

Comparison of Direct Trocar Insertion with Other Techniques for Laparoscopy

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ABSTRACT

Objective: To assess the safety of direct trocar insertion (DTI) before creating pneumoperitoneum in laparoscopic procedures.

Study Design: An observational study.

Place and Duration of Study: Combined Military Hospital (CMH) Kohat, Pakistan from November 2013 to January 2015.

Methodology: All the cases undergoing laparoscopy at the study centre in the above duration were included in the study after approval from the Hospital Ethical Committee and informed written consent. Out of the 200 cases, DTI was successfully used to establish peritoneal access in 190 cases, while open Hassen's technique (OL) was used in ten cases. Body mass index (BMI) of all the patients was calculated before surgery. All the cases were performed under general anaesthesia with adequate relaxation. A 10 mm permanent re-useable sharp metallic trocar was inserted through umbilical scar after lifting the abdominal wall using towel clamps. Studied variables included age, gender, BMI, operations, history of previous surgery, number of attempts for DTI and complications.

Results: Mean age of the patients in DTI group was 46.58 ± 13.94 years, while 48.70 ± 10.08 years in OL group. Female to male ratio in DTI group was 1.43:1; and 2.33:1 in OL group. Increase in BMI had a relation with number of unsuccessful attempts of DTI, so obesity was the main reason of failure of DTI.

Conclusion: DTI is a safe and effective method of peritoneal access for laparoscopy with very low failure rate related to BMI and minimal complications.

Key Words: Direct trocar insertion. Hassen's technique. Laparoscopy. Obesity.

INTRODUCTION

With the advent of laparoscopic surgery, creation of pneumoperitoneum is the most inevitable step. This abdominal access is associated with some unique complications, which are extremely rare with open surgery. Common complications include surgical emphysema, haemorrhage, bowel perforation, and vascular injuries.^{1,2} In order to minimise these complications, several techniques have been introduced over a period of time to create pneumoperitoneum. The most commonly used techniques include classical closed method with Veress pneumoperitoneum needle, open (Hassen) technique, direct trocar insertion (DTI) without prior pneumoperitoneum, optical Veress needle, use of shielded disposable trocars, optical trocars, radially expanding trocars, and a trocar-less reusable visual access cannula.³⁻⁷ None of the above mentioned techniques are 100% safe and major complications like bowel and vascular injuries are documented with each technique.¹⁻⁷ Dingfelder was the first to publish his results on DTI technique in 1978.⁸ The advantages of

the technique included one blind step (trocar insertion) as compared to three steps in Veress needle technique (needle insertion, insufflation and trocar insertion). It is the fastest method for creation of pneumoperitoneum and its failure rate is also very low. However, this technique is least commonly used by the surgeons.⁹ In literature, there are several studies favouring different techniques for creation of pneumoperitoneum depending upon surgeon's training, experience and bias.

The aim of this study is to evaluate feasibility, safety and advantages of DTI for creation of pneumoperitoneum by general surgeons.

METHODOLOGY

Between November 2013 and January 2015, all the cases in which laparoscopy was used at Combined Military Hospital (CMH) Kohat, Pakistan were included in this prospectively conducted observational study. Exclusion criteria included cases with intestinal obstruction where gut was distended, cases with hepatitis B or C infection, ascites, pregnancy, Ischemic heart disease, CCF and COPD. Based on the previous published studies, expected complication rate with DTI was 4.5% to 8.7%.^{10,11} Sample size was calculated using WHO sample size calculator with absolute precision required 0.05 and confidence level of 95%. Minimal sample size required for the study was 139; however, 200 cases were included to improve the quality of study.

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BMI of all the patients was calculated before surgery and obesity was not considered a contra-indication for DTI. All the cases were performed under general anaesthesia with adequate relaxation. A 10 mm permanent re-useable sharp metallic trocar was inserted through umbilical scar after lifting the abdominal wall using towel clamps. Trocar was advanced into the cavity using gentle twisting movements. Entry was confirmed by inserting camera and visualisation of abdominal cavity after which insufflation was instigated. Data was collected on personal computer. The collected data included age, gender, BMI, operations, history of previous surgery, number of attempts for DTI and complications. Follow-up was done on the 5th, 10th, and 30th day. All the patients were asked to report to the author's OPD in case of any late complications after the 30th day of operation.

Data had been analysed using SPSS version 20. Descriptive statistics were determined to describe the variables. Mean values and standard deviations were used for quantitative data age and BMI, while frequency and percentage were calculated for qualitative data gender and number of attempts with different techniques for pneumoperitoneum. Statistical comparison was performed using independent samples t-test. Statistical significance was accepted at the value of $p < 0.05$.

RESULTS

Out of 200 cases, DTI was successfully used to establish peritoneal access in 190 cases, while open Hassen's technique (OL) was used in the rest of 10 cases where DTI was unsuccessful.

Mean age of the patients in DTI group was 46.58 ± 13.94 , while 48.70 ± 10.08 in OL group. Female to male ratio in DTI group was 1.43:1; and 2.33:1 in OL group.

In DTI group, peritoneal access was achieved successfully in first attempt in 176 cases (92.6%), in second attempt in 12 cases (6.3%), and in third attempt in 2 cases (1.1%). Mean BMI in cases with 1st successful attempt of DTI was 24.49 ± 2.38 , while it was 27.71 ± 2.75 in cases which required 2nd and 3rd attempts. This difference was statistically significant ($p < 0.001$). Similarly, mean BMI was also higher in OL group, i.e. 27.40 ± 6.09 versus 24.73 ± 2.55 in DTI group. ($p = 0.004$).

Out of 10 cases in OL group, 5 cases (2.5 %) had a previous abdominal surgery and OL technique had to be adopted electively due to risk on intra-abdominal adhesions.

Failure rate of DTI was 2.5% (5 cases), in which OL technique was used after three unsuccessful attempts of DTI.

There were no immediate major or minor complications related to peritoneal access in either of the two groups. Similarly, there were no long term complications like port

site hernia in 3 months follow-up. (More than 6 months follow-up in 60% of the cases).

DISCUSSION

Almost half of the complications of laparoscopic surgery occur during entry into the abdomen.^{9,12,13} Studies have also shown that 13 to 50% of vascular injuries and 30 to 50% of bowel injuries remain undiagnosed initially at the time of injury leading to increased morbidity and mortality.¹⁴ One of the advantages of DTI is early recognition of any major complication before insufflation of abdomen. Other advantages are avoidance of complications associated with Veress needle (VN) like preperitoneal or intestinal insufflation, failed pneumoperitoneum and CO₂ embolism.¹⁵

Several studies have compared Veress needle technique, DTI and OL. Byron *et al.* reported more than three attempts to enter the abdomen in 2.7% of cases, failed technique in 1.4%, and a total complication rate of 4.2% with a significant increased risk of minor complications ($p < 0.001$).¹⁶ In this series, there was 0% complication rate. This difference might be because of the smaller sample size as compared to Byron's study. In a meta-analysis by Jiang *et al.*,¹⁷ comparing DTI with Veress needle technique, seven randomized studies were included consisting of 2940 women (VN 51.88%, $n=1525$; DTI 48.12%, $n=1415$). Although there was no statistically significant difference in the risk of major complications between the two groups, a significantly higher risk of minor complications was detected in the VN group (RR =10.78 [6.27-18.51] with 95% confidence interval). In another study, Molloy *et al.* reviewed 51 publications.¹³ Cases included 134,917 Veress needle entries, 21,547 OL, and 16,739 direct entries. Entry-related bowel injury rates were 0.04% with Veress needle, 0.11% with OL and 0.05% with DTI. Similarly, corresponding vascular injury rates were 0.04%, 0.01%, and 0%, respectively. The authors did not find any clear evidence as to the optimal form of laparoscopic entry in the low-risk patient. However, direct entry may be an under-utilised and safe alternative to the Veress needle and open entry technique.⁹

Some surgeons consider OL as gold standard for creation of pneumoperitoneum. But this technique is also not 100% safe; and both bowel and vascular injuries are reported with this technique. Hassen's reported that for open laparoscopy, the rate of umbilical infection was 0.4%, bowel injury 0.1%, and vascular injury 0%. Molloy *et al.* reported bowel injury 0.1% and vascular injury 0.005% with OL technique.⁹ Also time required to create pneumoperitoneum with OL is between 3 to 10 minutes as compared to 1 to 2 minutes with DTI. Similarly, most surgeons also experience that OL does not always allow a good visualisation of peritoneal cavity through 10 mm incision, especially in

obese patients; whereas larger incisions invalidate the advantages of laparoscopy, and prone the patients to increased risk of port site hernia.⁹ Another problem with OL is risk of bowel injury in patients with midline scar due to intra-abdominal adhesions. DTI, however, had successfully been used in these patients at left upper quadrant or Palmer's point. This site (3 cm below the left costal margin in the mid-clavicular line) is rarely affected by adhesions, and with splenomegaly and stomach distension excluded, has been shown to be safe even in obese patients.¹⁸ Society of Obstetricians and Gynaecologists of Canada reviewed all publications on entry techniques in laparoscopic surgery and made their guidelines and reaffirmed the continued use for direct insertion of the trocar without prior pneumoperitoneum as a safe alternative to VN technique.¹⁹

In authors' experience, DTI was a very convenient method of creating pneumoperitoneum in patients with normal BMI. However, rise in BMI (> 27 kg/m²) was associated with increased number of attempts for DTI. Failure rate of DTI was also very low, i.e. 2.5%, and that too was seen in obese patients.

CONCLUSION

DTI is a very safe and reliable technique for creation of pneumoperitoneum, and should be used routinely instead of closed Veress needle technique. However, in patients with very high BMI (> 27 kg/m²), OL should be considered as an alternative technique.

REFERENCES

1. Akbar M, Khan IA, Naveed D, Khattak I, Zafar A, Wazir MS *et al.* Comparison of closed and open methods of pneumoperitoneum in laparoscopic cholecystectomy. *J Ayub Med Coll Abbottabad* 2008; **20**:85-9.
2. Krishnakumar S, Tampe P. Entry complications in laparoscopic surgery. *J Gynec Endosc Surg* 2010; **31**:4-11.
3. Kassir R, Blanc P, Lointier P, Tiffet O, Berger JL, Amor IB, *et al.* Laparoscopic entry techniques in obese patient: Veress needle, direct trocar insertion or open entry technique? *Obes Surg* 2014; **24**:2193-4.
4. Lanvin D, Elhage A, Querleu D. Does the use of pneumoperitoneum and disposable trocars prevent bowel injury at laparoscopy. A randomised experimental study in the rabbit? *Gynaecol Endosc* 1996; **5**:343-8.
5. Tinelli A, Malvasi A, Mynbaev OA, Tsin DA, Davila F, Dominguez G, *et al.* Bladeless direct optical trocar insertion in laparoscopic procedures on the obese patient. *JSLs* 2013; **17**:521-8.
6. Ahmad G, O'Flynn H, Duffy JM, Phillips K, Watson A. Laparoscopic entry techniques. *Cochrane Database Syst Rev* 2012; **2**:CD006583
7. Carlson WH, Tully G, Rajguru A, Burnett DR, Rendon RA. Cameraless peritoneal entry in abdominal laparoscopy. *JSLs* 2012; **16**:559-63.
8. F. Agresta, G. Mazzarolo, N. Bedin. Direct trocar insertion for laparoscopy. *JSLs* 2012; **16**:255-9
9. Molloy D, Kalloo PD, Cooper M, Nguyen TV. Laparoscopic entry: A literature review and analysis of techniques and complications of primary port entry. *Aust NZJ Obstet Gynaecol* 2002; **42**:246-54.
10. Theodoropoulou K, Lethaby DR, Bradpiece HA, Lo TL, Parihar A. Direct trocar insertion technique: An alternative for creation of pneumoperitoneum. *JSLs* 2008; **12**:156-8.
11. Shayani-Nasab H, Amir-Zargar MA, Mousavi-Bahar SH, Kashkouli AI, Ghorban-Poor M, Farimani M, *et al.* Complications of entry using direct trocar and/or Veress needle compared with modified open approach entry in laparoscopy: Six-year experience. *Urol J* 2013; **10**:861-5.
12. Merlin TL, Hiller JE, Maddern GJ, Jamieson GG, Brown AR, Kolbe A. Systematic review of the safety and effectiveness of methods used to establish pneumoperitoneum in laparoscopic surgery. *Br J Surg* 2003; **90**:668-9.
13. Ahmad G, Duffy JM, Philips K, Watson A. Laparoscopic entry techniques. *Cochrane Database Syst Rev* 2006; **16**:CD006583.
14. Fuller J, Scott W, Ashar B, Corrado J. Laparoscopic trocar injuries: A report from a US Food and Drug Administration (FDA) Center for Devices and Radiological Health (CDRH) Systematic Technology Assessment of Medical Products (STAMP) Committee. 8/25/2005;1-14. Available at: <http://www.fda.gov/cdrh/medicaldevicesafety/stamp/trocar.html>. Accessed April 4, 2007.
15. Catarci M, Carlini M, Gentileschi P, Santoro E. Major and minor injuries during the creation of pneumoperitoneum: A multicenter study on 12,919 cases. *Surg Endos* 2001; **15**:566-9.
16. Byron JW, Fujiyoshi CA, Miyazawa K. Evaluation of the direct trocar insertion technique at laparoscopy. *Obstet Gynecol* 1989; **74**:423-5.
17. Jiang X, Anderson C, Schnatz PF. The safety of direct trocar versus Veress needle for laparoscopic entry: A meta-analysis of randomized clinical trials. *J Laparoendosc Adv Surg Tech A*. 2012; **22**:362-7.
18. Tulikangas PK, Niclas A, Falcone T, Price LL. Anatomy of the left upper quadrant for cannula insertion. *J Am Assoc Gynecol Laparosc* 2000; **7**:211-9
19. Vilos GA, Ternamian A, Dempster J, Laberge PY. The Society of Obstetricians and Gynaecologists of Canada. Laparoscopic entry: A review of techniques, technologies, and complications. *J Obstet Gynaecol Can* 2007; **29**:433-65.

