

A Comparative Study of Transumbilical and Infra-Umbilical Port Insertion in Laproscopic Surgeries

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Abstract:

Background: In the modern era of medical science, laproscopic surgeries are well preferred over the open surgeries because of less hospital stay time, better cosmetic results, minimal scarring and less post-operative pain. Umbilicus is the important landmark of abdomen. Camera port is inserted through supraumbilical, infraumbilical or Palmers. But recently transumbilical peritoneal entry is also used.

Method: Total 80 patients who underwent laproscopic surgery were included in the study. These patients divided into 2 groups with 40 patients in each group. Group A patients were having transumbilical and group B patients were having infraumbilical first port. The parameters evaluated were ease of entry, time taken to achieve pneumoperitoneum, number of attempts to enter peritoneum, loss of port, subcutaneous emphysema, and gas leak from port site, port site pain, port site infection, port site hernia and Cosmetic outcomes.

Results: Laproscopic cholecystectomy was done in 77 (96.25%) cases and appendicectomy was done in 3 (3.75%) cases. The transumbilical first port entry is easy than infraumbilical port entry. The mean time to achieve pneumoperitoneum was 7.01±2.55 and mean time taken to achieve pneumoperitoneum in group A was 5.24±1.25 which was significantly less than group B i.e 8.79±2.26. Intraoperatively, only 1 (2.5%) case of gas leakage in group A and only 1 (2.5%) case of loss of port in group B was observed. There were 2 (5.0%) cases of port site bleeding in group B. 1 (2.5%) case of bile duct injury and 2 (5%) cases of port site infection were observed in each group A and B. Cases of port site pain observed in group A were 2 (5%) and in group B were 4 (10%). Port site hernia was observed in 2 (5%) cases in group A and in 1 (2.5%) case in group B.

Conclusion: The technique of transumbilical port insertion is easy, safe and significantly less time consuming. However, there is no significant difference in terms of intraoperative and post-operative complications between the transumbilical and infraumbilical port insertion. So, transumbilical port insertion can be considered as an alternative to the infraumbilical port insertion in laproscopic surgeries.

Keywords: Umbilicus, transumbilical, infraumbilical, pneumoperitoneum, laproscopic.

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Introduction

Laproscopic procedures have conventionally been done mainly for taking down adhesion in abdominal surgeries and diagnostic biopsies of abdominal organs under direct vision. Gradual progression towards the modern era of medical science has shown laproscopic surgeries to be preferred over open surgeries because of less hospital stay time, better cosmetic results, minimal scarring and lesser post-operative pain [1]. Recently, there has been an increase in interest in laparoscopy for scarless surgery with the development of surgical instruments and

advancement of techniques. The aim of minimal trauma to tissue and invasiveness can further be achieved by reducing the number and size of the trocars and camera port. Various areas are used for insertion of ports for laproscopic surgeries. Umbilicus is the important landmark of abdomen. Approximately half of laparoscopic surgeons prefer the infraumbilical route and 35.7% prefer the supraumbilical area for entry [2]. There are two methods of creating a pneumoperitoneum, closed technique (Veress needle) and the open technique

(Hasson technique). Veress needle is the oldest method, developed by Dr. Veress in 1938. The classic location of veress needle puncture is the midline of abdomen near the umbilical scar [3]. Veress needle can be placed at various sites for creation of pneumoperitoneum like base of umbilicus, left upper quadrant (Palmer's point), 9th intercostal space (ICS) at the anterior axillary line, 2 Lee-Huang point (at midline between the umbilicus and xiphisternum), uterine fundus and posterior vaginal fornix [4]. The correct intraperitoneal placement of veress needle's tip is verified by various tests like double click, "hiss" sound, saline hanging drop and aspiration/syringe test. Hasson first described open laparoscopy in 1971. Open (Hasson) technique may be considered as an alternative to closed technique, as it associated with a reduced rate of failed abdominal entry, without a significant difference in visceral or vascular injury rates.

Laparoscopic surgery, however, has its own set of complications. Overall rate of major complications after laparoscopic surgery is 1.4 per 1000 procedures. Complications in laparoscopic surgery are visceral injury, omental injury, vessel injury and port site complications such as infection, pyoderma gangrenosum, hernia, foreign body granuloma formation and hypertrophic scar. The incidence of Port Site Infection (PSI) following laparoscopic surgery is 21 per 100,000 cases, which increases with increase in size of port site incision [5]. Access to the peritoneal cavity is one of the most crucial steps in laparoscopic surgery. It is achieved by the safe insertion of primary or initial port insertion. There are 50% chances of complications during the first port entry. Intestinal injury and vascular injuries are the most feared ones during first port insertion [6]. To minimize entry related injuries several techniques, instruments, and approaches have been introduced during last century.

These include the Veress-pneumoperitoneum trocar, classic or closed entry, the open (Hasson) technique, direct trocar insertion without prior pneumoperitoneum, use of shielded disposable trocars, optical veress needle, optical trocars, radially expanding trocars and trocarless reusable visual access cannula [7]. Camera port is inserted through supraumbilical, infraumbilical, transumbilical or Palmers point. However, there is no common consensus regarding the optimum site for camera port insertion. Common sites used for camera port insertion includes infraumbilicus and supraumbilicus. But recently transumbilical peritoneal entry is also used. Both close and open techniques are used for primary access through umbilicus. Umbilicus is the natural weakest point over the abdominal wall because it lacks the muscle or sheath which gives strength to the anterior abdominal wall and its location is at the greatest

diameter of abdomen. There are controversies regarding the use of umbilicus for the primary port site. Firstly, umbilicus is the dirtiest area and it causes port site infection. Secondly the chances of ventral hernia as it are the weakest area of anterior abdominal wall [8]. Hence present study is planned to compare transumbilical port insertion with infraumbilical port insertion through open method in laparoscopic surgery in regards to ease of entry, duration for successful start of pneumoperitoneum, port site complications and cosmetic outcomes.

Methods

This was a prospective comparative study conducted in the Department of General Surgery at tertiary care hospital of north india from 1st January 2021 to 31st October 2022 after clearance from Institutional Ethical Committee. Eighty patients of either gender who presented to OPD for laparoscopic surgery for any etiology were randomly included in the study using convenient sampling technique. These patients were divided into Group A and Group B.

Inclusion Criteria

- Patients with age 18 years and of either sex.
- Patients gave consent for laparoscopic surgery.

Exclusion Criteria

- Patients with age less than 18 years.
- Patient with immuno-compromised status.
- Patients with previous midline laparotomy.
- Patients with umbilical conditions like umbilical hernia, infection, scar.
- Patient with coagulopathy.
- Patient required more than 3 attempts by either approach.
- Morbid obese patients.
- Pregnancy.
- Ascites and portal hypertension.
- Patients unfit for surgery

The data was collected using a pre-designed structured performa eliciting information regarding socio-demographic and other clinical variables. All the patients were worked up and assessed according to detailed history and complete clinical examination along with complete routine investigations.

Pre-operative: Shaving was done at the operative area. All patients were given Inj Ceftriaxone 1gm intravenous stat 1 hour before surgery. Umbilicus was cleaned with spirit and 10% Povidone iodine sol. All the patients were explained about the procedure. Group allocation was done by envelop method. 80 no. of such sealed envelope with label T (transumbilical) and I (Infraumbilical) was kept in OT. Envelop was picked by some staff in the OT randomly and the approach of port insertion was selected accordingly. Group A (patients underwent

transumbilical port insertion) = 40 Group B (patients underwent infraumbilical port insertion) = 40

Operative technique: All the patients in the study were administered general anesthesia and placed in supine position. In Group A: After meticulously cleaning of umbilicus, umbilicus was lifted up and the central axle/apex of umbilicus was excised vertically with blade no. 11 after retracting the umbilical fold. The anterior abdominal wall was lifted both above and below the umbilicus. 10mm port was inserted blindly and location was confirmed visually using laparoscope and pneumoperitoneum will be done. All other ports were inserted under direct vision. At the end of procedure umbilicus was irrigated with normal saline and closed with interrupted sutures (no. 0 vicryl) in subcuticular fashion. In Group B: Infra-umbilical incision was given horizontally. Subcutaneous fat dissection was done and umbilical pillars were visualized.

Vertical incision was given at the junction of umbilical pillar and sheath. Port was inserted through the incision. Following parameters were evaluated: 1. Ease of entry. 2. Time taken from incision to camera port insertion with successful creation of pneumoperitoneum. 3. Bleeding from port site. 4. Number of attempts to enter peritoneum, loss of port, subcutaneous emphysema, gas leak from port site. Post-operative analysis was done. Post Op analgesic was given 8 hourly. Pain score using visual analogue scale (VAS) measured.

Patients were followed up to 8 weeks for delayed complications like port site pain, port site infection, port site hernia. Cosmetic outcomes were also noted. After completion of the study, observations obtained were tabulated, analyzed and evaluated using statistical methods. Statistical testing was conducted with the statistical package for the social science system version 17.0. Continuous variables were presented as mean \pm SD or median if the data was unevenly distributed. Categorical variables were expressed as frequencies and percentages. The comparisons of normally distributed continuous variables between the groups were performed using Student's t test. Nominal categorical data between the groups were compared using Chi-Square test or Fisher's exact test as appropriate. Non-normal distribution continuous variables were compared using Mann Whitney U test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

Results

In the present study a total of 80 patients (n=80) were included. Patients were randomized in two groups comprising of 40 patients each. Group A included 40 patients who underwent transumbilical port insertion (Transumbilical) (T) = 40 and Group B included another 40 patients who underwent infraumbilical port insertion (Infraumbilical) (I) = 40. Both the groups were comparable in terms of age and gender distribution (Table 1).

Table 1: Demographic characteristics

Parameter	Group A	Group B	Total	P value
Age in years	42.40 \pm 14.76	40.63 \pm 13.83	41.5 \pm 14.29	0.135
Gender female : Male	4:1 (32:8)	5.6:1 (34:6)	4.8:1 (66:14)	0.173

There were 3 cases of appendicitis and 77 cases of cholelithiasis for which Laproscopic cholecystectomy was done in 77 (96.25%) cases and laproscopic appendectomy was done in 3 (3.75%) cases. (Table 3)

Table 2: Distribution of cases according to diagnosis

Diagnosis	Group A (T)	Group B (I)	P value
Acute appendicitis	2 (5%)	1 (2.5%)	1.00
Cholelithiasis	38 (95%)	39 (97.5%)	
Total	40	40	80

Table 3: Type of surgery performed

Procedure	Group A (T)	Group B (I)	P value
Laproscopic Appendectomy	2 (5%)	1 (2.5%)	1.00
Laproscopic cholecystectomy	38 (95%)	39 (97.5%)	
Total	40	40	

The transumbilical first port entry was easy in 39 cases than 34 cases of infraumbilical port entry which was a significant difference in two group ($p=0.03$)(Table 4). The mean time to achieve pneumoperitoneum was 7.01 \pm 2.55 and mean time taken to achieve pneumoperitoneum in group A was 5.24 \pm 1.25 which was significantly less than group B

i.e 8.79 \pm 2.26 (Table 4). Intraoperatively, only 1 (2.5%) case of gas leakage in group A and only 1 (2.5%) case of loss of port in group B was observed (Table 4). There were 2 (5.0%) cases of port site bleeding in group B (Table 4). 1 (2.5%) case of bile duct injury and 2 (5%) cases of port site infection were observed in each group A and B (Table 4). Port

site hernia was observed in 2 (5%) cases in group A and in 1 (2.5%) case in group B (Table 4). Post-operative VAS score at one hour between two groups showed significant difference while latter on VAS score remained non-significant (Table 4).

There was no difference between two groups with regards to post-operative hospital stay (Table 4). Scar was not visible in transumbilical port insertion cases as compared to infraumbilical cases at 8 weeks.

Table 4: Comparison of Intraoperative and Postoperative variable

Variables	Group A (T)	Group B (I)	Total	P value
1.Ease of entry				
a) Difficult	1 (2.5%)	6 (15%)	7(8.75%)	0.03
b) Easy	39(97.5%)	34 (85%)	73(91.25%)	
2.No. of attempts to insert first port				
a) One attempt	39(97.5%)	38(95%)	77(96.25%)	0.603
b)Two attempts	1(2.5%)	1 (2.5%)	2(2.5%)	
c)Three three	0	1(2.5%)	1(1.25%)	
Mean±SD	1.03±0.16	1.08±0.35		
3.Time taken to achieve pneumo-peritoneum				
a) <5mins	23 (57.5%)	1(2.5%)	24(30%)	0.001
b) 5- 10mins	16 (40%)	33 (82.5%)	49(61.25%)	
c) >10mins	1 (2.5%)	6 (15%)	7(8.75%)	
Mean±SD	5.24±1.25	8.79±2.26	7.01±2.55	
Intraoperative Complications				
1.Without complications	39(97.5%)	37(92.5%)	76(95%)	0.256
2. Gas leakage	1(2.5%)	0	1(1.25%)	
3. Loss of port	0	1(2.5%)	1(1.25%)	
4.Port site bleeding	0	2(5%)	2(2.50%)	
Post-Operative complications				
1.Without complications	33(82.5%)	32(80%)	65(81.25%)	0.891
2.Bile duct injury	1(2.5%)	1(2.5%)	2(2.5%)	
3.Port site hernia	2(5%)	1(2.5%)	3(3.75%)	
4.Port site infection	2(5%)	2(5%)	4(5%)	
5.VAS at various time interval				
VAS_1 hour	4.73±1.11	5.30±1.14	5.01±1.12	0.025
VAS_6 hours	2.45±1.08	2.95±1.20	2.70±1.14	0.054
VAS_12hours	1.10±1.08	1.40±0.96	1.25±1.02	0.192
VAS_24hours	0.25±0.74	0.38±0.67	0.46±0.53	0.431
6. Post-operative Hospital stay (In days)	3.15±1.56	3.40±2.04	3.27±1.80	0.539

Discussion

Minimal access surgery in has shown rapid progress in recent years. First port insertion is the step of utmost importance in laproscopic surgeries with umbilicus being an important landmark for first port site insertion. First port can be introduced via open or closed method; at supraumbilical, infraumbilical or transumbilical sites. Available evidence has still not commented upon the best site and technique with respect to port insertion time, effortless entry, intraoperative and post-operative complications, infection rates and cosmetic outcomes. Hence, this study was done to compare the transumbilical and infraumbilical port insertion in laparoscopic surgery.

In the present study, minimum age was 22 years, maximum age was 87 years and mean value with standard distribution was 41.51±14.24. The mean and standard distribution of age in group A was 42.40±14.76 and in group B was 40.63±13.83 (Table 1). Similar to our study, study done by Sarder MAH et al on transumbilical first port placement observed a mean age of 45 years [6].

In our study, 66 females (82.5%) and 14 males (17.5%) were enrolled. Group A consisted of 8 (20%) males and 32 (80%) females. Group B consisted of 6 (15%) males and 34 (85%) females (Table 1). A study done by Elmegily HAA et al on open access technique by transumbilical and conventional methods during laproscopic

cholecystectomy found that laproscopic cholecystectomy was performed in females via transumbilical approach in 72.5% cases and via periumbilical site approach in 77.5% cases [9].

In our study, there were 77 (96.2%) cases of cholelithiasis, 38 each in Group A and 39 in B for which laproscopic cholecystectomy was done. There were only 3 (3.75%) cases of acute appendicitis, 2 in group A and 1 in B for which laproscopic appendectomy was done (Table 2, 3). Our study showed that first port entry was easy in 73 (91.25%) cases and tougher in 7 (8.75%) cases. This revealed that transumbilical first port entry was easier than the infraumbilical port entry. (Table 4)

In our study, the maximum number of attempts taken for first port insertion in group A was 2, which was only in one case and the mean value with standard deviation was 1.03+0.16. But in group B, 1 case with 3 attempts and 1 case with 2 attempts showed a mean value with standard deviation of 1.08+0.35. (Table 4). A study done by Wani et al. on comparison between transumbilical and infraumbilical closed port insertion techniques for camera placement in laparoscopic cholecystectomy showed 2 attempts in 10 patients and 3 attempts in 4 patients in the infraumbilical group & 2 attempts in 2 patients and 3 attempts in 1 patient in the transumbilical group [10].

Also, in our study, the minimum time to achieve pneumoperitoneum was 3.50 minutes and the maximum time was 16 minutes. In Group A, Mean time to achieve pneumoperitoneum was 5.24±1.25 while Group B, Mean time to achieve pneumoperitoneum was 8.79±2.26 (Table 4). This showed that time taken to achieve pneumoperitoneum in group A was significantly less compared to group B. A study done by Elmeligy H et al, in their comparison of transumbilical and conventional open access techniques for pneumoperitoneum creation during laparoscopic cholecystectomy, showed that the time taken for umbilical port entry was remarkably less in the transumbilical route compared to the supraumbilical and infraumbilical routes. They endorsed the use of transumbilical technique as it was faster for port entry [9].

Our study showed that maximum number of cases 76 (95%) were without any intra operative complications. Only 1 (2.5%) case of gas leakage was observed and that belonged to group A. Also, only 1 (2.5%) case of loss of port was observed and that belonged to group B. There were 2 (5.0%) cases of port site bleeding, both belonged to group B (Table 4) A study done by Sangrasi AK et al on a fast and effective technique for first port placement in pneumoperitoneum creation using infraumbilical modified open technique witnessed gas leakage in 6 cases (0.48%) and port site hematoma in 4 cases

(0.32%) (11) Karthik S et al. conducted a study on port site complications after laproscopic surgery and found port site infection in 10 (58%) cases, port site bleeding in 4 (23.5%) cases and port site hernia in 2 (11.8%) cases [12] In the present study, maximum number of cases 65 (81.25%) were without any post-operative complications. 1 (2.5%) case of bile duct injury and 2 (5%) cases of port site infection were observed in each group A and B. Port site hernia was observed in 2 (5%) cases in group A and in 1 (2.5%) case in group B. So, Port site hernia is more common in group A but the difference was not significant. (Table 4).

The study done by Elmeligy HAA et al on open access technique for pneumoperitoneum creation during laparoscopic cholecystectomy comparing the transumbilical and conventional port methods found that the port site infection in transumbilical port was in 2 cases which was less than the conventional sites with 4 cases of port site infection [9]. Pazzo R et al conducted a study on transumbilical portsite entry in laparoscopic surgeries and concluded that post-operative complications were found in 39 (4.0%) cases of which commonest was seroma in 24 (2.4%) cases, followed by SSI in 8 (0.84%) cases, incisional hernia in 5 (0.51%) cases and hematoma in 2 (0.21%) cases [13].

In our study, minimum and maximum VAS (visual analog score) observed was 0 and 8. Maximum mean value of VAS in group A and B were 4.73 and 5.30 respectively at 1 hour and the result was significant (p value = 0.025) but VAS score at 6 hours, 12 hours and 24 hours between two groups were not statistically significant (Table 4). Similar to this study a study done by Siribumrungwong B et al. compared the postoperative pain at umbilical wound site between transumbilical and infraumbilical incisions in conventional laparoscopic cholecystectomy. They carried out pain measurement using visual analog score at 6 hours, 24 hours and 7-day post operation and found no significant difference between the groups [14].

Comparing the duration of hospital stay in our study groups, group A had a minimum hospital stay of 2 days and maximum stay of 10 days (3.15+1.56); group B had a minimum stay of 2 days and maximum stay of 15 days (3.40+2.04) which was not significant (Table 4)

Conclusion

To conclude, cholecystectomy is by far the commonest procedure done laparoscopically using various techniques and sites for port insertion. By carrying out this study, we have drawn the inference that transumbilical port insertion technique in laparoscopic surgery is easy, safe and notably less time consuming. However, there is no significant difference in terms of intraoperative and post-operative complications between the transumbilical

and infraumbilical port insertion techniques. Hence, transumbilical port insertion can be considered as an alternative to the infraumbilical port insertion in laparoscopic surgeries.

Ethical approval: The study was approved by the institutional ethic committee

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