Direct Trocar Insertion: A Safe Laparoscopic Access

N Mahajan, N Gaikwad

Citation

N Mahajan, N Gaikwad. *Direct Trocar Insertion: A Safe Laparoscopic Access*. The Internet Journal of Gynecology and Obstetrics. 2006 Volume 8 Number 2.

Abstract

Background: The most important and potentially dangerous first step in laparoscopy is safe and successful insertion of a primary port. Techniques for the creation of pneumoperitoneum at laparoscopy include the standard technique of insufflation after insertion of the Veress needle (VN) via the umbilicus, open laparoscopy, optical trocar insertion and direct trocar insertion (DTI) as well as variations on these techniques. The DTI technique without pre-insufflation is an alternative to VN insertion and open laparoscopy for accessing the abdominal cavity for operative laparoscopy. It recommends elevation of anterior abdominal wall with the non-dominant hand while inserting the sharp primary trocar directly and blindly towards the peritoneal cavity with the other.
Conclusion: After reviewing the methods available and surveying the existing data concerning the rates of failure and complications, we conclude that, DTI at laparoscopy is a safe alternative to the VN technique and is associated with fewer minor complications.

INTRODUCTION

In minimal access surgery, technique of first entry inside the human body with telescope and instruments is called access technique. The first and the most important but potentially dangerous step in laparoscopy is safe and successful insertion of a primary port which is the first access site through which a lens, camera and light is introduced. The existence of numerous techniques for the creation of pneumoperitoneum at laparoscopy indicates that none have been proven totally efficacious or complication free. These methods include the standard technique of insufflation after insertion of the Veress needle (VN), open laparoscopy involving opening of the peritoneum under direct vision, optical trocar insertion and direct trocar insertion (DTI) as well as variants of these techniques.

Many of the complications associated with operative laparoscopy arise from creation of the pneumoperitoneum, such as subcutaneous emphysema and gas embolism, injury to internal structures during abdominal entry, minor and major vascular injury and intraperitoneal adhesions. Published data reveals that a minimum of 25% of practicing gynecologists has experienced VN or cannula injuries[1]. Significant complications from laparoscopy are primarily visceral and vascular injury. Published reports suggest an incidence of complications of between 0.6 and 1.0 per 1000 for minor and diagnostic procedures and between 8.9 and 17.9 per 1000 for advanced procedures[2,3].

BACKGROUND

The number of laparoscopic procedures has increased steadily since the late 1980s. Each year, more than 2 million patients undergo laparoscopic procedures in the US. Estimates of the numbers of trocars used in the U.S. indicate a steady increase from just over 3 million in 1994 to nearly 4.8 million in 2000[4]. Injuries occur most frequently during insertion of trocars into the abdomen or pelvis. Several studies[5,6,7,8,9] suggest that the initial trocar insertion is the most dangerous aspect of trocar use, and possibly the most dangerous step in minimally invasive surgery. A 1996 study by Champault et al[6] found that 83% of vascular injuries, 75% of bowel injuries, and 50% of local hemorrhage injuries were caused during primary trocar insertion. The Wherry review[10] of patient records in military facilities found a 6% complication rate. The average incidence of trocar-related vascular injuries is approximately 0.1%. Bowel injuries are reported to occur more frequently, with the average incidence less than 1%. Mortality rates are typically reported at 0.1% or less[10].

Minimally invasive surgery typically involves use of multiple trocars and cannulas. The primary trocar is used to

place a cannula through which a laparoscope is inserted to view internal structures. Secondary trocars aids in insertion of other instruments such as biopsy forceps, etc. Along with the Hasson procedure, several other techniques have been used to improve the safety of primary trocar insertion. Semm[11] advocated blind access with a VN and insufflation before primary trocar insertion. Injuries related to the blind VN insertion led to studies on alternative methods. Some suggest it is safer to skip the VN step altogether and use a DTI technique[12,13,14]. Schaller and associates[15] recommended open dissection and identification of the tissue layers during VN placement.

DIRECT TROCAR INSERTION

The DTI technique without pre-insufflation is an alternative to VN insertion and open laparoscopy for accessing the abdominal cavity for operative laparoscopy. It recommends elevation of anterior abdominal wall with the non-dominant hand while inserting the sharp primary trocar directly and blindly towards the peritoneal cavity with the other. CO2 gas stopcock must be kept open, to relieve negative intra-abdominal pressure, as soon as the vented instrument tip enters the sealed peritoneal space. It is postulated that viscera falls off its parietal apposition prior to contact with advancing sharp trocar[16].

In a study by Byron et al[14], DTI was performed in 1249 laparoscopic procedures. There were no major complications. With increased experience, the frequency of minor complications decreased: 5.3% in 1983, 5.0% in 1984, and 1.3% in 1985. Similar observations were made by Byron et al[16], Copeland et al[17] and Inan et al[18]. Jacobson et al[19] reviewed DTI in 1385 patients, VN insertion in 133 patients and open laparoscopy was used in 22 patients. Three (0.21%) major complications occurred: 1 enterotomy, 1 omental herniation, and 1 bowel herniation. No trocar-related injuries occurred among patients in whom the DTI technique was used.

In open comparative randomized prospective study in 598 nonobese patients, DTI was feasible in 100% of patients vs. 98.7% in the VN group. Minor complications were nil in the DTI group and 5.9% in the VN group ($p < 0.01$). Major complications were nil in the DTI group and 1.3% among VN patients[20]. In a recent study by Ziya et al[21], 578 patients who underwent laparoscopic procedures were assigned to one of the following groups: blind insertion of the VN (group 1, n = 301) and DTI (group 2, n = 277). Total complication rates were 15.7% (n = 33) and 3.3% (n = 4) in groups 1 and 2, respectively ($P < 0.05$). Although it may seem intuitive that the Hasson technique (using an open approach) for trocar placement is safer than blind trocar insertion, the level of safety provided is the subject of some debate[8,10,22,23].

DISCUSSION

Despite numerous recent technical advances in minimally invasive surgical technique, the potential exists for serious morbidity during initial laparoscopic access. Safe access depends on adhering to well-recognized principles of trocar insertion, knowledge of abdominal anatomy, and recognition of hazards imposed by previous surgery. Trocar use requires considerable training, practice, skill, manual dexterity, adequate muscular strength, knowledge of the associated risks, and careful patient selection. Debate continues over the protection provided by fail-safe features in preventing trocar related injury (shields, optics, radially-expanding designs). Due to their unique design and use issues, trocars with these features may require additional training, knowledge, or skill[24].

According to Woolcott[25], each method has individual advantages and disadvantages, with similar morbidity and mortality, when performed by experienced operators with appropriate indications. The individual surgeon should assess which technique best suits his or her operating style in light of the particular circumstance of each patient. Preference should be given to the method with which the surgeon is most comfortable, or with which he or she has the most experience.

In entering the abdomen directly with a trocar, critical surgical points are emphasized: adequate relaxation, sharp trocars, adequate skin incision, and elevation of the abdominal wall and insertion of the trocar into the true pelvis. When DTI is compared to other laparoscopic access techniques, it offers certain advantages over other techniques. This technique offers more clinical security because it does not place reliance on secondary tests but emphasizes concentration entirely upon surgical skill and anatomic knowledge during entry[17]. After creation of pneumoperitoneum lifting of abdominal wall is not easy since it tends to slip but it should be grasped firmly as to offer some counter force against the pressure exerted by the tip of trocar.

Subcutaneous emphysema, one of the main complications of needle-induced pneumoperitoneum is reduced in DTI. Single blind entry in DTI can be considered superior to VN

insertion as it allows insertion of a single trocar instead of two blind entries in VN insertion technique. DTI also reduces the operation time. The time saved using the DTI is explained by a significant reduction in the mean laparoscope insertion time, which was 2.2 minutes and 5.9 minutes for the DTI and VN techniques, respectively[16].

After reviewing the methods available and surveying the existing data concerning the rates of failure and complications, we conclude that DTI at laparoscopy is a safe alternative to the VN technique and is associated with fewer minor complications. Finally, we recommend a large-scale combined survey by the colleges of obstetricians and gynecologists and surgeons on rates of failure and complications of the varied approaches of abdominal entry for laparoscopy.

CORRESPONDENCE TO

Dr. Niraj N. Mahajan 31, Dhaqnvantri Nagar, Sevagram, Dist- Wardha, State– Maharashtra, India. Pin – 442102 Tel. 091-9821899581, Fax 091-7141263346, Email: nirajdr@hotmail.com

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Author Information

Niraj N. Mahajan, M.D.
Ex-consultant, Department of Obstetrics and Gynaecology, Padhar Hospital

Nilima L. Gaikwad, MD
Consultant, Department of Obstetrics and Gynaecology, Padhar Hospital