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Incidence of Trocar Site Hernia in Fascial Closure of the Port site Versus Skin Closure Only

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Abstract: Background: Laparoscopy is widely practiced and offers realistic benefits over conventional surgery. Spreading of laparoscopic surgeries has increased the occurrence of trocar site hernias (TSHs). The obliquity of laparoscopic port make direct visualization of rectus fascia is difficult. The study is to show wither if there's a benefit from closure of the rectus fascia at the port site or not. **Objective:** To evaluate the outcomes and complications in laparoscopic surgeries without fascial sheath closure of the port site **(Group A)**. We compared the result with another group in which fascial closure of the port site was done by a standard method **(Group B). Patients and Methods:** All of patients were subjected to full history taking, careful physical examination. The patients were diagnosed and prepared for surgery under the supervision of general surgery department. **Results:** One case of TSH occurred in group A and no cases in group B with statistical insignificant differences between two groups (p=0.827). Also, there is statistical insignificant correlation between type of surgery and TSH (p=0.326). **Conclusion:** As per our study insignificant difference was found between the 2 groups as per the incidence of TSHs. So, the choice of port closure after laparoscopy will depend on the individual patient characteristics (such as body habitus, number and size of ports), the surgeon's preference, and available resources. we should ensure the proper closure of port sites. Otherwise, the morbidity associated with a PSH will negate the expected benefits of the intended minimally invasive surgery. Our data suggest that patients undergoing their first laparoscopic surgery may not need fascia closure.

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1. Introduction

Trocar site hernias (TSHs) are rare complications that occur in approximately 1% of all laparoscopic surgeries. With the use of bladeless, blunt-tipped entry trocars, some surgeons have argued that all port sites do not require fascial closure. Several cases of PSHs, however, have been reported recently with the use of bladeless trocars. The development of non-bladed obturators with integrated stability sleeves allows for creation of a muscle-splitting dilated laparoscopic port site with minimal abdominal wall defects after removal of trocar sleeves [(1)].

It is recommended in literature that preventive measures should be taken to prevent TSHs after laparoscopic surgery [(2)]. Trocar site hernia (TSH) is defined as an incisional hernia which occurs after minimally invasive surgery on the trocar incision site [(3)].

Treatment of this complications is done by suture or mesh repair. But the best treatment remains is prevention. This prevention requires Knowledge of the risk factors of this condition. Large port sites and increasing number of ports needed for more complex surgeries increase the incidence of PSHs. PSHs tend to develop more frequently at umbilical and midline port sites due to the lack of rectus muscle coverage, weakness of linea alba and the thinness of umbilical skin. Port closure is important after laparoscopic surgeries to prevent trocar site hernias. Complications related to port sites are most commonly reported to be incisional hernias. Many techniques and devices have been introduced into practice to minimize the risk of port site complications, which occur in 1-6% of cases [(4)].

The PSH depends on the trocar diameter, the trocar design, pre-existing fascial defects, and the direction of the port insertion. The risk of PSH is greater in obese and bariatric patients because of the larger pre-peritoneal space and elevated intra-abdominal pressure and some authors advise closure of holes > 5 mm at the fascial level. The various methods for port closure after laparoscopic surgery are: 1) standard closure (via skin wound); 2) laparoscopic direct visualization fascial closure methods; 3) using a spring-loaded needle or suture passer needle; and 4) angiocatheter technique [(5,6,7)].

Aim of the Work

The aim of this study is to evaluate the outcomes and complications in laparoscopic surgeries without fascial sheath closure of the port site **(Group A)**. We compared the result with another group in which fascial closure of the port site was done by a standard method **(Group B).**

2. Patients and Methods

Subjects:

This was a randomized controlled clinical trial which include 30 patients who underwent different laparoscopic procedures in Department of Surgery, Ain Shams University Hospital and Nasr City Police Hospital from the December 2018 to June 2019. Subjects were selected by convenience sample method and divided into 2 groups: Group A which included 15 patients underwent skin only closure of the port site and Group B also included 15 patients underwent fascial closure of the port site. Patients were selected with the following criteria:

Inclusion criteria

Age range >12 years old. Both sex. Patients who had any laparoscopic surgeries (Cholecystectomy, appendectomy, gynaecological surgery, bariatric surgeries). Patients who had gastric sleeve with cholecystectomy.

Exclusion Criteria:

Patients with pre-existing hernias. Patients with major systemic illness (liver cell failure, renal cell failure, musculoskeletal diseases). Patients with past history of midline incision for exploration. Patients with recurrent incisional hernia, on steroids, and those unfit for laparoscopic surgery. Patients undergoing laparoscopic surgeries which then converted into open surgery.

Methods:

Preoperative preparations:

Preoperative assessments were done and the patients will be well prepared. Full Labs: (Complete blood count - liver and kidney functions – Bleeding profile-Random blood sugar- Viral markers). Pelvi-abdominal ultrasound was done. Chest X-ray.ECG.

Operative procedures:

A less than 1 cm infraumblical or supraumbilical skin incision was given according to surgery and laparoscopic access to the peritoneum is done through Veress needle technique. Veress needle: Modern needles are 12 to 15 cm long, with an external diameter of 2 mm. The outer cannula consists of a beveled needle point for cutting through tissues of the abdominal wall. A spring-loaded, inner stylet was positioned within the outer cannula. This inner stylet had a dull tip to protect any viscera from injury by the sharp, outer cannula. Direct pressure on the tip—as when penetrating through tissue—pushed the dull stylet into the shaft of the outer cannula. When the tip of the needle enters a space such as the peritoneal cavity, the dull, inner stylet springs forward. Carbon dioxide was then passed through the Veress needle to inflate the space, creating a pneumoperitoneum. Blunt trocar (BT) (non-sharped trocar) was used to enter the abdomen for camera port. Other three ports were made of (5 or 10 or 12 or 15 mm).

In group A, fascia was not closed and only skin was closed. In group B, fascial sheath was closed with absorbable vicryl 1-0 and skin was closed. In both the groups, we did not use any other instrument to open the sheath (e.g. artery forcep to separate the fat or sheath); without any handling to the sheath fibers, abdomen was entered. If shallow wound & thin subcutaneous layer we did direct suturing of the sheath using Vicryl 0 If thick Subcutaneous layer closure of the sheath was done through fascial closure needle using Vicryl 0.

Figure (1): Blunt trocar (BT) was used to enter the abdomen after creation of the pneumoperitoneum.

Post-operative assessment:

All patients were followed up from 3-6 weeks for any major complications in both the groups like infection or hernia formation. Clinical examination was done regularly. Follow-up for the complications as (hernia, infection and hematoma) was done.

Ethical Considerations:

Written informed consent was taken from the patients according to ethical committee consideration after detailed explanation of the procedure to the patients. All patients signed a consent reviewing the tests, medications and procedures including all complications and test results.

Statistical Analysis

Data were collected and analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. Data was presented and suitable analysis was done according to the type of data obtained for each parameter. The following tests were used:

Descriptive statistics:

Mean, Standard deviation (± SD) and range for parametric numerical data, while Median and Interquartile range (IQR) for non-parametric numerical data. Frequency and percentage of non-numerical data.

Analytical statistics:

Student T Test was used to assess the statistical significance of the difference between two study group means. Mann Whitney Test (U test) was used to assess the statistical significance of the difference of a non-parametric variable between two study groups. Chi-Square test was used to examine the relationship between two qualitative variables. Fisher's exact test was used to examine the relationship between two qualitative variables when the expected count is less than 5 in more than 20% of cells. Correlation analysis (using Pearson as parametric and spearman rank as non-parametric) to assess the strength of association between two quantitative variables. The correlation coefficient denoted symbolically "r" defines the strength (magnitude) and direction (positive or negative) of the linear relationship between two variables. r= 0-0.19 is regarded as very weak correlation. r=0.2-0.39 as weak correlation. r=0.40-0.59 as moderate correlation. r=0.6-0.79 as strong correlation. r= 0.8-1 as very strong correlation.

3. Results

Regarding the characteristics of the included groups, the mean age of group A is higher than group B with statistical insignificant difference (p=0.406). Females are predominant in both groups than males with insignificant difference (p=0.724). The BMI of group A is higher than group B with statistical insignificant difference (p=0.406). Characteristics differences between two groups show no statistical significance which indicate good matching.

Table (1): Characteristics for both groups.

		Group A N = 15	**Group B** N = 15	**Test value**	***P*-Value**
		Mean ± SD N (%)	Mean ± SD N (%)		
Age		36.27± 6.33	34.47± 5.30	0.844	0.406[1]
Sex	Male	4 (26.7%)	4 (26.7%)	1.00	0.659[2]
	Female	11 (73.3%)	11 (73.3%)		
BMI		31.73± 2.12	30.87± 1.96	1.63	0.256[1]

1. Student t-test; 2. Fisher exact test *statistically significant at $p< 0.05$.

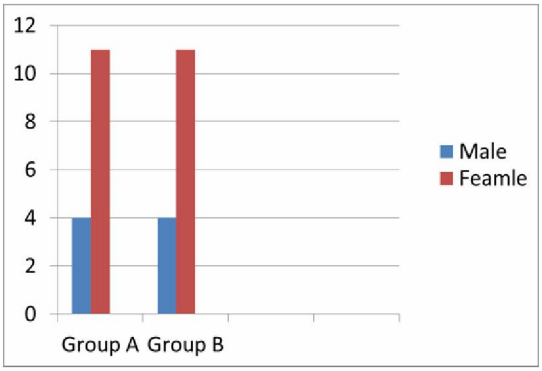

Figure (2): Sex distribution in both groups.

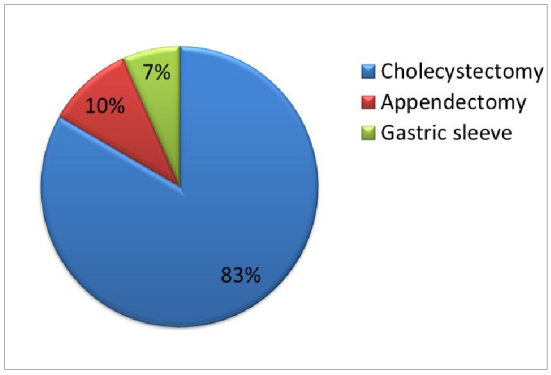

Figure (3): Surgical operations in the studied population.

Table (2): Surgical operations in both groups.

Operation	**Group A** N = 15	**Group B** N = 15	**Test value**	***P*-Value**
	N (%)	N (%)		
Cholecystectomy	12(79.9%)	13(86.6%)	0.879	0.657[1]
Appendectomy	2 (13.4%)	1 (6.7%)	0.879	0.657[2]
Gastric sleeve	1 (6.7%)	1 (6.7%)	1.00	1.00[2]

1. Chi square test; 2. Fisher exact test *statistically significant at p< 0.05.

In the table (3), the cholecystectomy is higher in group B, appendectomy is higher in group A and both groups have same percentage of gastric with statistical insignificant differences between two groups (p>0.05).

In the table (4), One case of TSH occurred in group A and no cases in group B with statistical insignificant differences between two groups (p=0.827). One case of post-operative infection occurred in group B and no cases in group A with statistical insignificant differences between two groups (p=0.827). Also, no post-operative hematoma occurred in both groups.

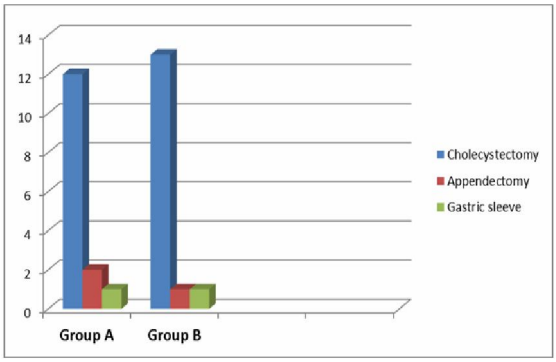

Figure (4): Distribution of Surgical operations in both groups.

Table (3): Complications in both groups.

	Group A N = 15	**Group B** N = 15	**Test value**	***P*-Value**
	N (%)	N (%)		
Trocar Site Hernia (TSH)	1 (6.7%)	0(0%)	0.879	0.827[1]
Trocar Site Infection	0 (0%)	1 (6.7%)	0.879	0.827[1]
Trocar Site Hematoma	0 (0%)	0(0%)	0.00	1.00[1]

1. Fisher exact test *statistically significant at p< 0.05.

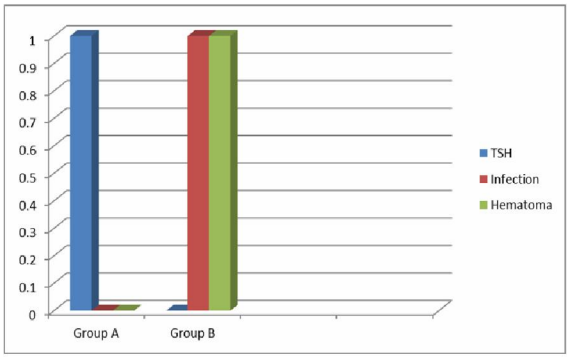

Figure (5): Distribution of complications in both groups.

In the table (4), there is statistical insignificant correlation between type of surgery and TSH (p=0.326).

Table (4): Correlation between type of surgery and complications.

	Type of surgery	
	r	*P*-value
Trocar Site Hernia (TSH)	0.186	0.326

1. Spearman rank correlation test *statistically significant at p< 0.05.

4. Discussion

Laparoscopic surgery has existed since the development of diagnostic laparoscopy in the 1960s. The pioneers of laparoscopic surgery **Semm K** and **Muehe E** changed it from a diagnostic to a surgical procedure at the beginning of the 1980s, and it has since become a frequently applied technique for a wide field of indications [(8)]. The procedure has become the gold standard for many organ systems [(9)]. But the incorporation of laparoscopy in routine surgical practice has resulted in some specific complications, including incisional hernia at trocar sites [(10)].

Port site hernias (PSHs) are rare complications that occur in approximately 1% of all laparoscopic surgeries[(11)]. but there are many techniques and devices have been introduced into practice to reduce this risk [(4)]. There is a contradictory evidence which mainly based on retrospective studies if fascial closure will reduce the incidence of PSH after laparoscopic surgeries. Also, the short and poor-defined follow up is another factor that hinders taking a proper decision.

The study of TSH is difficult for several reasons. First, the low incidence of this condition means that any approach requires a large study sample. This is not possible without a multicenter study, which introduces bias such as the use of different trocar models, suture materials, and the involvement of a larger number of surgeons. Further, most TSH are

small, have little aesthetic impact, and are not always symptomatic; therefore, we suspect that diagnosis depends on a meticulous interview and examination by the surgeon [12].

PSH is commonly seen (96%) in trocar sites of a minimum of 10 mm, located often in the umbilicus region (82%) [13]. The excitement to develop new techniques, to improve cosmesis and hasten recovery, has given rise to the natural orifice transluminal endoscopic surgery (NOTES), and more recently to single incision laparoscopic surgery (SILS). Furthermore, a single incision may decrease postoperative hernia rate [14]. It is seen that port site incisional hernia commonly occurred due to diameter of the cannula. In SILS technique, the fascial defect is larger than that in conventional laparoscopy and, in addition, multiple defects are converted to a single larger fascial defect, which increases PSH. Although it is unclear whether this technical maneuver translates into actual PSH, there are several reports in the literature that suggest that prolonged manipulation coupled with reinsertion of the port may be associated with an enhanced risk of PSH[15].

As regard demographic data, both groups were similar in terms of age, sex, BMI, and type of procedure. Our data shows insignificant difference between the two groups in terms of TSH formation. These results show that fascial closure does not change in the incidence of TSH formation. Our study results are consistent with several studies. Singal and his colleagues, in a prospective randomized clinical trial, reported that there were no significant differences between the two groups in terms of PSH formation, bleeding and infection in non-obese cases. Apart from minor complaints, not much difference was observed immediately in terms of complications like PSH, bleeding, and visceral injury in these two groups. There was infection seen only in two cases in group B that was insignificant. As per the Fischer's exact test, the value came as 1.00 and P value was non-significant (> 0.5) [11].

Also, **Lago and his colleagues**, in a randomized prospective clinical trial, did not find any significant differences between the groups regarding TSH formation (P=0.17) and did not found any significant correlation between trocar size (11 and 12 mm) or trocar sites or location with TSH formation [12]. Five TSH cases were diagnosed—four (5%) in group A and one (1.2%) in group B (P=.176). They found 10 wound infections, 7 (8.75%) in group A and 3 (3.65%) in group B (P=.154).

In another study comparing conventional cutting trocars with radially expanding (blunt) trocars, **Bhoyrul** and his colleagues in a multicenter, prospective, randomized clinical trial, if there were fascial defect 10 mm or larger the defects were closed. they reported that there was no significant difference between each group after a follow up period of 6 to 18 months [16].

However, in a published systematic review conducted by **Helgstrand and his colleagues** found inconsistent result**,** they found that the incidence of TSH after suturing the fascia (regardless of the suture material) may be 0.6% (42 of 8,719), compared to 1.5% (53 of 3,585) when not suturing the fascia[16,17]. Slow absorbable sutures were used to close the trocar site in three studies, with an incidence of TSH of up to 2.2% [5,18]. When using fast absorbable sutures, the TSH incidence was up to 2.8%[19, 20]. No study directly compared slow absorbable and non-absorbable with fast absorbable sutures to reduce the incidence of TSH. While regarding the trocar size, only five cases of 129 (4%) TSH were from 5 mm trocars, whereas 118 (96%) originated from 10–12 mm trocars.

As per our study insignificant difference was found between the 2 groups as per the incidence of TSHs.

So, the choice of port closure after laparoscopy will depend on the individual patient characteristics (such as body habitus, number and size of ports), the surgeon's preference, and available resources. This choice should be individualized. For example, all ports > 10 mm may be closed. Some 5-mm ports should be closed when the peritoneal and/or fascial defect has enlarged significantly. Enlarging the incision to allow proper closure should take precedence over obtaining a good cosmetic result. Port closure should include fascia and peritoneum and it is advised to check the abdominal side of each wound during fascial closure via the laparoscope [21,22].

In conclusion, we should ensure the proper closure of port sites. Otherwise, the morbidity associated with a PSH will negate the expected benefits of the intended minimally invasive surgery. Our data suggest that patients undergoing their first laparoscopic surgery may not need fascia closure.

We recommend larger studies with longer follow up period to be more certain of our results.

Conclusion

As per our study insignificant difference was found between the 2 groups as per the incidence of TSHs. So, the choice of port closure after laparoscopy will depend on the individual patient characteristics (such as body habitus, number and size of ports), the surgeon's preference, and available resources. we should ensure the proper closure of port sites. Otherwise, the morbidity associated with a PSH will negate the expected benefits of the intended minimally invasive surgery. Our data suggest that

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