

## To study the incidence of port site complications and their associated risk factors in patients undergoing elective laparoscopic surgery

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**Abstract: Background & Objective:** - Laparoscopic surgery, also called minimally invasive surgery (MIS) is a modern surgical technique in which operations in the abdomen are performed through small incisions using ports (usually 0.5–1.0 cm) as compared to the larger incisions needed in laparotomy. However, extent, nature and procedure of surgery remains the same except it is done through minimal size incisions by using laparoscopic instruments with telescopic camera and under vision of monitors.<sup>1</sup>

Laparoscopic procedures are associated with port site infections (PSIs), though they have less incidence but they may be associated with significant morbidity. The purpose of study is to access the incidence of port site complications and their associated risk factors in patients undergoing elective laparoscopic surgery in our hospital, as there have been several studies conducted to identify the incidence of various port site complications following laparoscopic surgery. However, studies to assess risk factors contributing to these port site complications are less. Most of previous studies were done in tertiary care centres and very limited data is available for secondary care centres, like our hospital

**Materials and Methods:** We study prospectively the incidence of port site complications and their associated risk factors in 400 patients undergoing elective laparoscopic surgery in our hospital. Study will be conducted only in first year i.e., from Feb 2019 to Feb 2020 and followed up period is one year. After Laparoscopic procedure organ retrieval was done with umbilical port only. First wound inspection was done on second post-operative day and thereafter, OPD follow-up was done weekly for the first month, and then two monthly up to one year. Data was entered in MS Excel work sheet and all descriptive data was expressed as mean and standard deviation.

**Results & Conclusion:** Laparoscopic surgeries are associated with minimal port site complications. The incidence of port site infections and port site incisional hernias after elective laparoscopic surgery observed in our study were 2.78% and 0.83% respectively. There is strong and significant correlation between laparoscopic appendectomy and port site infections. Diabetic patients were more prone to develop port site infections postoperatively, and this was statistically significant.

**Key Word:** Laparoscopic Surgery, Port site complication, Umbilical Hernia, Surgical site infection.

Date of Submission: 08-07-2021

Date of Acceptance: 23-07-2021

### I. Introduction

Laparoscopic surgery, also called minimally invasive surgery (MIS) is a modern surgical technique in which operations in the abdomen are performed through small incisions using ports (usually 0.5–1.0 cm) as compared to the larger incisions needed in laparotomy. However, extent, nature and procedure of surgery remains the same except it is done through minimal size incisions by using laparoscopic instruments with telescopic camera and under vision of monitors.<sup>1</sup>

The location on the skin where a laparoscopic instrument is inserted into the abdominal cavity are called port sites. In this procedure, small incisions are given in the abdominal wall to access peritoneal cavity. To maintain pneumoperitoneum as well as allow ease of access for the instruments, special instruments called Ports are used. These are available in various sizes (viz 3mm, 5mm, 10mm, 12mm) and consist of a sharp trocar and cannula with valve.

Laparoscopic techniques have revolutionized the field of surgery and has become the gold standard for cholecystectomy and is gaining popularity in other surgeries also. As ports came into vogue with the introduction of laparoscopic surgery it has brought along with it a new set of complications termed as port site complications.

The common complications at port site are:

- a) Port site infections.
- b) Port site bleeding.
- c) Port site incisional hernia.
- d) Stitch granuloma.
- e) Hypertrophic scar.

Laparoscopic procedures are associated with port site infections (PSIs), though they have less incidence but they may be associated with significant morbidity.<sup>2</sup> These can present as superficial and deep infections like wound abscesses, cellulitis, necrotizing fasciitis and atypical mycobacterium infection. The presence of significant peri-incisional erythema, wound drainage, and fever may indicate the presence of a necrotizing fascial infection.<sup>3</sup>

Port site infection (PSI) may occur due to contamination following spillage of gut or biliary contents, hematoma formation or breach in aseptic technique.

Umbilical port site was the most common site of PSI followed by epigastric port site. In the literature, there is great emphasis on the increased frequency of umbilical site PSIs, the role of umbilical flora in the development of PSIs, and frequent retrieval of specimen from umbilical port.

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 debridement, dressings, and appropriate antibiotics.

Port Site Incisional Hernia (PSIH) is a rare complication caused by trocar-site fascial defects. Larger defects of 10 mm or greater carry a higher risk of postoperative complications. Omentum or bowel may become trapped and present 3 to 5 days postoperatively, sometimes as Richter's hernia.

The incidence of incisional hernia is quite low. The risk of developing incisional hernia is low with the use of trocars  $\leq 12$  mm, radially dilating trocars, or bladeless trocars.<sup>4</sup> Although rare, hernia has been reported even for 5 mm trocar sites. When port site hernia is identified following laparoscopy, the site should be repaired to prevent the development of intestinal complications (i.e., obstruction, strangulation).<sup>5</sup> Various factors are attributed to the occurrence of these complications including: a) removal of the ports prior to complete deflation of the peritoneal cavity, b) inadequate/ faulty closure of the port site incisions, and c) large incision at the port site.<sup>6</sup>

The purpose of study is to access the incidence of port site complications and their associated risk factors in patients undergoing elective laparoscopic surgery in our hospital, as there have been several studies conducted to identify the incidence of various port site complications following laparoscopic surgery. However, studies to assess risk factors contributing to these port site complications are less. Most of previous studies were done in tertiary care centres and very limited data is available for secondary care centres, like our hospital.

## **II. Material And Methods**

My study is a prospective observational study conducted in the Department of General Surgery, Nalanda Medical College and Hospital, Patna patients between February 2019 to February 2021, after taking informed consent.

### **Study population:**

All patients undergoing elective laparoscopic surgery in Department of General Surgery.

### **Study period:**

Two years (Feb 2019-Feb 2021).

### **Study design:**

Observational, institution based prospective study.

### **Sample size:**

For present study, formula which used for calculation of sample size is:

$$n = [Z^2 \times (pq)/d^2]$$

n = minimal sample size

z = linked to 95% confidence interval (used 1.96)

p = expected prevalence (fraction of 1)

q = 1-p (expected non prevalence)

d = relative desired precision

As we have followed up period of one year, enrolment for study will be done only in first year of study i.e., from Feb 2019 to Feb 2020. Average no. of elective laparoscopic surgery done in one year is 410. A total of 400 patients availing the hospital services during the study period and fulfilling the inclusion criteria were

included in the study. All the patients underwent elective laparoscopic surgery in our hospital. 15 patients did not give consent for the study and 40 patients were lost to follow-up who were excluded from the study.

Study duration- 2 years

Follow up period- 1 year Population- 400

Confidence limit- 95%

Confidence interval- 5

**Inclusion criteria:**

All patients undergoing elective laparoscopic procedure done in Department of General Surgery at Nalanda Medical College and Hospital, Patna.

**Exclusion criteria:**

Patients not willing to be part of the study.

Patients lost to follow up.

Port site infection will be taken as per CDC criteria of surgical site infection.<sup>7</sup> Port site hernia diagnosis will be done by clinical examination.

All such cases will be managed suitably by operating surgeon.

**Study works up:**

\*) All patients who opted for laparoscopic surgery were evaluated, pre anaesthetic check-up done and optimized on

OPD basis.

\*) All patients were admitted a day before surgery.

\*) Thorough history was taken and all relevant details were noted.

\*) Preoperative preparation was identical in all cases (hair clipping, bathing, betadine painting and covering of surgical site before taking to OT.)

\*) Pre-operative antibiotic prophylaxis (2nd generation cephalosporin) was given 30 min before surgery in every

patient.

\*) All surgeries were done in our modular OT under standard operating conditions.

\*) All surgeries were done under general anaesthesia.

\*) All surgeries were done by senior consultants.

\*) Under all aseptic and antiseptic precautions, proper painting with 10% povidine iodine and proper draping done.

\*) Umbilicus is cleaned separately with povidine iodine and isopropyl alcohol.

\*) Pneumoperitoneum is achieved with Veress needle technique followed by primary or camera port placement at

umbilicus in all patients.

\*) Secondary ports were placed at different positions according to different procedures under vision.

\*) Organ retrieval was done using suitable endobag through umbilical port to avoid port site contamination.

\*) Umbilical port (camera port) was closed by standard technique in two layers, rectus by vicryl 1-0 and skin by nylon 3-

0. Other ports were closed in one layer by nylon 3-0.

\*) After closing fascial layer at camera port, umbilicus is irrigated with povidine iodine and topical gentamicin followed

by skin closure with nylon 3-0.

\*) Post operatively, patients were managed suitably in surgical ward.

\*) First wound inspection was done on 2<sup>nd</sup> postoperative day and findings were noted with change of dressing done.

\*) If there is evidence of port site infections, suitable treatment in accordance with operating surgeon was given and it

was remarked as positive for port site infection.

\*) Other patients were discharged on 2<sup>nd</sup> postoperative day.

\*) There after OPD follow up schedule was as follows: At 1<sup>st</sup> week for suture removal. Thereafter, OPD follow-up was

done weekly for the first month, and then two monthly up to one year.

\*) For port site infections, patients were followed up to one month. If there is no evidence of infection up till end of one

month it was marked as negative for PSI.

\*) For port site incisional hernia, patients were kept under follow up till one year.

**Statistical Analysis:**

Data was entered in MS Excel work sheet and all descriptive data was expressed as mean and standard deviation. For comparison of binominal or discrete variables Chi-square test was used while for continues variables, Student’s t-test (for independent sample) was used. Finally, the calculated value was compared with the tabulated value at particular degree of freedom and finds the level of significance. Probability value („p” value) was calculated with the help of the software, MSEXL sheet, IBM- SPSS 20.0 for Windows, (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) „P” value < 0.05 was considered to be significant.

**III. Result**

**Demographic Parameter**

Table no. 01  
Sex distribution among the patients

Gender	No. of patients	Percentage
Male	126	35%
Female	234	65%

In my study 360 (126 male and 234 female) patients were included; hence, number of male patients were less than female patients.

Graph no. 01

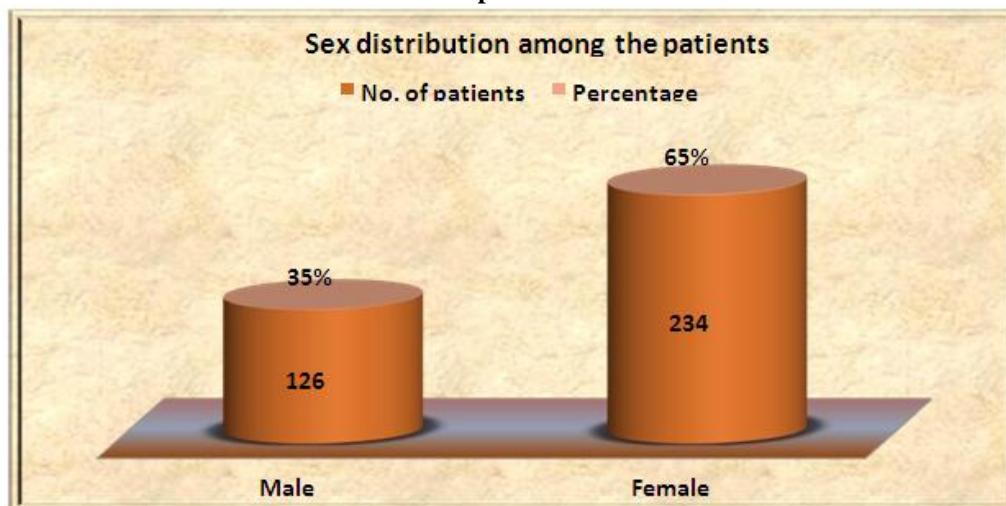


Table no. 02  
Age distribution among the patients

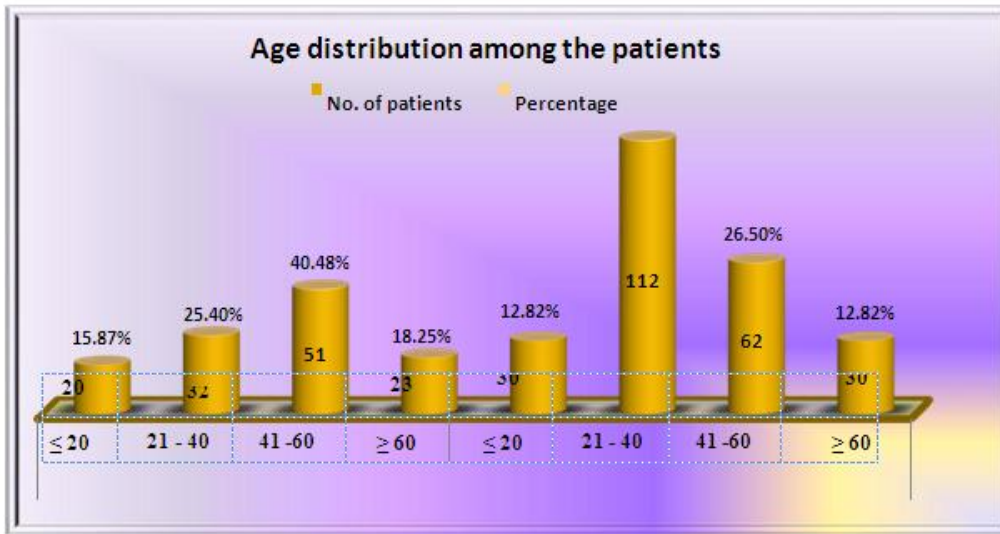
Age ( in year )	Male ( n = 126 )		Female ( n = 234 )	
	No. of patients	Percentage	No. of patients	Percentage
≤ 20	20	15.87%	30	12.82%
21 – 40	32	25.40%	112	47.86%
41 – 60	51	40.48%	62	26.50%
≥ 60	23	18.25%	30	12.82%

Overall Mean ± standard deviation among the patients are ( $\mu \pm \delta$ ) = 40.89 ± 17.

For Test of Significance, Here we use “Test of Significance for Difference of two means” Male: Mean ± Standard of age ( $\mu \pm \sigma$ ) = 43.47 ± 18.38.

Female: Mean ± Standard of age ( $\mu \pm \sigma$ ) = 39.51 ± 16.64.

Graph no. 02



Graph no. 03

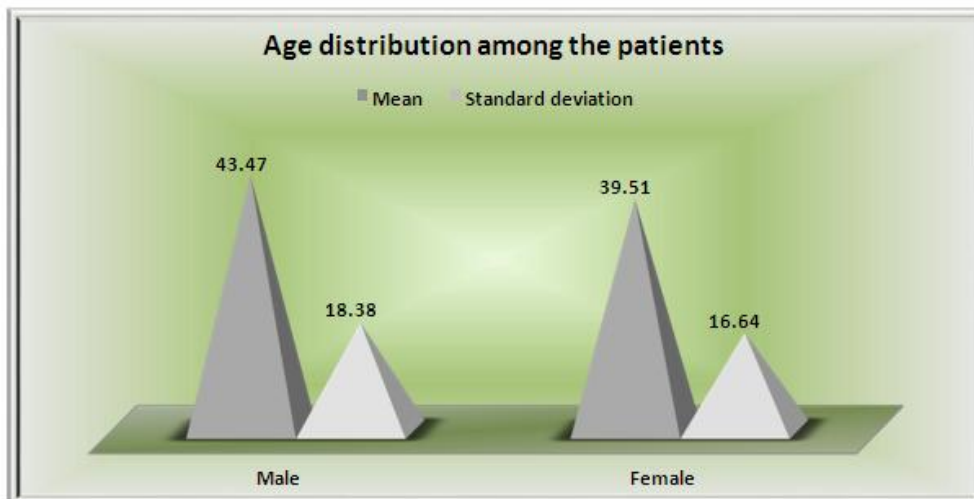


Table no. 03

Weight distribution among the patients

Parameter	No. of patients	Percentage
Under weight (16 – 18.4)	5	1.39%
Normal (18.5 – 24.9)	145	40.28%
Over weight (25 – 29.9)	132	36.67%
Obese (I) (30 – 34.9)	55	15.28%
Obese (II) (35 – 39.9)	13	3.61%
Obese (III) (≥40)	10	2.78%

Most of the patients (40.28%) were come under normal BMI (18.5 – 24.9).

Graph no. 04

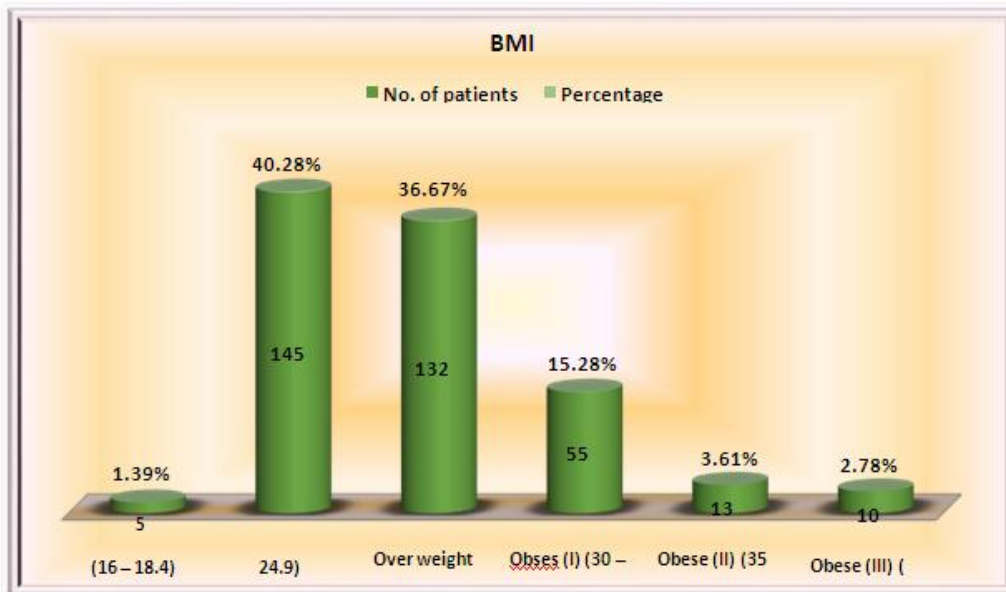


Table no. 04  
Diabetes status among the patients

Diabetes	No. of patients	Percentage
Present	65	18.06%
Absent	295	81.94%

In my study only 65 patients were diabetic and 295 were non diabetic.

Graph no. 05

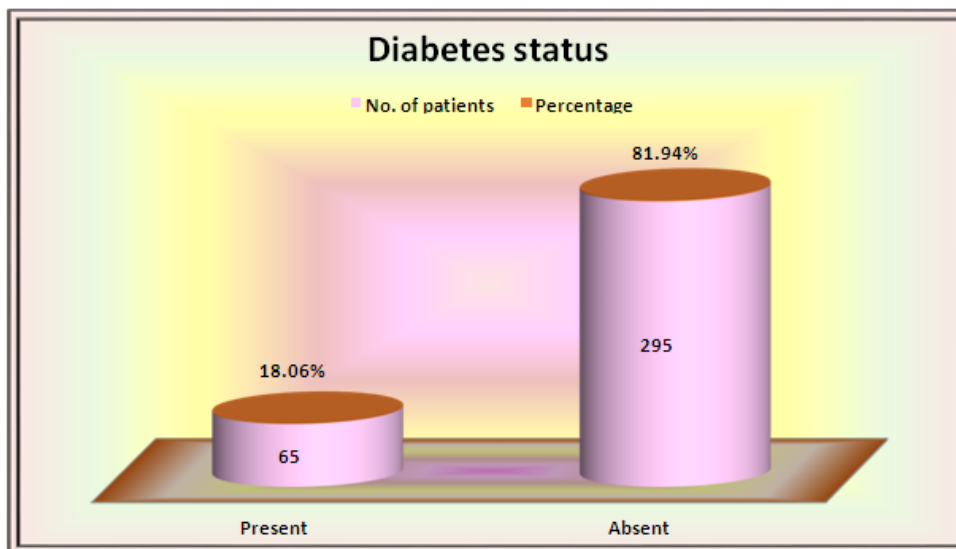
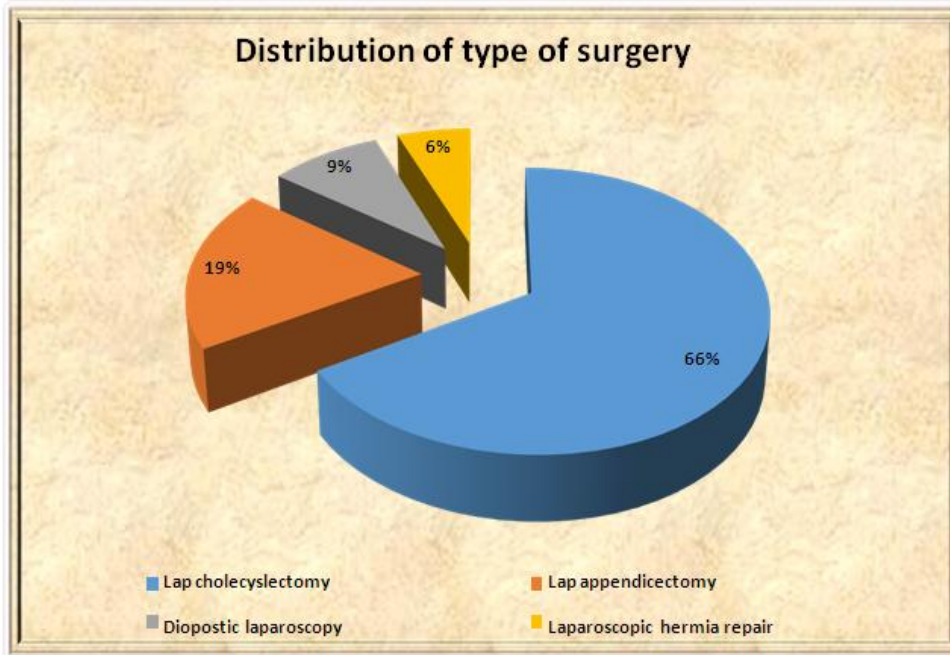


Table no. 05  
Distribution of type of surgery

Type of surgery	No. of patients	Percentage
Lap cholecystectomy	239	66.39%
Lap appendicectomy	68	18.89%
Diagnostic laparoscopy	32	8.89%
Laparoscopic hernia repair	21	5.83%

Laparoscopic cholecystectomy was the most commonly performed procedure (66.39%), followed by Laparoscopic appendicectomy (18.89%), Diagnostic laparoscopy (8.89%), and Laparoscopic hernia repair (5.83%).

**Graph no-6**



**Table no. 06**

**Distribution of number of ports**

Total no. of ports	No. of patients	Percentage
3	121	33.61%
4	219	60.83%
5	20	5.56%

Three ports were used in 121 patients, four ports were used in 219 patients, while five ports were used in 20 patients only.

In Laparoscopic cholecystectomy generally we used four ports, but sometimes we required one extra port. In Laparoscopic appendicectomy, Diagnostic laparoscopy, Laparoscopic hernia repair we used three number of ports.

**Graph no. 07**

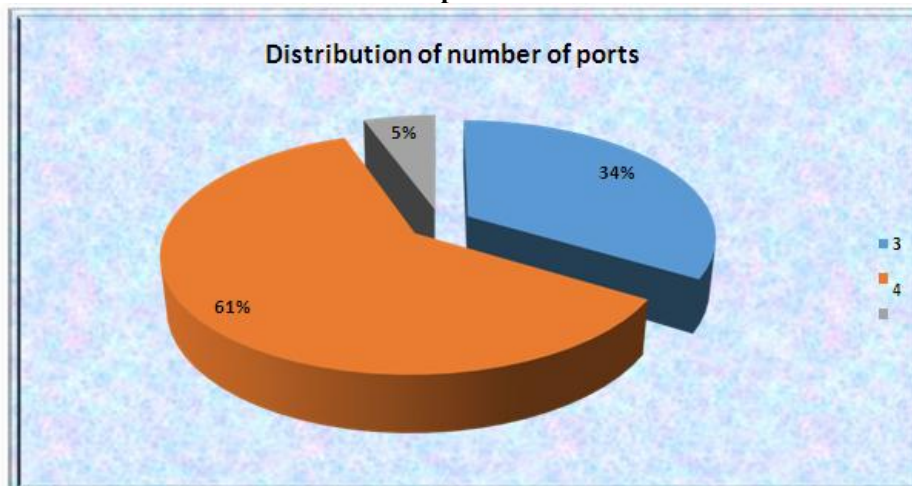


Table no. 07  
Distribution of size of ports

Size of ports		No. of patients	Percentage
10 mm	1	121	33.61%
	2	239	66.39%
5 mm	2	340	94.44%
	3	20	5.56%

In Laparoscopic cholecystectomy we placed two 10mm ports (umbilical and epigastric) and two or three 5mm ports as per requirement, while in other three procedure we placed one 10mm ports (umbilical) and two 5mm ports.

In present study, one 10mm port was used in 121 cases (33.61%), two 10mm ports were used in 239 cases (66.39%). Two 5mm ports were used in 340 cases (94.44%) while three 5mm ports were placed in 20 cases only (5.56%).

Graph no. 08

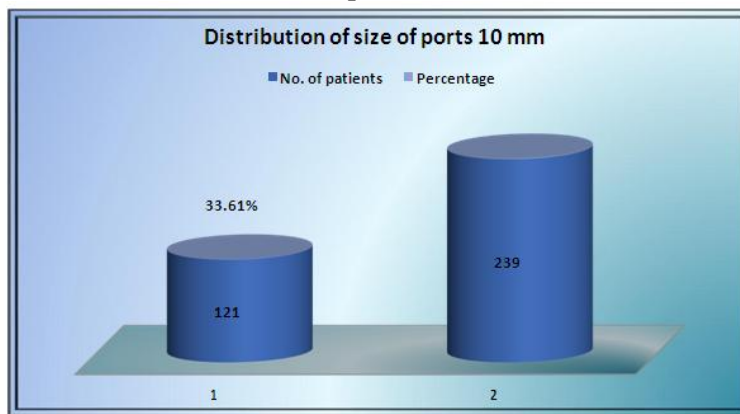


Table no. 08

Incidence of port site infections

No. of patients	No. of PSI's	Percentage
360	10	2.78%

The incidence of port site infections in my study was 2.78%, as 360 patients underwent elective laparoscopic surgery in Department of General surgery at Nalanda Medical College and Hospital . Only 10 patients were developed port site infections.

All PSI's were superficial, involving only the skin and subcutaneous tissue

Graph no. 09

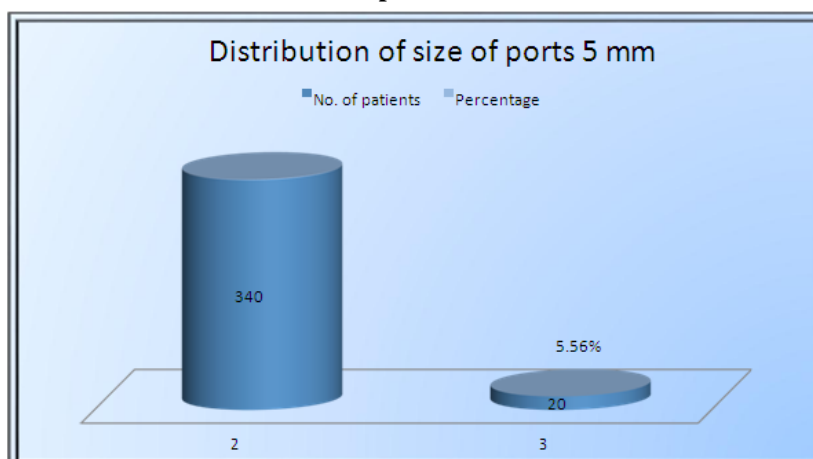




Table no. 09  
Incidence of port site incisional hernia

Total no. of patients	PSIH	Percentage
360	3	0.83%

The incidence of port site incisional hernia in my study was 0.83%, as 360 patients underwent elective laparoscopic surgery in Department of General surgery at Nalanda Medical college and Hospital. Only 03 patients were developed port site incisional hernia.

Graph no. 10

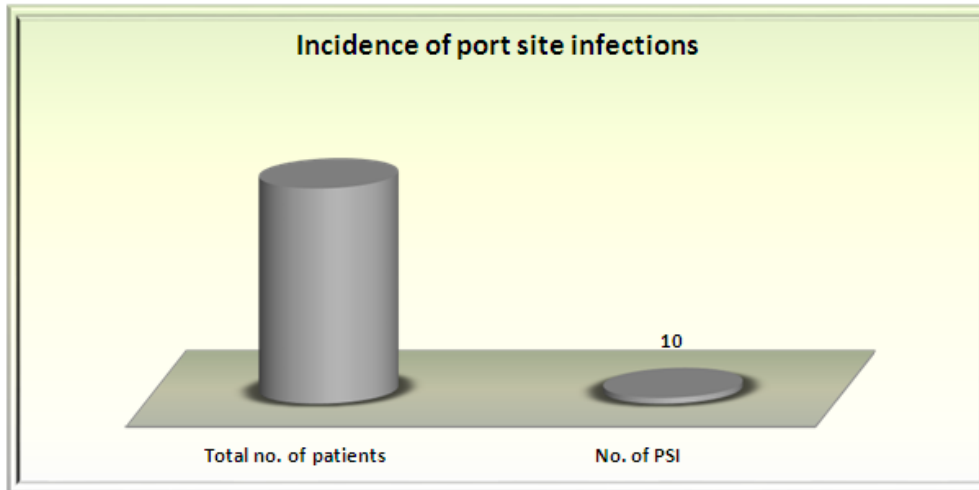


Table no. 10  
Comparison of port site complications with age

Age (in years)	No. of complication ( n = 13 )			
	PSI's(1)		PSIH(2)	
	No. of patients	Percentage	No. of patients	Percentage
≤ 20	1	10%	-	-
21 - 40	3	30%	-	-
41 - 60	4	40%	2	66.67%
≥ 60	2	20%	1	33.33%

There were statistically no significant differences shown among the patients according to their comparison of port site complications with different age groups, with p – value = 0.6295 (p>0.05).

Graph no. 11

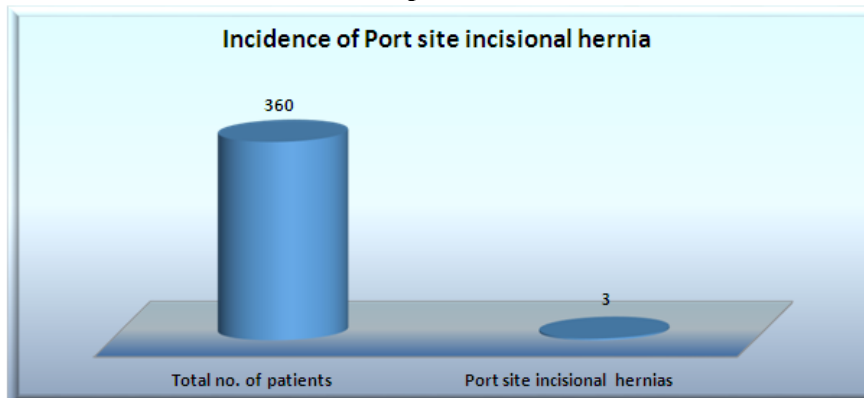


Table no. 11  
Association of port site complications with gender

Gender	No. of complications	Percentage
Male	4	30.77%
Female	9	69.23%

There were statistically significant differences shown among the patients according to their comparison of complications with male and female gender, with p – value = 0.0082 (p<0.05). Majority of port site complications (69.23%) were seen in female patients, while 4 out of 13 complications (30.77%) were observed in male patients

Graph no. 12

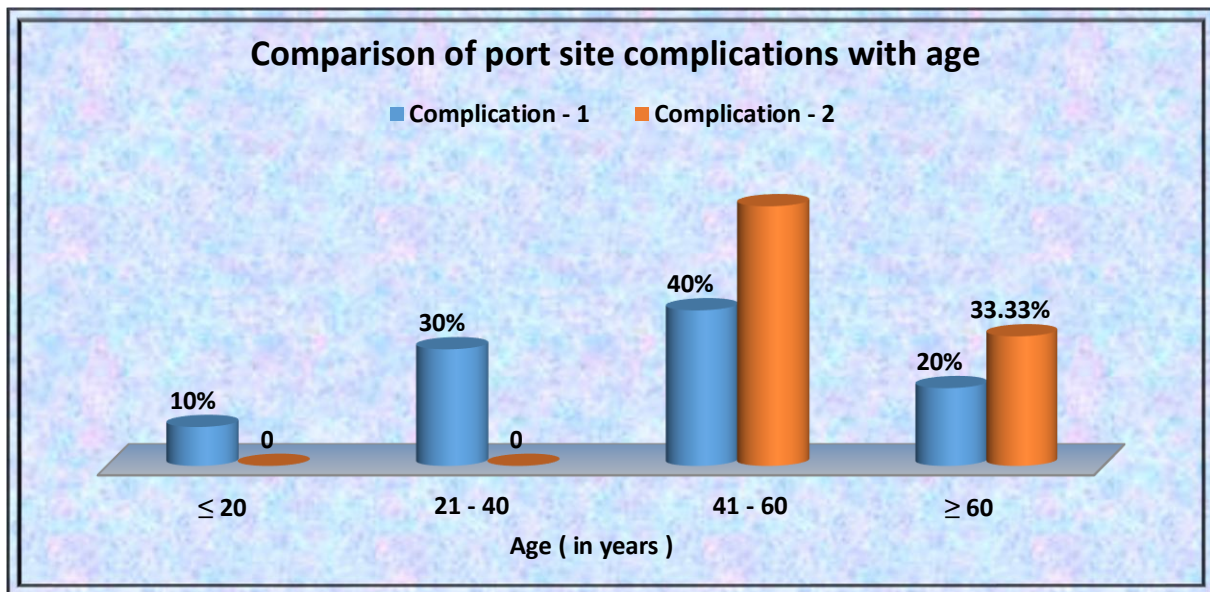


Table no. 12  
Association of port site complications with diabetes status

Diabetics status	No. of complications	Percentage
Diabetic	8	61.54%
Non-Diabetic	5	38.16%

There were statistically significant differences shown among the patients according to their comparison of complications with diabetes status, with p – value = 0.0071 (p<0.05). Majority of port site complications (61.54%) were observed in diabetic patients, whereas five complications (38.16%) were observed in non-diabetic group.

Graph no. 13

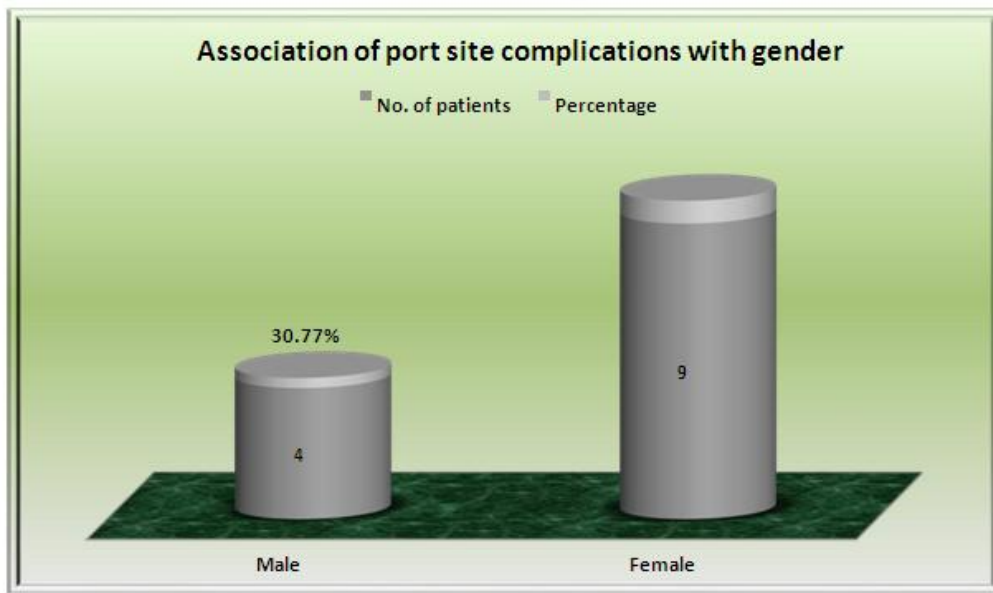


Table no. 13

Association of port site infections with diabetic status

	No. of PSI's	Percentage
Diabetic	7	87.5%
Non Diabetic	3	12.5%

There were statistically significant differences shown among the patients according to their comparison of port site infections with diabetic status with  $p$  – value = 0.0023 ( $p < 0.05$ ). As 87.5% of PSI's were seen in diabetic patients, while 12.5% of PSI's were seen in non-diabetic patients.

Graph no. 14

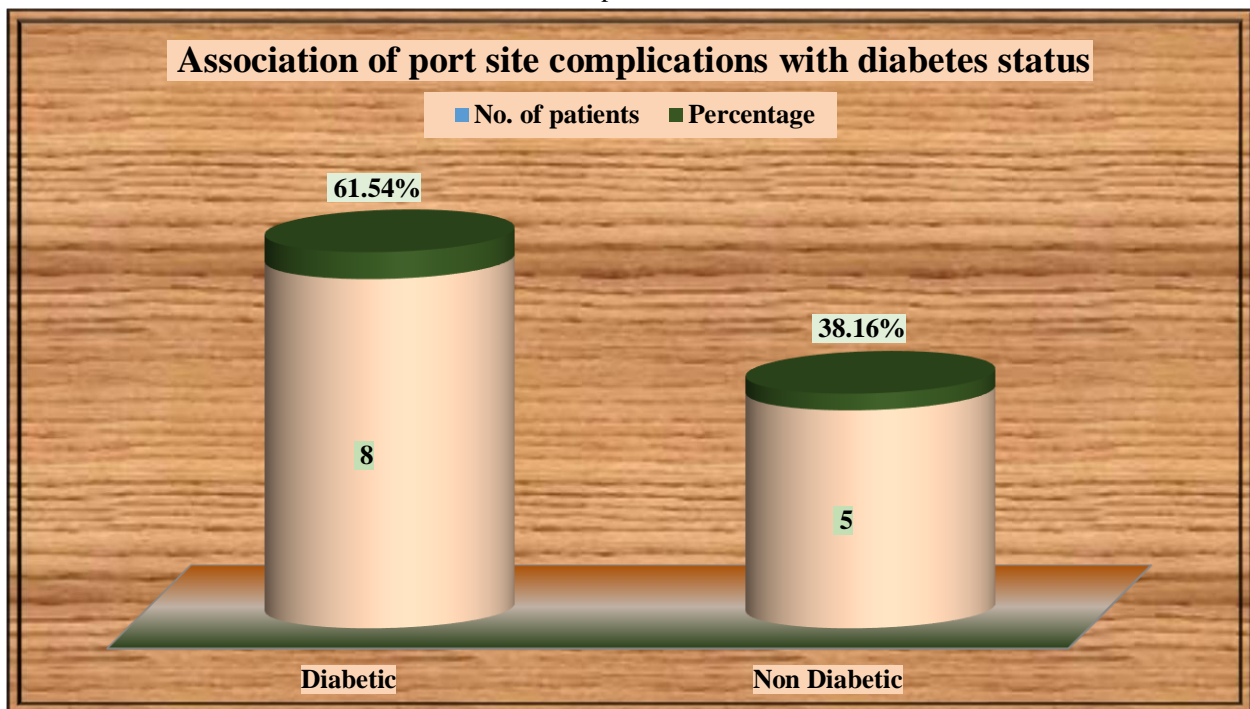
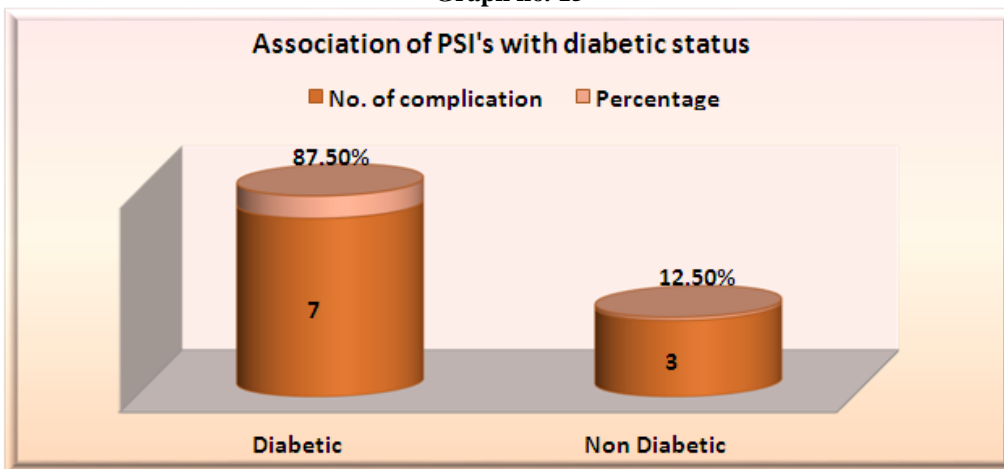


Table no. 14  
Association of port site complications with obesity

Parameter (BMI)	No. of patients	Complications
Under weight (16 – 18.4)	5	-
Normal (18.5 – 24.9)	145	5
Over weight (25 – 29.9)	132	5
Obese (I) (30 – 34.9)	55	1
Obese (II) (35 – 39.9)	13	-
Obese (III) (≥40)	10	2

There were statistically no significant differences shown among the patients according to their comparison of port site complications with obesity, with p – value = 0.1958 (p>0.05)

Graph no. 15



Graph no. 16

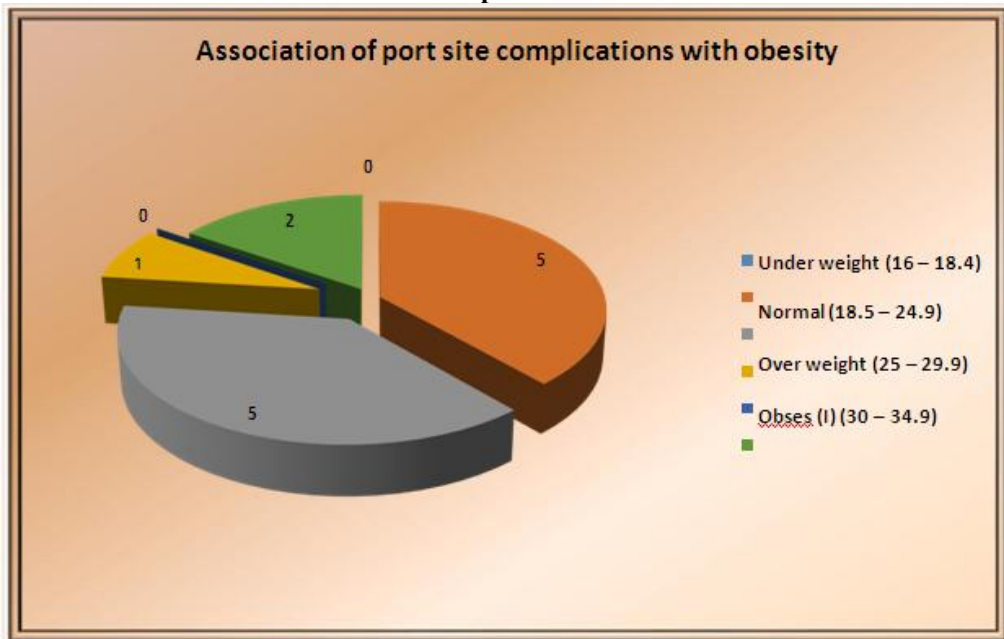


Table no. 15 and 16  
Comparison of port site complications with type of surgery

Type of surgery	No. of complications	Port site complications	
		PSI	PSIH
Lap cholecystectomy	9	6	3
Lap appendicectomy	2	2	-
Diagnostic laparoscopy	1	1	-
Laparoscopic hernia repair	1	1	-

Type of surgery	No. of Surgery		No. of complications		$\chi^2$	DF	p-value
	No. of patients	Percentage	No. of patients	Percentage			
Lap cholecystectomy	239	66.39%	9	69.23%	4.325	1	0.0376
Lap appendicectomy	68	18.89%	2	15.39%	68.424	1	<0.0001
Diagnostic laparoscopy	32	8.89%	1	7.69%	29.243	1	<0.0001
Laparoscopic hernia repair	21	5.83%	1	7.69%	44.229	1	<0.0001

There were statistically significant differences shown among the patients according to their comparison of port site complications with type of surgery, with p – value < 0.05 in all type of laparoscopic surgeries. The present study showed that Laparoscopic cholecystectomy was the commonest procedure performed and more frequently associated with port site complications (69.23%).

Graph no. 17

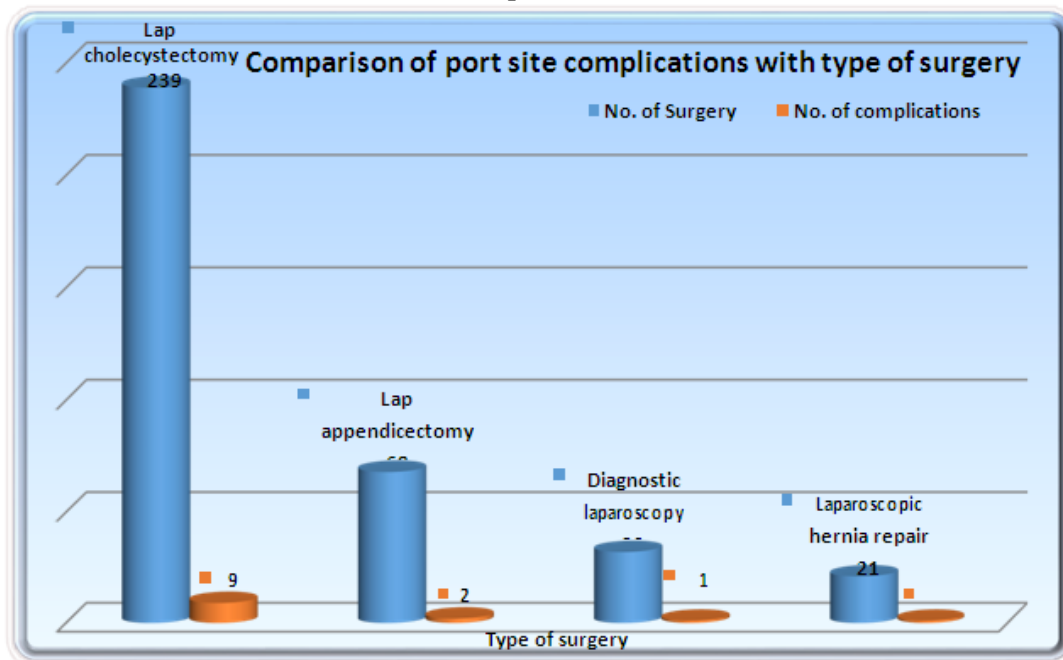


Table no. 17  
Association of port site complications with port site

Site of ports	No. of complications	Percentage (%)	Port site complications	
			PSI	PSIH
Umbilical	11	84.62	8	3
Epigastric	2	15.38	2	-

There were statistically significant differences shown among the patients according to their comparison of port site complications with port site, with p – value = 0.0114 (p<0.05). Majority of the port site complications (84.62%) were seen at umbilical port in respect of epigastric port (15.38%). No complications were seen at other ports in my study.

Graph no. 18

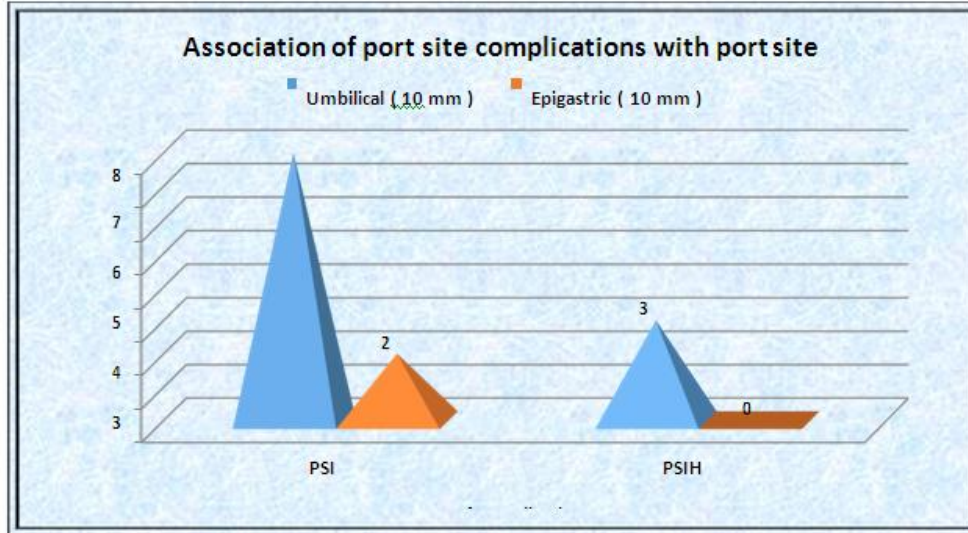


Table no. 18  
Association of port site complications with size of ports

Size of ports	No. of complication	Type of complications	
		PSI	PSIH
10 mm	13	10	3
5 mm	0	-	-

All the port site complications were observed in 10mm port size which include 10 PSI's and 3 PSIH. None of the complication were observed in 5mm port size in our present stud

Graph no. 19

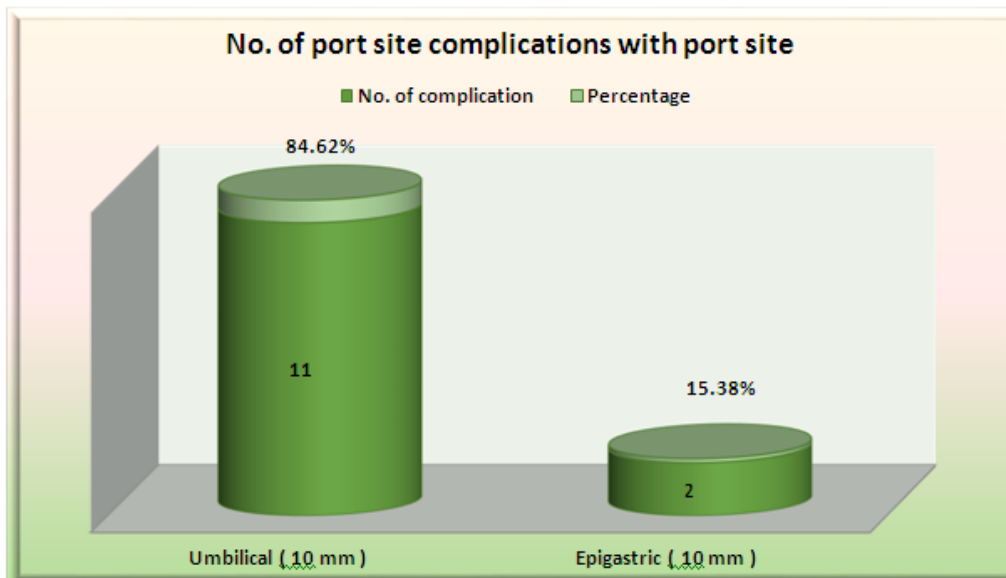
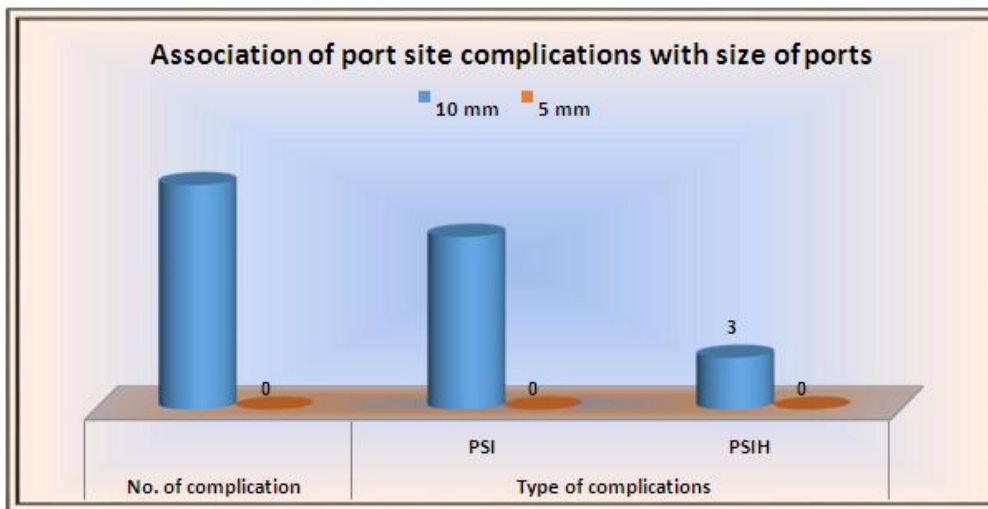


Table no. 19  
Association of port site complications with number of ports

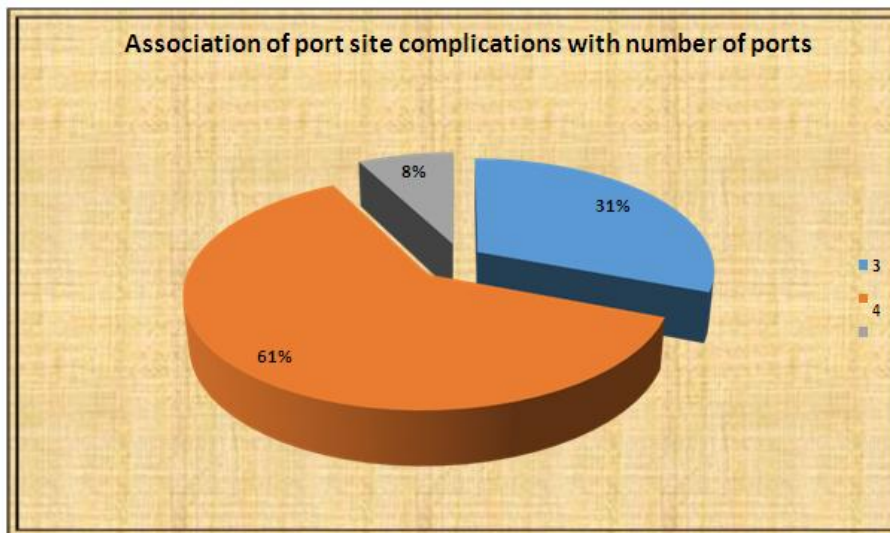
Number of ports	No. of complication	Percentage
3	4	30.77%
4	8	61.54%
5	1	7.69%

There were no statistically significant differences shown among the patients according to their comparison of port site complications with number of ports, with p – value = 0.1281 (p>0.05). As most of the port site complications (61.54%) were seen in laparoscopic surgeries where 4 no. of ports were used. Only one complication (7.69%) was seen where 5 no. of ports were used.

Graph no. 20



Graph no. 21



#### IV. Discussion

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 invasive surgery (MIS) 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 techniques have revolutionized the field of surgery. It has become the gold standard for cholecystectomy and is gaining popularity in other surgeries also. As ports came into vogue with the

introduction of laparoscopic surgery it has brought along with it a new set of complications termed as port site complications.

Port site complications raised new concerns among the patients, requiring greater precautions from surgeons. These became a new source of increase in the morbidity, hospital stay and financial loss to the patient.

There have been several studies conducted to identify the incidence of various port site complications following laparoscopic surgery. However, studies to assess risk factors contributing to these port site complications are less. Most of previous studies were done in tertiary care centres and very limited data is available for secondary care centres, like our hospital. Thus, the need for present study arises.

This study is an attempt to access the incidence of the two common port site complications (PSI's and PSIH) and their associated risk factors in patients undergoing elective laparoscopic surgery in Department of General Surgery at Nalanda Medical college and Hospital, Patna.

A total 360 patients who underwent elective laparoscopic surgery fulfilling the inclusion and exclusion criteria were included in the study.

In a present study, 126 male (35%) and 234 female (65%) patients were operated for different ailments laparoscopically, with 40.48% male patients were in 41–60-year age group and 47.86% female patients in 21–40-year age group. Mean age of the patients was 40.89. Most of the patients (40.28%) were categorized under normal BMI (18.5-24.9). Out of 360 patients, 65 (18.06%) were diabetic.

The laparoscopic procedures include 239 Laparoscopic cholecystectomy (66.39%), 68 Laparoscopic appendectomy (18.89%), 32 Diagnostic laparoscopy (8.89%), and 21 Laparoscopic hernia repair-TAPP/TEP (5.83%). Laparoscopic cholecystectomy was the most commonly performed procedure

### **Incidence of port site infections**

The incidence of port site infections after elective laparoscopic surgery observed in our study was 2.78%. Laurie Barclay<sup>7</sup>, Swarupjit Ghata et al<sup>8</sup>, Somu Karthik et al<sup>9</sup> has also reported an incidence of 2.11%, 3%, and 1.8% respectively. While Adewale O Adisa et al<sup>10</sup>, S. Sujith Kumar et al<sup>11</sup> reported an incidence of 7.6% and 5.7% respectively.

All PSI's were superficial, involving only the skin and subcutaneous tissue. Superficial skin infection is more common and has been reported by other studies also.<sup>9, 10, 11</sup>

### **Incidence of port site incisional hernias**

The incidence of port site incisional hernia after elective laparoscopic surgery observed in our study was 0.83%, which is comparable to other studies like Abdul Zahra Hussain et al<sup>16</sup>(0.14%), Somu Karthik et al<sup>9</sup> (0.35%), and Deepak Sharma et al<sup>12</sup> (0.47%).

### **Comparison of port site complications among different age groups**

In our study there was statistically no significant difference observed with respect to port site complications among the patients of different age groups, with  $p$  – value = 0.6295 ( $p > 0.05$ ). However, most of the complications were seen in the 41–60-year age group.

Somu Karthik et al<sup>9</sup> found that port site complications were common in the 20–40-year age group but there was no statistically significant difference seen.

S. Sujith Kumar et al<sup>11</sup> suggested that PSI's were common in 30–40-year age group, while Swarupjit Ghata et al<sup>8</sup> reported highest number of complications in patients of 60-79 years of age, and suggested that old patients who already had less immunity and who were suffering from other co-morbid conditions were at increased risk of complications from laparoscopic surgeries

### **Comparison of port site complications with respect to gender**

In our present study there was statistically significant difference seen between males and females with respect to port site complications, with  $p$  – value = 0.0082 ( $p < 0.05$ ).

This significant relationship could be due to greater number of female patients (65%) as compared to male patients (35%) in our study. Thus, majority of complications (69.23%) were seen in female patients. However, requires further study.

S. Sujith Kumar et al<sup>11</sup> reported more number of port site complications in female patients, as study included 78 female and 26 male patients only.

### **Association of port site complications with respect to diabetes status**

Our study showed 61.54% port site complications in diabetic patients. Thus, there was statistically significant difference among the patients depending on their diabetic status, with  $p$  – value = 0.0071 ( $p < 0.05$ ).



In our study, there is increase in the frequency of PSI with diabetes. Out of 10 patients who had PSI, 7 were diabetic. The literature shows that there is 2-3-fold increase in risk of developing PSI in patients with diabetes. This may be related to altered cellular immune function. This is supported by Naeem Taj et al<sup>13</sup>, who concluded that diabetic patients were more prone to develop infections postoperatively.

#### **Association of port site complications with obesity**

In our study, there was no increase in the frequency of morbidity related to obesity, with p – value = 0.1958 (p>0.05).

The literature shows that obesity is associated with increased morbidity related to port site due to various factors like the need for longer trocars, thick abdominal wall, need for larger skin incision to expose fascia adequately, and limitation in mobility of the instrument due to increased subcutaneous tissue.

However, further studies are required with larger sample size to confirm my results.

Somu Karthik et al<sup>9</sup> also did not note any significant differences among the patients according to their comparison of port site complications with obesity

#### **Comparison of port site complications with respect to type of surgery**

The present study showed that laparoscopic cholecystectomy was the commonest procedure performed (66.39%) and more frequently associated with port site complications (69.23%) including 6 PSI and 3 PSIH, with p – value = 0.0376 (p<0.05).

Somu Karthik et al<sup>9</sup> also conclude that laparoscopic cholecystectomy was the most commonly performed surgery with highest port site complications (52.9%). This is also comparable to observations made by Fuller et al.<sup>14</sup>

In our study we found 3 PSIH, all were noted in laparoscopic cholecystectomy at umbilical port. One of the predisposing factors could be dilatation of the umbilical port to extract the gall bladder specimen in all cases. This is comparable to results concluded by Deepak Sharma et al<sup>12</sup>.

Our study included 239 cases of laparoscopic cholecystectomy which were associated with 6 instances of PSI. However, though only 68 laparoscopic appendicectomies were performed, they were associated with 2 instances of PSI which was more statistically significant, with p – value <0.0001. One of the reasons behind this might be greater infective pathology, as most of the cases of laparoscopic appendicectomy were acute in nature. This is comparable to observations made by S. Sujith Kumar et al.<sup>11</sup>

Only 1 PSI was noted in Diagnostic laparoscopy and laparoscopic hernia repair each. However, due to the small sample size of these surgeries, no comment can be made on the significance.

#### **Association of port site complications with respect to port site**

In our study majority of the port site complications observed at umbilical port (84.62%) including 8 PSI and 3 PSIH. Thus, there was significant difference with respect to the port site, with p – value = 0.0114 (p<0.05).

Only 15.38% port site complications i.e., 2 PSI were noted at epigastric port. No complications were seen at other port sites in our study.

Somu Karthik et al<sup>9</sup> also suggest that umbilical port was most commonly involved port in port site complications and showed that all PSIH (2/570) were occurred through umbilical port. Adewale O Adisa et al<sup>10</sup> reported 66.7% PSI at umbilical port. Yi F<sup>15</sup> et al concluded same results as all PSIH (2 cases) in his study was associated to umbilical port.

Umbilical port site was the most common site for PSI's followed by epigastric port site. In the literature, there is great emphasis on the increased frequency of umbilical site PSI's and the role of umbilical flora in the development of PSI's. Emphasis is also there on the increased frequency of PSI and the trocar site of extraction. All gall bladder specimens in cholecystectomy were removed through the umbilical port.

Umbilicus is the weakest point of anterior abdominal wall and in laparoscopic cholecystectomy, the gall bladder is retrieved after spreading the umbilical port. This could be one of the predisposing factor for developing PSIH through umbilical

#### **Association of port site complications with size of ports**

In Laparoscopic cholecystectomy we placed two 10mm ports (umbilical and epigastric) and two or three 5mm ports as per requirement, while in other three procedure we placed one 10mm ports (umbilical) and two 5mm ports.

In our present study, all the port site complications were noted in 10mm size port which includes 10PSI's and 3 PSIH. No complication was seen in 5mm size port.

Somu Karthik et al<sup>9</sup>, S. Sujith Kumar et al<sup>11</sup>, Swarupjit Ghata et al<sup>8</sup> also found same results and concluded that most of the port site complications were associated with 10mm size ports.

### **Association of port site complications with number of ports**

In Laparoscopic cholecystectomy generally we used four ports, but sometimes we required one extra port. In Laparoscopic appendectomy, Diagnostic laparoscopy, Laparoscopic hernia repair we used three number of ports. Thus, three ports were used in 121 patients, four ports were used in 219 patients, while five ports were used in 20 patients only.

Thus, in our study we did not note any significant differences among the patients according to their comparison of port site complications with number of ports, with  $p$  – value = 0.1281 ( $p > 0.05$ ).

Somu Karthik et al<sup>9</sup> supported our results and noted insignificant relation of port site complications with increased number of ports, with  $p$  – value = 0.23.

### **Limitations:**

- \*) Larger sample size of obese patients is required to study the impact of obesity on port site complications
- \*) A longer follow-up period of 3 years is better to assess the total incidence of PSIH.

### **V. Conclusion**

- 1) Laparoscopic surgeries are associated with minimal port site complications. The incidence of port site infections and port site incisional hernias after elective laparoscopic surgery observed in our study were 2.78% and 0.83% respectively. These incidences were comparable with statistics worldwide.
- 2) There is no statistically significant difference in respect to port site complications among the patients of different age groups. However, most of the complications were seen in the 41–60-year age group.
- 3) Majority of complications were seen in female patients and this was statistically significant. This could be due to greater number of female patients as compared to male patients in our study. However, it requires further study to rule out other causes.
- 4) Diabetic patients were more prone to develop port site infections postoperatively, and this was statistically significant. The literature also shows that there is 2-3-fold increase in risk of developing PSI in patients with diabetes.
- 5) There is no significant increase in port site complications associated with obesity. However, a study focusing specifically on obese patients with a larger sample size is required to confirm the results.
- 6) Laparoscopic cholecystectomy is the most common procedure performed and significantly associated with highest number of port site complications i.e., 6 PSI and all 3 PSIH.
- 7) There is strong and significant correlation between laparoscopic appendectomy and port site infections. This might be due to potentially contaminated field, as most of the cases of laparoscopic appendectomy were acute in nature.
- 8) Umbilical port site is the most common site for PSI's followed by epigastric port site.
- 9) Umbilical port site is also the most common site for PSIH. Umbilicus is the weakest point of anterior abdominal wall, and in laparoscopic cholecystectomy, the gall bladder is retrieved after widening the umbilical port. This could be the major reason behind it.
- 10) All port site complications were noted in 10mm size port.
- 11) There is no significant relation seen between the port site complications and number of sports.

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Sumit Kumar, et. al. “To study the incidence of port site complications and their associated risk factors in patients undergoing elective laparoscopic surgery.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(07), 2021, pp. 36-54.