

Comparing Closed and Open Methods for Creation of Pneumoperitoneum in Laparoscopic Cholecystectomy

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ABSTRACT

Background: This study is based on the access technique for the creation of pneumoperitoneum in the operative procedure of laparoscopic cholecystectomy. This technique is a crucial step in this operative procedure.

Aim: The specific aim is to study the efficacy of closed and open methods for creating pneumoperitoneum in laparoscopic cholecystectomy by comparing their outcomes and complications.

Materials and methods: Our study is a prospective observational study for 2 years January 2021 to January 2023 of cases done in our facility at central and southern Ondo, Nigeria. Consecutive patients with cholelithiasis who consented to laparoscopic cholecystectomy were recruited into the study using a purposive sampling method after applying the exclusion criteria. The patients demographics and comparative variables were imputed into a proforma which was analyzed using SPSS version 26 (IBM incorporated Chicago, Illinois).

Results: Of the 50 patients under study there were 4 males (8%) and 46 females (92%). The mean age was 45.74 ± 6.2 years. About 28 underwent the closed method of access while 22 underwent the open method. Minor complications like gas leaks during the procedure were observed more in the open method group. Other complications such as visceral and vascular injury and conversion to open surgery after the initial access were not observed in both groups. However umbilical port-site hematoma, umbilical port-site infection, and incisional hernia were observed in the open access method during follow-up period. The time taken to close abdominal ports wound was almost the same in both groups. However, the mean operating time was significantly less in the closed-access method. In general, the length of hospital stay in both groups was not significantly different.

Conclusion: Even though both access methods are safe, the closed method is more efficacious than the open method.

Keywords: Access, Cholecystectomy, Closed, Laparoscopic, Open.

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INTRODUCTION

This study was conducted on the background of the access technique which is the initial step in the operative procedure of laparoscopic cholecystectomy and intraoperative cholangiogram

Laparoscopic surgical outcome may not be satisfactory all the time as a result of associated complications.^{1,2}

The most crucial step in laparoscopy is the creation of pneumoperitoneum.^{3,4}

The majority of these complications result from the initial process of creation of pneumoperitoneum at the umbilicus.⁵

The incidence of vascular injuries is 2 in 10,000 procedures. These are life-threatening major vascular injuries visceral injuries have also been reported and is up to 3 in 10,000 operations of laparoscopic cholecystectomy.^{6,7}

The two most common access techniques are⁸⁻¹⁰

1. Closed—where Veress needle is used.
2. Open—where Hasson's cannular is used.⁸⁻¹⁰

Pneumoperitoneum is activated by a blind puncture at the umbilicus using the Veress needle followed by insertion of trocar at the same point. Whereas in the open method, dissection at the navel and identification of the peritoneum are first performed before the introduction of the cannular. However, it still remains controversial which of the techniques is optimal in the operative procedure of laparoscopic cholecystectomy.

We aim to evaluate the two access techniques and determine the difference in terms of outcome and complications at the operative

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procedure of laparoscopic cholecystectomy which remains the gold standard in the management of gall bladder disease.

MATERIALS AND METHODS

This was a 2-years prospective observational study conducted at the University of Medical Science Teaching Hospital, Ondo, and the

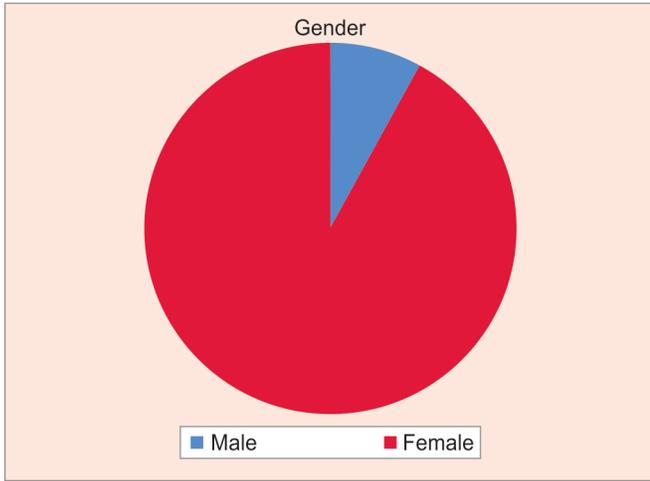


Fig. 1: Gender distribution

George and Martin Specialist Laparoscopy Center Ore Ondo state Nigeria, between January 2021 to January 2023.

Consecutive patients who presented with cholelithiasis were recruited into the study. After obtaining informed consent, the patient was asked to choose either of the closed or open methods of creating pneumoperitoneum. By this purposive random sampling, participants are chosen based on the purpose or method agreed with the surgeon.

Exclusion criteria included patients with uncontrolled pre-morbid disease others with a visceral hernia at or close to the umbilicus and also those with previous surgery at the upper abdomen. Laparoscopic cholecystectomy was done and the variables studied where demographics of the patients, access group, gas leak, intraoperative complications, postoperative complications, wound closure time, operating time, and the period spent in the hospital.

Access Time: Timing from the Knife on the Skin to Installation of the Telescope into the Abdomen

Operating time: Time taken from knife on skin to closure of all ports.

Vascular injury: We concentrated on major vascular injuries.

Visceral injury: Injury of the intra-abdominal viscera.

Postoperative vomiting: Vomiting within 48 hours of surgery.

Postoperative urinary retention: Not being able in half of a day postoperatively.

Port-site hematoma: Presence of a hemorrhagic discharge or clot from the port-site wound within 7 days of surgery or beyond.

Port-site hernia: Presence of a hernia at the umbilicus at and beyond 30 days postoperatively.

Statistical analysis was performed through the use of SPSS version 26 (IBM, Chicago, USA).

Student's *t*-test was applied to compare the two groups, *p*-value < 0.05 was considered statistically significant.

Chi-squared nonparametric test was applied to categorical variables at 95% confidence interval.

RESULTS

The overall 28 patients had the closed method while 22 had the open access method of creation of pneumoperitoneum. Figure 1 shows that in the study, 96% were females while 8% were males

Table 1: Showing gender distribution of patients

	Gender			
	Frequency	Percent	Valid percent	Cumulative percent
Valid				
Male	4	8.0	8.0	8.0
Female	46	92.0	92.0	100.0
Total	50	100.0	100.0	

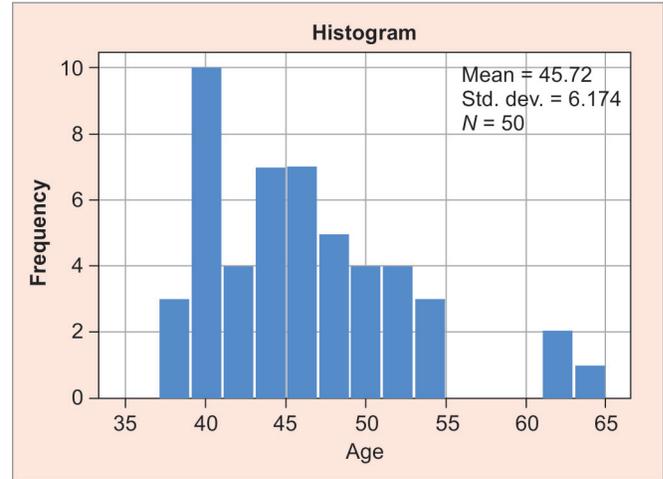


Fig. 2: Showing age distribution and the mean age

Table 2: Showing age distribution and the mean age

	N	Mean	Std. deviation
Age (years)	50	45.72	6.174
Valid N	50		

Table 3: Showing access time in the two groups

Access group	Access time			
	5-15 minutes	16-25 minutes	More than 25 minutes	
Open	8	12	2	22
Closed	11	17	0	28
Total	19	29	2	50

(Table 1). Figure 2 shows a bell-shaped normal age distribution irrespective of two outliers at the extreme and Table 2 presents the mean age overall to be 45.72 ± 6.2 years. Table 3 presents of access time in the two groups and Table 4 the mean access time of 12.8 ± 1.2 minutes in the closed and 18.55 ± 5.4 minutes in the open which is of significant difference.

Table 5 depicts gas leak, with no gas leak in the closed group and a significant difference of 81.8% of gas leak in the open method. Table 6 displays the postoperative complications with no hematoma at the port site, absence of infection, and no incisional hernia in the closed group. Table 7 displays the time taken to close port-site wounds of 7.36 ± 3.3 minutes in the closed group and 7.59 ± 2.6 minutes in the open group with no significant difference in the two groups. Table 8 presents the mean operating time of 135.54 ± 14.8 minutes in the closed group and 161.05 ± 44.4 minutes in the open group with a significant difference in the two groups.



Table 4: Showing mean access time in the two groups

Access group	N	Mean	Std. deviation	Std. Error mean
Access time (minutes)				
Open	22	18.55	5.387	1.149
Closed	28	12.18	1.786	0.337
<i>p</i> -value = 0.000				

Table 5: Showing gas leak in the two groups

Access group	<i>p</i> = 0.000 Gas leak		Total
	No gas leak	There is gas leak	
Open	4	18	22
Closed	28	0	28
Total	32	18	50

Table 6: Showing postoperative complications

Postoperative complications	Access group		
	Open	Close	Total
No complication	9	25	34
Postoperative vomiting	2	2	4
Postoperative urinary retention	1	1	2
Port-site hematoma	5	0	5
Port-site infection	2	0	2
Incisional hernia	3	0	3
Total			
<i>p</i> -value = 0.004	22	28	50

Table 7: Showing time taken to close the wound

<i>p</i> -value = 0.787	Access group	Group statistics			
		N	Mean	Std. deviation	Std. error mean
Time taken to close the wound of the ports (minutes)	Open	22	7.59	2.594	0.553
	Closed	28	7.36	3.302	0.624

Table 8: Showing operating time

<i>p</i> -value = 0.000	Access group	Group statistics			
		N	Mean	Std. deviation	Std. error mean
Operating time (minutes)	Open	22	161.05	44.387	9.463
	Closed	28	135.54	14.844	2.805

Table 9: Showing hospital stay

<i>p</i> -value = 0.926	Access group	Group statistics			
		N	Mean	Std. deviation	Std. error mean
Hospital stay (days)	Open	22	3.55	1.262	0.269
	Closed	28	3.57	0.690	0.130

Table 9 illustrates the length of hospital stay of 3.57 days ± 0.69 in the closed group and 3.55 ± 1.3 days in the open method group with no significant difference in the two groups.

DISCUSSION

The most important step in laparoscopy is the creation of pneumoperitoneum. The great majority of complications arising from laparoscopy occurs at the beginning of the main surgery at creation of pneumoperitoneum.⁸⁻¹⁰

We have thus compared Harrith Hasson open method and Veress blind puncture techniques of creating pneumoperitoneum, which are the most commonly used methods.¹¹⁻¹⁴

A study was done in which the mean time needed to create pneumoperitoneum with the closed techniques was 4.1 ± 1 minutes and open method was 5 ± 1 minutes, respectively (*p*-value = 0.000).^{3,15}

Another study noted that the average time of access in the closed method was 7 ± 2 minutes, and in the alternate method 5.1 ± 2 minutes. For us, the access time in closed techniques came to be 12 ± 2 minutes and in the open technique 18 ± 5 minutes (*p*-value 0.000). Our study thus varies with then for mentioned studies in not only a longer general access time but also in the fact that there is a significant differences in mean access time in the two groups.¹⁶

In our study there was no gas leak in the closed method whereas 18 (81.8%) patients had leakage of gas out of 22 cases. Our findings correspond to other studies in which the incidence of gas leakage was higher in the open technique of creating pneumoperitoneum.

In our study, no vascular or visceral injuries was seen and conversation to open cholecystectomy was also not seen. However, Bonjer et al. reported 0.08% of visceral injury and 0.07% of vascular injury in the closed technique, and their frequency of visceral injury was 0.05% and blood vessel injury of 0% in the open technique of pneumoperitoneum (*p* = 0.002).¹⁷⁻¹⁹

Our study observed more postoperative complications like postoperative vomiting, urinary retention, hematoma at the port-site, infection at the port site and incisional hernia in the open method than in the closed method and a marked difference between the techniques (*p* = 0.004). Other studies were in keeping with thin finding.

A study noted infection at the umbilical site as 5.31%. Another noted 6.3% and also another noted below 20%.²⁰⁻²³

The mean time taken to close the wound was 7.36 in the closed group and 7.59 in the open group (*p* = 787) showing no significant difference.

The operating time was however shorter in the closed group. This was probably due to the less time taken to create pneumoperitoneum at the start (*p* = 0.000). The mean hospital stay in days was 3.57 in the closed group and 3.55 in the open group *p* = 926 showing no significant difference in the length or duration of hospital stay in the two groups.

CONCLUSION

The closed method of access is more efficacious in shortening the time of access and overall operative time, saving hospital resources by the reduction in gas usage and also having lower postoperative complications rate. However, there is no significant difference in the length of hospital stay between the two access techniques.

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