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Original Research Article

Assessment of Open versus Closed Method of Establishment of Pneumoperitoneum in Laparoscopic Surgery: Prospective Comparative Parallel Randomized Trial

Roshani Prasad[1], Sumit Raj[2], Lallan Singh[3], Ashok Rai[4]

[1]Senior Resident, Department of Surgery, JLNMCH, Bhagalpur, Bihar, India
[2]Senior Resident, Department of Surgery, JLNMCH, Bhagalpur, Bihar, India
[3]Senior Resident, Department of Surgery, JLNMCH, Bhagalpur, Bihar, India
[4]Associate Professor, Department of Surgery, JLNMCH, Bhagalpur, Bihar, India

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Corresponding author: Dr. Sumit Raj
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Abstract

Aim: To compare open or Hasson's method and closed or Veress method of creation of pneumoperitoneum.

Material & Methods: This was a prospective comparative parallel randomized control trial with an allocation ratio of 1:1. The study was conducted at the Department of Surgery, over a period of one year and included all the patients (n=160) who were undergoing laparoscopic surgery in this time period at our department.

Results: The mean time required to create pneumoperitoneum by closed method (group C) was 9.0 seconds while by open method (group O), it was 7.7 seconds with p value <0.001 which is significant Lap incisional hernia repair was seen in 3 cases of closed method and 2 cases in open method and diagnostic laparoscopy was observed in 1 case of close method.

Conclusions: Even though the open method takes less time to create pneumoperitoneum, both methods are similar in terms of time taken to complete the operation and major and minor complications because there was no statistically significant difference in the frequency of these parameters between the two techniques.

Keywords: Pneumoperitoneum, Veress needle, Hasson's method, Laparoscopy

Introduction

The word laparoscopy is the method of examining the abdominal cavity which is achieved by sufficiently distending the abdominal cavity by air called pneumoperitoneum and visualizing the abdominal contents using illuminated telescope containing camera. The major difference between laparoscopic surgery and conventional open surgery is the minimal access to the abdominal cavity, as the abdominal incision is replaced by very small incisions. As a result there is minimal traumatic insult to the patient, if achieved without complication, the patient's postoperative recovery will be shorter with less pain and return to full activity and work in shorter time. [1]

Hasson first described the open laparoscopy in 1971 and it remains the favorite entry method for many laparoscopic surgeons [2]. In open

technique 1-1.5 cm sub-umbilical incision is made, subcutaneous fat is dissected; rectus sheath and then peritoneum are incised under direct vision. The laparoscopic sheath without its trocar is then inserted into the peritoneal cavity followed by insufflations. After completion of the intended procedure the rectus sheath is closed with interrupted absorbable or purse string suture followed by the skin closure.

Other methods under evaluation for safe insufflations are palpation of aorta [3], the spinal needle test [4], imaging (CT, MRI) and direct measurement of the distance [5]. In a study USG was used for predicting infra umbilical adhesions by observing visceral movement and reported infra umbilical adhesion was 12%. A visceral slide threshold <1cm to predict adhesion had sensitivity of 86%, specificity 91%, positive predictive value of 55% and negative predictive value of 98% [6]. The USG observation of bowel movement can be combined with peri umbilical ultrasound guided saline infusion (PUGSI) of 8-10ml in to the peritoneum for detection of fluid pocket which indicates presence of adhesion. The PUGSI test was able to detect all cases of obliterating sub umbilical adhesion, demonstrating sensitivity and specificity of 100% [7].

The overall incidence of complications in laparoscopic surgery is still less compared to open surgery. Past studies indicate that the open method is better than closed method in terms of duration of the surgery and frequency and severity of complications, especially in patients with low BMI, scars of previous surgery, abdominal tuberculosis, and pelvic inflammatory disease. [8-9] Thus, we aim to compare open or Hasson's method and closed method of creation of pneumoperitoneum.

Material & Methods:

This was a prospective comparative parallel randomized control trial with an allocation ratio of 1:1. The study was conducted at the Department of Surgery, over a period of one year and included all the patients (n=160) who were undergoing laparoscopic surgery in this time period at our department.

Exclusion criteria consisted of conditions not allowing induction of general anesthesia, presence of anterior abdominal wall infection, presence adhesions from previous surgeries, mechanical bowel obstruction, liver cirrhosis or portal hypertension, and patients not giving consent for laparoscopic surgery.

Methodology

We divided the patients into two groups i.e. open or Hasson's method (group O) (n1=80) and closed or Veress method (group C) (n2=80) groups using the envelope method of randomization. After obtaining a written informed consent, we obtained the following data on a printed pro-forma such as history: name, age, gender, religion, education, occupation, residential address, chief complaints, past history, family history, diet, bowel and bladder habits, addiction, etc., detailed clinical examination: general, per abdominal, and per rectal examination, routine investigations: hemoglobin, total count, urine albumin, urine sugar, blood sugar, blood grouping, X-ray chest, and ultrasonography (abdomen and pelvis) and specific investigations: serum creatinine, electrolytes, bilirubin, bleeding and clotting time, computed tomography (abdomen), etc.

Before the operation, shaving and cleaning of local parts, antibiotic prophylaxis, and catheterization was carried out. The laparoscopic procedure was conducted under general anesthesia in sterile conditions. In closed technique (Veress technique), we created a sub-umbilical longitudinal skin incision of 2-3 mm through which Veress needle was inserted in the midline in sagittal plane at a 45 degree angle to the spine to avoid injury to

major vessels especially in thin and lean patients. Confirmation of the entry of Verres needle into the peritoneum was done by saline drop test and initial intra-peritoneal pressure of less than 10mm Hg in order to prevent extra peritoneal insufflations. In case of open technique (Hasson technique), we created a small longitudinal sub-umbilical transverse skin incision of 1.3-1.5 cm which was followed by opening of the rectus sheath with a triangular knife (size 11) in the same direction and separating it and the rectus muscle with straight artery forceps both transversely and longitudinally. The peritoneum was picked with artery forceps and a nick was made with a triangular knife to open the peritoneal cavity. After opening the peritoneal cavity, we inserted the cannula or laparoscopic sheath without the trocar followed by CO_2 insufflation maintained at a flow rate of 2 l/min and at 12 mm Hg pressure. The abdominal cavity was thoroughly inspected after creation of the pneumoperitoneum for complications before the intended procedure and complications were divided into major (emphysema extending up to the neck causing dyspnoea, bowel perforation, bladder perforation, and mesenteric vascular injury) and minor (abdominal bruise, localized emphysema, small hematoma, omental injury, bowel serosa injury, and gas leak) depending upon the nature and severity of injuries. The operative procedure was carried out and excised organs were removed from the umbilical port. All patients were given Injection Cefosulbactum (1.5 gm IV 12 hourly) for a period of 3 days with the first dose given 3 hours prior to induction. Inj diclofenac (50 mg diluted in 100 ml normal saline IV 12 hourly) for 3 days followed by tablet diclofenac (50 mg BD) for post-op pain. Patients were kept nil-by mouth till bowel sounds were heard. Their dressing was done on alternate days and sutures were removed on the 12th post-operative day. Post-operative local examination done to check for signs of infection by looking for tenderness over suture line, color change and discharge while the presence of hematoma was checked by the presence of swelling over suture line. A detailed systemic examination to assess the abdomen, respiratory, cardiovascular, and central nervous systems was carried out.

This study used descriptive and inferential statistical analysis with results on continuous measurements presented on Mean±SD (Min-Max) and categorical measurements presented in number (%). Significance was assessed at 5% level of significance assuming normal distribution of dependent variables and randomization of independent samples. We used Student t- test (two tailed, independent) to find the significance of study parameters on continuous scale between two groups (Inter group analysis). The statistical software namely, MedCalc Software Version 12.5.0 was used for the analysis of the data and Microsoft Word and Excel have been used for data entry.

Results:

All the 160 patients that participated in this study belonged to the age group of 10-69 years out of which majority were 15-50 years old which is the period of maximum physical activity (Table 1).

In our study, the distribution of surgery was 20% laparoscopic appendectomy, 20% laparoscopic inguinal hernia repair, 36.25% laparoscopic cholecystectomy, 12.5% laparoscopic incisional hernia repair, and 11.25% diagnostic laparoscopy. The mean time required to create pneumoperitoneum by closed method (group C) was 9.0 seconds while by open method (group O), it was 7.7 seconds with p value <0.001 which is significant (Table 2).

Lap incisional hernia repair was seen in 3 cases of closed method and 2 cases in open method. Whereas, Diagnostic laparoscopy was observed in 1 case of close method. (Table 3)

Table 1: Distribution of patients according to age

Age in years	Number of patients	Percentage (%)
10-19	22	13.75
20-29	36	22.5
30-39	43	26.87
40-49	26	16.25
50-59	18	11.25
60-69	15	9.37
Total	160	100

Table 2: Time required to create pneumoperitoneum

Operation	%	Closed method (minutes)	Open method (minutes)	P value
Lap appendectomy (n=32)	20	7.3 (n1=16)	6.0 (n2=16)	<0.001
Lap inguinal hernia repair (n=32)	20	11.3 (n1=16)	7.6 (n2=16)	<0.001
Lap cholecystectomy (n=58)	36.25	8.8 (n1=29)	8.2 (n2=29)	<0.001
Lap incisional hernia repair (n=20)	12.5	12.9 (n1=10)	12.0 (n2=10)	0.263
Diagnostic laparoscopy (n=18)	11.25	7.5 (n1=9)	6.3 (n2=9)	0.001
Average (n=160)	100	9.0 (n1=80)	7.7 (n2=80)	<0.001

Table 3: Incidence of omental injury

	Close method	Open method	P value
	Number	Number	
Lap appendectomy (n=32)	0 (n1=16)	1 (n2=16)	0.4732
Lap inguinal hernia repair (n=32)	0 (n1=16)	0 (n2=16)	-
Lap cholecystectomy (n=58)	0 (n1=29)	0 (n2=29)	-
Lap incisional hernia repair (n=20)	3 (n1=10)	2 (n2=10)	0.6830
Diagnostic laparoscopy (n=18)	1 (n1=9)	0 (n2=9)	0.4462

Discussion:

The complications in open method were due to the larger incision size associated with the open method. Indeed, the incision is a mini laparotomy as opposed to the needle puncture the closed technique. However, Bonjer et al in their comparison between open and closed techniques found that the rates of visceral and vascular injury were respectively 0.08% and 0.07% after closed laparoscopy, and 0.05% and 0% after open laparoscopy (p=0.002). There was no significant difference in the mortality rates [10].

The European association for endoscopic surgery states that, the randomized controlled trials comparing closed versus open approach have an inadequate sample size to find a difference in serious complications. [11] In large outcomes studies, there were fewer complications in the closed group, although randomized controlled trials found the open approach faster and were associated with a lower incidence of minor complications. The panel did not favor the use of either technique over the other. In this study, we found that the open technique was faster than the closed technique. This is also similar to previous studies. Petigen et al found that the open technique took half the time required by the closed technique and recommended its use on the basis of it being more cost-effective. [12]

Christopher et al., in their national survey of 248 registered members of Canadian Association of General Surgeons reported that 50% of laparoscopic complications were entry related and most injury related litigations were trocar related [13]. Pawan Lal et al., reported 2.91% (22) periumbilical hematoma out of 755 cases of modified open laparoscopy, but in our study sub umbilical hematoma was only 0.47% in the open method [14]. A Pickersgill et al., reported leakage of gas in less than 5% cases out of 647 open laparoscopy [15].

Schafer et al., evaluated 26 major vascular injuries and reported that only four (15%) of them caused by inexperienced surgeon (surgeons who had performed fewer than 50 laparoscopic procedures). The other 22 (85%) injuries had been caused either by experienced surgeons (51and 100 procedures) or very experienced surgeons (>100procedures) [16].

Our study shows similar findings when compared to the Borgatta et al study in terms of the time required to create pneumoperitoneum. [17] The Peitgen. et al and the Cogliandolo et all studies show that the open technique is faster as compared to the closed technique with similar frequency of complications. This correlates with the findings of this study where the open method took 7.84 mins and the closed method took 9.3 mins onan average with similar rates of major and minor complications. [18-20]

Conclusion:

Even though the open method takes less time to create pneumoperitoneum, both methods are similar in terms of time taken to complete the operation and major and minor complications because there was no statistically significant difference in the frequency of these parameters between the two techniques.

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