



## **Open VS Closed Techniques for Laparoscopic Abdominal Surgeries**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors OUH and HR conceived the idea, designed the project, and did bench work. They also supervised the whole project. Authors AA and MAA wrote the manuscript and authors SKS and OUH done the statistics, author SA and FZK helped in sampling, reviewing and extraction of whole data and bench work. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** Laparoscopic surgery or "minimally invasive" surgery is a type of specialist surgery. The most crucial, demanding, and risky part of the laparoscopy is the creation of pneumoperitoneum. The two most prevalent methods for creating a pneumoperitoneum are the closed and open approaches. Despite the fact that there is no universal consensus on the best approach to gain access to the peritoneal cavity in order to create a pneumoperitoneum. The aim of present study was to compare the operative time and post-operative outcome associated with closed technique and open classic technique.

**Methods:** This randomized controlled trial was carried out by recruiting patients presented in surgery department of Ziauddin Hospital North campus. The samples were divided into two equal groups A and B. Group A was operated for Laparoscopic abdominal surgery by open technique

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while group B operated through closed technique. Effectiveness of procedures was measured by number of complications occurred during and after surgery. Chi-square test and independent T-test were applied for association. P-value of < 0.05 was considered as significant.

**Results:** Mean age was found to be 45.5±16 years and mean weight was 68±10.5 kilograms. Mean time of operations was 84.5±18.5 minutes. 60 (69.8%) of patients included underwent the laparoscopic cholecystectomy while 15 (17.4%) patients had laparoscopic appendectomy. 13/86: 15.1% of patients had the minor complication including 12/43: 27.9% in group B and 1/43: 2.3% in group A. The comparative analysis between the two groups in terms of effectiveness of either method compared by means of development of the complications was found to be highly significant with p value 0.002.

**Conclusion:** The open approach to laparoscopic entrance has been linked to fewer surgical problems than the closed approach.

*Keywords: Open techniques; closed technique; laparoscopic; hasson technique; palmer's point technique.*

## 1. INTRODUCTION

Laparoscopic surgery, sometimes known as "minimally invasive" surgery, is a type of specialist surgery. This method was historically widely used in gynecologic and gallbladder surgeries [1]. Over the last ten years, this method has been used in colon surgery. In traditional "open" surgery, the surgeon enters the belly with a single incision. Laparoscopic surgery was a watershed moment in surgery, ushering in a shift from open abdominal surgery to the minimally invasive surgical revolution [2]. A "port" is a term used to describe each incision. A trocar, a tubular tool, is placed into each port. During the procedure, specialized equipment and a laparoscope (a special camera) are passed through the trocars [3]. The method is named after the laparoscope, a small piece of equipment with a tiny video camera and light on the end. For a range of normal and complex surgical procedures, such as cholecystectomy, appendectomy, splenectomy, adrenalectomy, and other procedures, laparoscopy is now the most common and recommended method [4]. The most crucial, demanding, and risky part of the laparoscopy is the creation of pneumoperitoneum followed by the introduction of the first trocar [5]. Over the years, many laparoscopic entry procedures have been documented. Finding a safe entry technique is a key priority, not only for the safety of the patients, but also because the rate is on the rise. The two most prevalent methods for creating a pneumoperitoneum are the closed (Palmer's point) and open (Classic/Hasson) approaches [6]. Despite the fact that there is no universal consensus on the best approach to gain access to the peritoneal cavity in order to create a pneumoperitoneum [7]. Palmer's point is a safe

access port, but because of its physically higher location, it is rarely used during the later stages of surgery [8]. The open technique's concept is to make a small incision, incise the layers of the abdominal wall, cut the peritoneum, and enter the abdomen [9]. In patients with a past history of abdominal surgeries, obesity, patients with intra-abdominal adhesions, and cases where other entry procedures have failed, open laparoscopic entry is favored, very thin patients with little gap between the abdominal wall and the spine have all benefited from this procedure [10]. The open entrance approach virtually eliminates vascular damage, while anecdotal incidences of aortic laceration have been observed. Gas embolism, preperitoneal insufflation, and maybe visceral and major vascular damage are also the potential advantages [11]. Therefore the objective of current study was to compare the operative time and post-operative outcome associated with classic closed technique and open classic technique (Hasson technique).

## 2. MATERIALS AND METHODS

This randomized controlled trial was carried out at the Ziauddin Hospital, North campus, Department of surgery. Consenting patients (both genders) aged 18 to 70 years, scheduled to undergo elective laparoscopic therapeutic and diagnostic procedures at the study setting shall be included in the study. Following satisfactory anesthesia, all consecutive patients presenting to the study setting and meeting the eligibility criteria were randomly assigned to one of the two groups (A and B) using computer generated simple randomized numbers and operated on using one of the two entry techniques (closed or Open - Hasson). The operating time was started when the surgery began and counted until the

final wound was closed. To reduce bias, the surgeries were conducted by a single operating surgeon. Depending on the form and severity of the injuries, the complications were categorized into major and minor categories after a comprehensive examination of the abdominal cavity. Major complications includes bowel or bladder perforation, failure of pneumoperitoneum, injury to omentum and bowel serosa, bleeding/hemorrhage, injury to mesenteric vasculature while the minor complications included were emphysema, minor hematoma, bruising of abdominal area. Any complication that arise are observed and recorded by the lead investigator and handled by a senior surgeon (with 3 years of post-fellowship experience) in accordance with the institution's standards. The lead investigator monitored the patients for up to two weeks to see if there were any delayed unfavorable events. Chi-square test and independent T-test were applied for association. P-value of < 0.05 was considered as significant.

### 3. RESULTS

To produce the pneumoperitoneum, all 126 study subjects were separated into two equal groups: group A, consisting of 43 patients, was operated on using the open (Hasson technique), whereas group B, also consisting of 43 patients, was

operated on using the closed (Palmer's point) technique. Mean age of the study subjects included in current study was found to be  $45.5 \pm 16$  years ranged between 14 to 86 years. Mean weight recorded was  $68 \pm 10.5$  between the ranges of 40 kilograms to 90 kilograms. Mean time of operations taken by surgeon was  $84.5 \pm 18.5$  minutes. Maximum time taken was 150 minutes and minimum time recorded was 45 minutes. 55 (64%) Females were included in the study compared to males 31 (36%). As our study had more number of female patients so majority of them had history of previous caesarean section (17: 19.8%) followed by the patients having history of trans-abdominal hysterectomy and bilateral salpingo-oophorectomy (3: 3.5%) and remaining 58: 67.4% had no history of previous abdominal surgery. 60 (69.8%) of patients included underwent the laparoscopic cholecystectomy while 15 (17.4%) patients had laparoscopic appendectomy Fig. 1.

We separated the procedure-related issues into two categories: minor complications and major complications, The minor complications occurred in 12/43 (27.9%) in group B (Closed/Palmer's point approach) and 1/43 (2.3%) in group A (Open/Classic/Hasson technique). There were no major complications reported by any of the patients during or after the procedure. Fig. 2

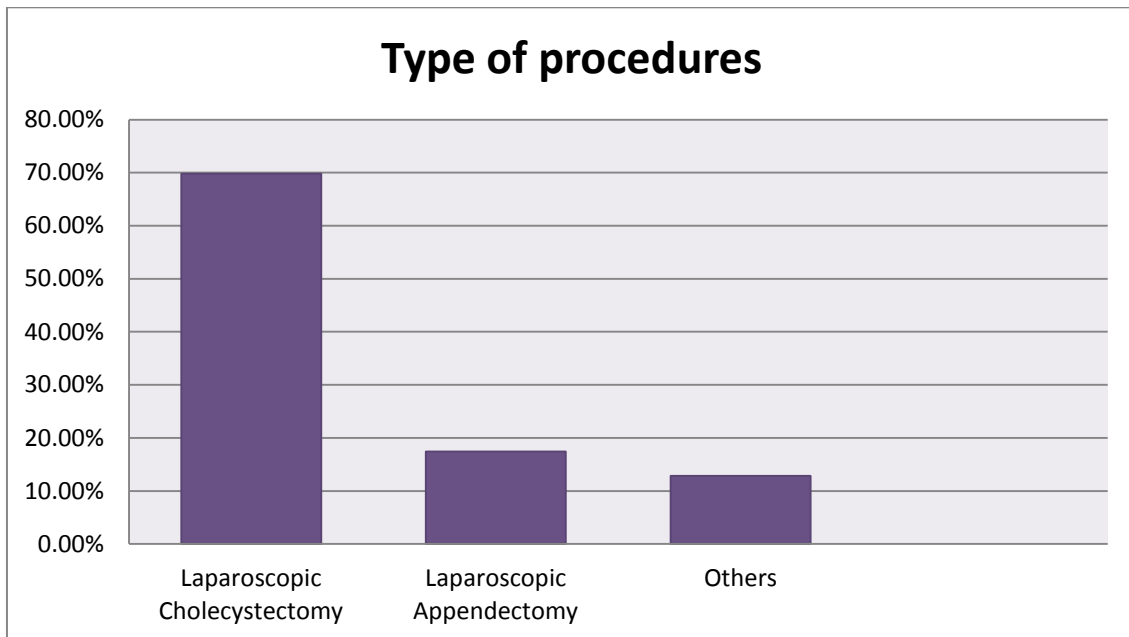


Fig. 1. Frequency of type of surgery performed

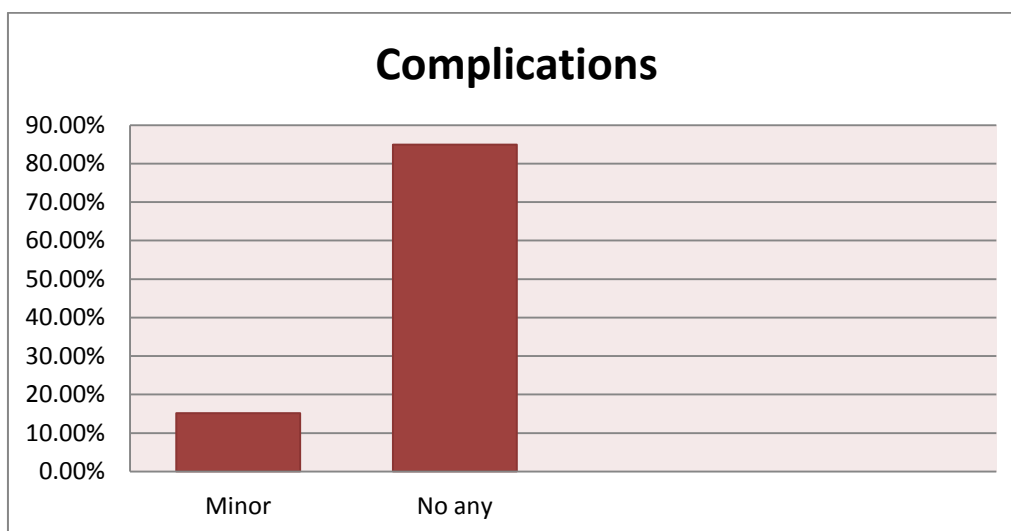


Fig. 2. Frequency of complications

Table 1. Association of complications with two groups

Complications	Groups		p-value
	A (Open/Hasson)	B (Closed/Palmers Point)	
Minor Complications	1	12	0.002*
No any complication	42	31	

\*Fisher's Exact Test

Table 2. Association of individual complication with two groups

Complication		Groups		p-value
		Open/Hasson	Closed/Palmers Point	
Difficulty at Entry Site	Yes	01	00	1.00 <sup>a</sup>
	No	42	43	
Bruises	Yes	00	10	0.001 <sup>a</sup>
	No	43	33	
Localized Emphysema	Yes	00	04	0.116 <sup>a</sup>
	No	43	39	
Omental Injury	Yes	00	01	1.00 <sup>a</sup>
	No	43	42	

<sup>a</sup>Fischer's Exact Test

The comparative analysis between the two groups in which A was operated by open method and B group was operated with closed techniques in terms of effectiveness of either method compared by means of development of the complications was found to be highly significant with p value 0.002. Table.

We further aimed to determine the statistical link between the two groups open and closed techniques with the individual complication developed during or after the procedure. We found that development of bruises at the site of operation is significantly associated with the

technique used with p value 0.001 while other complication developed like localized emphysema, omental injury and difficulty entry at operative site have insignificant statistical link Table: 2.

#### 4. DISCUSSION

Laparoscopy is a standard procedure in several surgical fields. The procedure's first penetration into the abdomen is frequently associated to laparoscopy problems. The secure placement of the Verres needle or first trocar for pneumoperitoneum establishment is the most

essential stage in a laparoscopic operation [12]. Over the last few decades, many solutions and guidelines have been established to eliminate issues in the creation of pneumoperitoneum. The closed classic approach and the open classic technique are the two most used methods for inducing pneumoperitoneum [13]. More study is needed because there is no consensus on a safe way to access the peritoneal cavity. However, the argument over laparoscopy (open vs. closed) is still ongoing [14]. Many studies have demonstrated that open laparoscopy is preferable to closed laparoscopy in terms of not just the frequency of complications, but also the kind and severity of those complications [15].

There is a wide list of minor complication like difficulty in primary entry, bruise, primary site hematoma, localized emphysema, bleeding, gas leakage, omental injury and others while failure to create pneumoperitoneum, emphysema extending up to the neck, bowel perforation, bladder perforation, mesenteric vascular injury are the major complications reported in laparoscopic procedures. When compared to laparotomy, laparoscopy leads in smaller incisions, less postoperative pain, and a speedier recovery [16]. Milan Kumar et, al in 2016 reported in his comparative study done to evaluate the complications in closed versus open laparoscopic techniques revealed 5.33% of major complication and 1.33% of minor complication in closed technique while only 4% major and 0.133% minor complications occurred in open techniques [13]. Another study done by Eric Monnet et, all in 2019 reported that Injury to the colon and main arteries during laparoscopy has been documented in 0.02 percent and 0.04 percent of surgeries, respectively, using open- and closed-entry techniques [17]. These findings are very close to over findings. Complications from laparoscopy vary depending on the surgeon's and medical staff's experience, as well as the wide range of operational requirements [18].

Complications occur in 0.1 to 1.3 percent of patients. Despite this, 30%–50% of all intestinal injuries and 13%–50% of all vascular injuries are not recognized immediately during the operation, resulting in disproportionately high morbidity and mortality rates [19]. There have been no serious complications reported in the current trial. This could be attributed to well-trained surgeons and staff handling the patients with care [20]. The most prevalent surgery in the current study was laparoscopic cholecystectomy, followed by laparoscopic appendectomy [21]. Many studies

disagree, depending on the exposure to various risk factors, disease prevalence, and environmental exposure [22,23]. Open procedures have traditionally been utilized to address acute colonic disease. Recent advances suggest that there is a trend toward less intrusive methods in this sickness situation. While each surgeon's definition of a stable patient varies, we believe that all stable patients should have laparoscopic surgery [24]. The findings are consistent with those of other investigations. When comparing the complications of both approaches, Schafer et al. found that the open access method had a modest advantage over the closed technique in terms of minor difficulties.(25) Bonjer et al. observed that the rates of visceral and vascular injury were 0.08 percent and 0.07 percent following closed laparoscopy, respectively, and 0.05 percent and 0 percent after open laparoscopy ( $p=0.002$ ) [26].

The most prevalent surgery in the current study was laparoscopic cholecystectomy, followed by laparoscopic appendectomy. Many studies disagree, depending on the exposure to various risk factors, disease prevalence, and environmental exposure [27]. Open procedures have traditionally been utilized to address acute colonic disease. Recent advances suggest that there is a trend toward less intrusive methods in this sickness situation. While each surgeon's definition of a stable patient varies, we believe that all stable patients should have laparoscopic surgery [24].

The fatality rates were not statistically different from any other deaths reported in the current trial using either approach. Chandler et al. also discovered that the open approach had no advantage in terms of safety over the closed technique; however neither group encountered any major difficulties in this trial [28]. It could be explained by the fact that in randomized controlled trials comparing closed versus open procedures, the sample size is insufficient to detect a meaningful difference in outcomes. In laparoscopy, the primary trocar entrance technique is still a contentious issue [29]. There isn't a single method that works in every situation. Each case's entrance method may be modified based on the preoperative evaluation and surgical experience. The different ways in development to reduce difficulties require multi-centric investigations for their safety and everyday practical usefulness [30].

The quantity of participants in this study was the most significant drawback. We were unable to

compare the safety of these two procedures completely because many of the problems of laparoscopic procedures are rare. However, in terms of the majority of the factors, the sample met the study's objectives. Another drawback is that this was a single-center study, and the results, as with other single-center trials, cannot be extrapolated. Because the sample was limited, confounding variables such as co-morbid conditions and age group were controlled. However, it would be interesting to observe how these two methods compare when employed on patients with more complex medical issues. Because the data was only collected for a year and the study participants were not followed up on for a long time, complications such as port-site hernias and other issues arose which were not recorded.

## 5. CONCLUSION

We have observed statistically significant difference in few of minor complications in our study compared in both open and closed laparoscopy. We did not found any major complication in either technique. The open approach looks to be a safer technique because minor complications are uncommon, therefore it may be used during the learning and initial stages of a laparoscopic treatment. The open approach to laparoscopic entrance has been linked to fewer surgical problems than the closed approach.

## CONSENT

Verbal and written informed consent was obtained from all patients.

## ETHICAL APPROVAL

Ethical approval was taken from Ethics Review Committee (ERC) of Ziauddin University Karachi accordance with institutional guidelines (281120OHSUR).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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