

**PNEUMOPERITONEUM BY DIRECT TROCAR INSERTION: SAFE LAPAROSCOPIC ACCESS**Rajneesh Kumar<sup>1</sup>, Ankur Hastir<sup>2</sup>, M. K. Bandlish<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT:** Purpose of this study is to access the safety and efficacy of direct trocar insertion (DTI) for accessing the abdominal cavity for operative laparoscopy without prior pneumoperitoneum. DTI is one of the safe and effective alternative to veress needle insertion, open access (Hassan's technique) and visual entry systems (disposable optic trocars and endotip visual cannula) in laparoscopic surgery. **METHODS:** The study included 2480 patients who has undergone laparoscopic procedures at civil hospital, Jalandhar from Nov. 2003 to Sept. 2012 and at Punjab Institute of Medical Sciences (PIMS) Jalandhar from Sept. 2012 to June 2014. Procedures include 2310 laparoscopic cholecystectomies, 148 laparoscopic appendectomies, 10 cases of TAPP Groin hernia repairs and 12 cases of simple ovarian cysts. For DTI, abdominal wall was lifted and trocar was pushed through the fascia and muscle layer. The surgeon felt click when the trocar had pierced the peritoneum and entered the abdominal cavity. **RESULTS:** Direct trocar insertion was feasible in 100% of patients. There was no evidence of intestinal or vascular injury during trocar placement. Peritoneal access and creation of laparoscopic workspace were attained faster and more efficiently by the DTI technique. **CONCLUSIONS:** DTI is a fast, safe and reliable alternative to traditional techniques of primary port placement in laparoscopic procedures for creation of pneuoperitoneum. **KEYWORDS:** Direct trocar insertion (DTI), Pneumoperitoneum, veress needle (VN), Laparoscopy.

**INTRODUCTION:** The establishment of pneumoperitoneum is a pre-requisite for most laparoscopic surgeries and the method used is not necessarily dependent on the procedure for which it is intended. Over the last decade rapid increase has occurred in both the applications of operative laparoscopy and the number of surgeons using this technique. Laparoscopic abdominal surgery requires the establishment of successful pneumoperitoneum in the vast majority of patients with more than half of all the complications occurring at the time of entry into abdomen.

The rationale for an adequate pneumoperitoneum is that it provides buffer space between the insertion site and pelvis or abdominal viscera. Several techniques and technologies have been introduced over the past 50 years to minimize laparoscopic related injuries. The standard technique of insufflation after insertion of Veress needle, open laparoscopy involving opening of the peritoneum under direct vision (Hasson's method), optical trocar insertion and direct trocar insertion (DTI) as well as variants of these techniques.

Recent experiences with laparoscopy has revealed significant complication associated with Veress needle insufflation such as gas embolism, subcutaneous emphysema, failed pneumoperitoneum with resultant failed laparoscopy and bowel and visceral insufflations.<sup>(1,2)</sup> Open assess as described by Hasson in 1971<sup>(3)</sup> has shown to minimize vascular injuries but does not reduce bowel injury. Also open access is complicated by gas leak and port instability.

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The DTI technique was first reported by Dingfielder in 1978<sup>(4)</sup> and later described by Copeland et al in 1983. According to Copeland et al, the keys to a successful DTI are adequate wall relaxation, proper skin incision and the use of a sharp trocar.<sup>(5)</sup> Byron et al preferred direct trocar insertion technique for trocar placement because it had fewer minor complications and less operating time.<sup>(6)</sup>

The rationale for DTI without pneumoperitoneum is based on the fact that many complications reported during laparoscopic procedures are directly related to the use of Veress needle. DTI has been reported as a safe alternative to VN insertion. Direct insertion of the trocar has been associated with fewer insufflation-related complications, such as gas embolism and to be a faster technique than the Veress needle technique.<sup>(7)</sup> The present study was conducted to assess the safety and efficacy of direct trocar insertion on a bigger sample size.

Direct trocar insertion although a blind procedure reduces the number of “blind steps” from 3 with veress needle (insertion, insufflations, and trocar introduction) to just one, that of trocar introduction. It is fast as it is a one step pneumoperitoneum.

**MATERIAL AND METHOD:** In present study, Direct trocar insertion was performed on 2480 laparoscopic procedures from the Nov, 2003 to June, 2014. 2140 study subjects were females and 340 study subjects were males. The mean age was 32 yrs ranged between 16 to 72 years. Procedures include 2310 laparoscopic cholecystectomies, 148 laparoscopic appendectomies, 10 cases of TAPP Groin hernia repairs and 12 cases of simple ovarian cysts. All operations were performed by one consultant surgeon. All study subjects were placed in the laparoscopic surgery position. Operating table is lowered at or below the level of surgeon’s waist. After institution of adequate General anesthesia for relaxation of lower abdomen, a 12-15 mm skin incision was made vertical or horizontal at the level of umbilicus, infraumbilical or supraumbilical wide enough for trocar to be inserted without undue resistance from the skin. Care is taken to make the incision length slightly greater than the diameter of trocar, and all the layers of skin are cut down to peritoneum through entire length of the incision. Sharpness of the pyramidal trocar is important, because force to insert blunt trocar will bring the abdominal wall back down onto bowel and vessels at the time of entry. The lower abdominal wall was lifted by left hand grasping between the umbilicus and pubic symphysis, and elevated with moving the skin upward.

With elevated abdominal wall tip of 10mm trocar is freely inserted through the incision at a 90 degree angle and advanced in a controlled manner into the abdomen into the peritoneal cavity with a twisting semicircular motion. Surgeon holds the trocar with his index finger positioned 3-4 cm away from the trocar tip to guard against sudden uncontrolled entry into the abdomen. In contrast to veress needle insertion, where one can feel the penetration through the fascia and peritoneum separately a distinct single “Click” on entering/piercing sheath and peritoneum is being felt with palm of right hand which signifies that trocar has pierced the fascia and peritoneum. These simple steps allow easier introduction of trocar with minimum force and maximum control. The laparoscope is then introduced, proper intraperitoneal placement ascertained and a pneumoperitoneum created with high flow insufflations. The CO2 stopcock is left open so as to relieve the negative intra-abdominal pressure caused by the abdominal wall elevation and allow apposed viscera to fall back. The underlying structures are then examined carefully for injury. In all the study subjects’ skin incision, adequate wall relaxation and use of sharp trocar was done. In patients who had

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previous laparotomies, upper umbilical incisions, Palmer's point entry was done and they were excluded from the study. Even in patients who had either Pfannenstiel or lower midline incisions were subjected to DTI by supraumbilical port insertion.

**RESULTS:** It was observed that in our study of DTI there were no complications related to trocar entry and trocar was inserted successfully into the abdomen in all the study subjects. None of the complications like subcutaneous emphysema, minor and major vascular injury, gas embolism and injury to internal structures like bowel or bladder during abdominal entry was reported. All cases done with single attempt. In no case was there failure to insert trocar. No port site infection, which we routinely prevent by putting trocars dipped in povidine iodine solution before insertion.

**DISCUSSION:** Ever since the first laparoscopy was performed by Jacobeus of Sweden in 1925<sup>(8)</sup> different techniques, technologies and evidence based guidelines have been introduced to eliminate risk associated with laparoscopic entry whatever method to be adopted for first port entry into the abdomen. Good surgical skills and proper evaluation of the patient are important for safe access in minimal invasive surgery, as it is a blind procedure associated with vascular and visceral injuries and potential exists for serious morbidity during initial laparoscopic access.

From studies it is proved that 50% of laparoscopic surgeries major complications occur prior to commencement of surgery<sup>(9,10)</sup> & there is delay in diagnosis of visceral injury or delay in morbidity will increase leading to mortality.<sup>(11)</sup>

Direct trocar insertion without previous pneumoperitonium has been shown before to be a safe and effective method associated with fewer complications.<sup>(4,5,6)</sup>

Literature gives one impression that gynecologists are more worried about access related complications<sup>(12,13)</sup> as they have to call surgeon for vascular and enteric injury where surgeon tackles himself by converting to open procedure.

DTI has statistically significantly lower incidence of bowel injury as compared to the technique (1.9/1000 for V.N. 1.5/1000 for open and 0.3/1000 for D.T.I)<sup>(12)</sup>

Most proponent of D.T.I. consider previous surgery a contraindication to direct umbilical entry preferring entry at Palmer's point or an open placement technique. Dingfelder, when first outlined the technique of D.T.I. in 1978, specified avoidance of previous incision sites<sup>(4)</sup>

Minor complications were significantly more frequent in the veress needle method,<sup>(14)</sup> this is because of insufficient depth achieved with the veress needle, resulting preperitoneal insufflation and that will lead to difficulty in subsequent placement of trocar.

Intra - abdominal injuries are avoided by the direct placement of 1<sup>st</sup> trochar without previous pneumoperitoneum because of peristaltic movement which tends to distance the intestine and omentum from the cutting object.<sup>(15)</sup>

Direct trocar entry is only one blind cutting maneuver in D.T.I. as against that of veress needle: two blind entries with one intervening blind insufflation, insufflation and trocar insertion.<sup>(16-17)</sup> Another benefit of D.T.I. is that it takes less time to establish pneumoperitonium. Prieto et al<sup>(18)</sup> reported a laparoscopic insertion time that was significantly different between two techniques (D.T.I. 1.5 +\_ 0.5 versus V.N. 3.0+\_ 0.4 minutes < 0.001).

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Byron et. al<sup>(14)</sup> reported mean insertion time of 2.2 minutes and 5.9 minute for D.T.I. & V.N. technique respectively. These shows that procedure itself is a simpler and because of enhanced flow rate through the wider cannula as against veress needle.

Altun and associates compared DT and VN techniques and reported 2.2% major complications for VN, but nothing for D.T.I. They also reported 6.75% minor complications for VN and 2.05% for DT. They concluded that surgeon's preference, skill, anatomic knowledge and experience are determining factors in the selection of technique.<sup>(19)</sup>

Other advantages of D.T.I. are that pre – insufflation makes it difficult to grasp and elevate abdominal wall for counter pressure during primary trocar entry. Pressure of 12 – 15 mm Hg is high enough to distance the abdominal wall elasticity and dynamics.<sup>(4, 20)</sup>

An adherent unmovable gut loop is equally likely to be penetrated by both needle and trocar if it directly underlies the entry site, Pre – insufflation cannot obviate injury to an adherent bowel loop. This risk may be minimized but is not eliminated even by open Hasson's placement.

Volpi et. al suggests strong elevation of the umbilical scar with towel clips and using a scalpel blade tip for peritoneal entry.<sup>(13)</sup>

According to Woolcott,<sup>(21)</sup> each method has individual advantages and disadvantages, with similar morbidity and mortality, when performed by experienced operators with appropriate indications. Preference should be given to the method with which the surgeon is most comfortable, or with which he or she has the most experience.

The Open Access technique was described by Hasson in 1971 and was recommended for patients with previous laparotomies when adhesions were well expected.<sup>(22)</sup> The reported problem with this technique was gas leakage.

Ahmad G et al (2012) in their similar study reported that a reduction in the incidence of failed entry, reduced risk of extraperitoneal insufflation and reduced omental injury were demonstrated with the use of direct entry technique in comparison to Veress needle entry.<sup>(23)</sup> In the study of Brill et al<sup>(24)</sup> – 5,360 women who had prior laparotomies were evaluated for adhesions between the anterior abdominal wall and underlying omentum and bowel at operative laparoscopy. Specifically, the patients with midline incision extending above the umbilicus were more likely to have bowel adhesions, when compared with these with either Pfannenstiel or lower midline incision.

We have no complication of D.T.I. in patient who had Pfannenstiel or lower midline incisions. In these cases we opted for supraumbilical port insertion without any complication, adhesions if present are lower down in pelvis. Only upper umbilical midline incisions were subjected to Palmer's Point.

The author is using this technique of DTI since 1992 while performing tubal band ligations (Tubal sterilization) in family planning camps both in rural and urban areas where 20 – 30 and sometimes more cases were to be done in single day.

We are using DTI technique in cases of laparoscopic surgeries other than tubal sterilization since 2003. In the present study of 2480 cases of laparoscopic surgeries other than tubal sterilization were subjected to DTI, out of which in 22 cases Palmer's point technique was used, due to history of previous surgery. There is no complication reported till date. Elevating the abdominal wall and inserting the trocar before insufflation makes it easier to feel each layer during trocar insertion than it is when the abdomen is distended with gas. Abdominal distension secondary to insufflation necessitates increased force to achieve trocar insertion. In our opinion, this method is easier, safer

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and more effective than the veress needle technique. We support that this technique when taught under supervision and practiced on appropriate abdomen not previously operated upon is clinically more secure than the standard Veress needle insufflation technique. It is easy to learn and practice. Safe for use in very thin and obese patients. It is superior to veress needle insertion because it eliminates time consuming steps. The present study was conducted to assess the safety and efficacy of direct trocar insertion technique. Our findings were consistent with those from the literature with no major complications.

No complication is occurred if there is proper case selection, not previously operated, and practiced in relaxed abdomen, adequate incision; sharp instruments, anatomical knowledge and dynamics, Proper elevation of abdomen are requirement of this technique.<sup>(5,17)</sup>

**CONCLUSION:** We conclude that Direct trocar insertion to establish for initial access in laparoscopic surgery is safe, fast, efficacious and provides quick entry into peritoneal cavity without prior pneumoperitoneum. It has very high feasibility rate and was found to be free of major complications. DTI is underutilized and safe alternative to VN and open entry technique.<sup>(25)</sup>

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