertrophic scar in 3 (11.53%) patients and emphysema in 4 (15.38%) patients. None of these complications occurred in present study.

11) Comparison of corelation of psi and retrieval of specimen

Table 24: Comparison of Corelation of Psi and Retrieval of Specimen

Retrieval of Specimen	Compilations	
	Karthik *et al.* [30]. (N=17)	**Present Study(N=20)**
YES	15 (88.23%)	16 (80%)
NO	2 (11.76%)	4 (20%)

- Retrieval of specimen is related to higher complication as found in Karthik *et al.* [30]. Study 15 (88.23%) and present study 16 (80%).
- During retrieval there are chances of spillage of bile (In cholecytectomy) or infective material increase in port complications.
- Also during retrieval there may be a need for extending incision which attributes to port site complications.

Conclusion

Port site complications are minimal that includes wound infection, dehiscence, herniation of small bowel, entrapment of the omentum, bleeding, recurrence of tumour, and so on. Cautious insertion of trocar, use of safety trocar, closure of sheath with port closure needle and proper surgical techniques can minimize these complications further.

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