

# Visually Guided Trocar Entry: Experience with the Optical Trocar

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**B**lind insertion of the Veress needle and the conventional primary trocar have remained troublesome steps during laparoscopic surgical procedures. The standard primary trocar can be inserted directly without preexisting pneumoperitoneum, thus avoiding use of the Veress needle. This approach still requires blind insertion, and inadvertent traumatic injuries have been reported.<sup>1</sup> Complications from such trocar insertions can be severe and at times lethal. Although the rate of such complications is acknowledged to be small, the absolute number becomes a relevant public health issue in light of the high frequency of both operative and diagnostic laparoscopic procedures worldwide. Traumatic injuries to vessels, bowel, and other abdominal organs continue to occur despite proper surgical training, operator experience, and use of up-to-date equipment.

With difficult blind trocar insertions, most laparoscopic surgeons commonly experience a few tense moments before the proper intra-abdominal placement of the instrument is verified with the conventional laparoscope. During standard entry, uncertainty about the exact location of the trocar tip contributes to various inadvertent injuries.<sup>2</sup> To provide

greater confidence in penetrating the abdominal wall, one of the authors (SGK) introduced the optical trocar (Endopath Optiview™) into clinical practice (Ethicon Endo-Surgery, Cincinnati, Ohio).<sup>3</sup> The broad potential benefits of such a visually directed trocar entry system have been identified in a follow-up clinical series.<sup>4</sup> In this report we describe the use and the

additional advantages of video-aided continuous visual imaging and blunt dissection during trocar entry at laparoscopy.

## **INSTRUMENT AND METHOD OF INSERTION**

The optical trocar has an optically clear transparent blunt conical tip with recessed plastic tissue separators on each

side (Fig. 1). It comprises a hollow shaft and an ergonomically designed handle to provide the operator with a more natural motion for the penetration. The obturator is complemented by a conventional 0-degree 10-mm laparoscope with the usual light source and video attachments. The trocar sheath is standard and is applied prior to insertion (Fig. 2). Figure 3 shows the complete assembly and grasping position for insertion.

At the outset of the operation, a 1.3-cm semilunar incision is made at the lower rim of the navel. The tip of the optical trocar is first inserted parallel with the skin surface (Fig. 4). The instrument is advanced approximately 3 cm under the skin (upper portion of the "Z" technique); then the optical trocar is redirected at a 90-degree angle to the abdominal wall so as to create the most direct approach for penetration. The surgeon and assistant each firmly grasp and lift the abdominal wall laterally midway between the symphysis and umbilicus to provide countertraction to the trocar throughout the insertion process (Fig. 5). These steps help to avoid

abdominal wall tunneling. Once the conical tip enters the peritoneal cavity, the instrument is redirected again toward the pelvis to complete the "Z" technique until satisfactory placement is assured. The obturator is then removed and the same laparoscope is reintroduced for the diagnostic or operative laparoscopy.

Progressively penetrating layers of the abdominal wall, the optical trocar assembly provides a characteristic contact view of tissues. The yellow fatty tissue is easy to separate provided the skin incision is adequate. The fascia appears characteristically white and it can be split atraumatically by forward rocking motion along its longitudinal fibers (Fig. 6). Penetrating the fascia is associated with recognizable tactile resistance. Beneath the fascia the vascular yellow preperitoneal fat begins to appear followed by the transparent peritoneum (Fig. 7). Bowel and omentum movement can be readily observed through the peritoneum. Figure 8 shows partial entry into the gas-filled abdominal cavity. Furthermore, the blunt nature of the conical tip permits direct contact of these viscera

without trauma.

#### EXPERIENCE WITH THE NEW TECHNIQUE

To date 165 healthy women of reproductive age were recruited for an initial clinical study. All subjects requested laparoscopic sterilization and provided appropriate informed consent. Routine preoperative workup included a medical history, physical examination, and laboratory screen. Pneumoperitoneum was established in 105 cases prior to insertion. The optical trocar assembly was employed in all cases and video documentation of the entire insertion process obtained. Sterilization was achieved with bipolar coagulation.

All procedures were completed successfully. No multiple insertions were required and the proper intra-abdominal placement was verified in all cases. There had been two patients with omental adhesions at the insertion site and the instrument had to be advanced through an avascular area of the omentum under direct visualization. Two additional women were

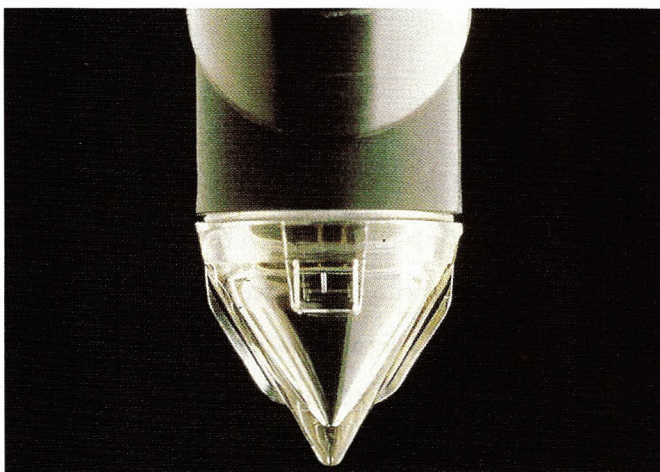


Figure 1. Blunt transparent conical tip with recessed tissue separators.

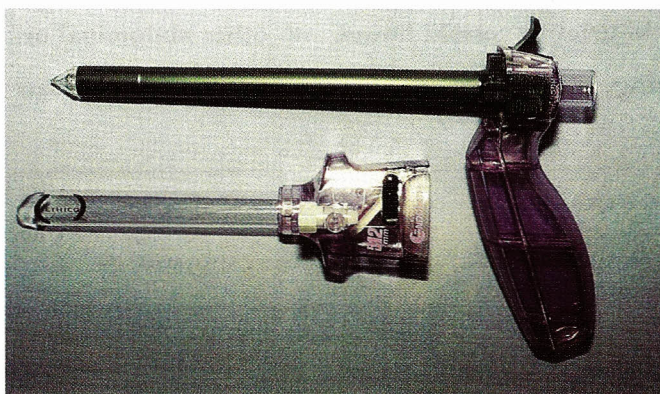


Figure 2. Hollow obturator with handle and standard trocar sheath.

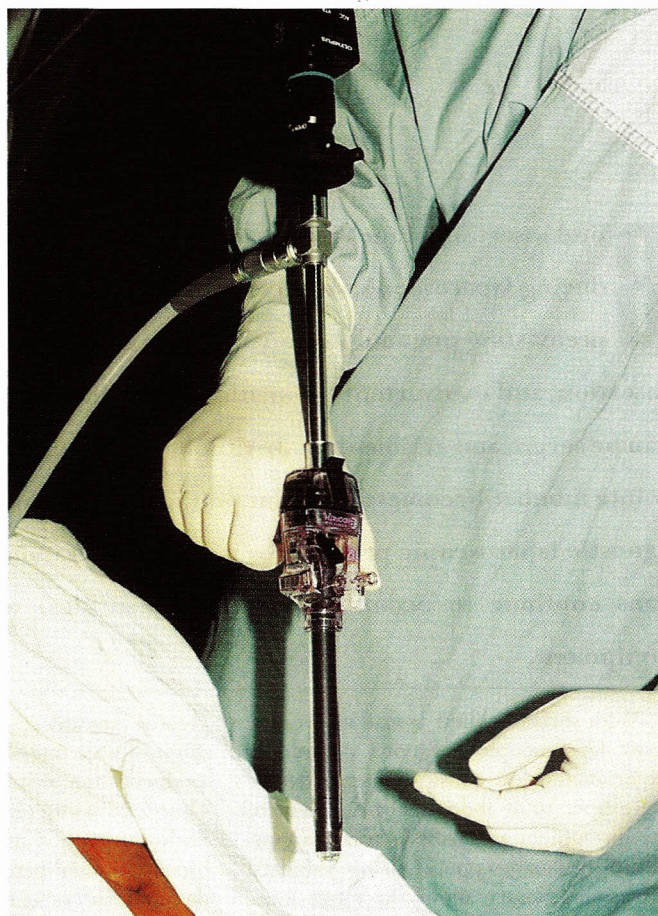


Figure 3. Complete assembly of optical trocar (Endopath Optiview™) with grasping position (Ethicon Endo-Surgery, Cincinnati, Ohio).

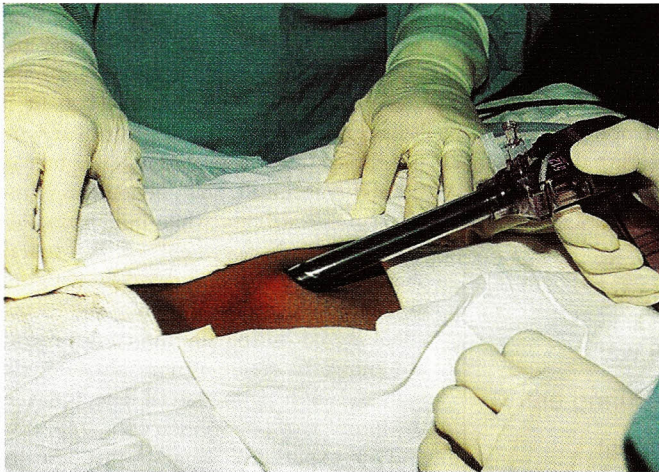


Figure 4. Insertion of optical trocar under the skin.

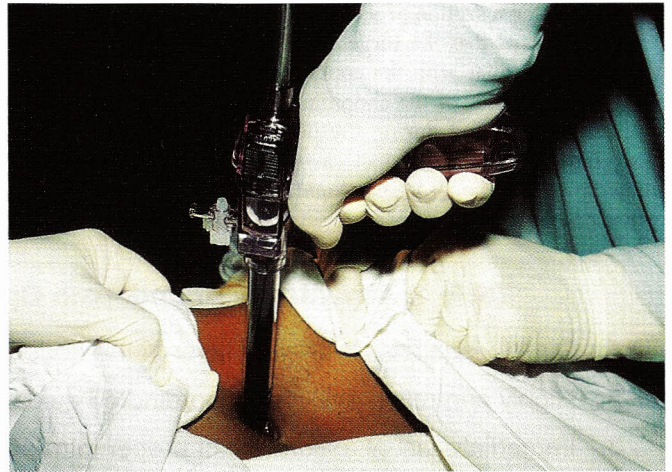


Figure 5. Proper position of the instrument and elevation of the abdominal wall during penetration.



Figure 6. Separation of the fascia along its longitudinal fibers.

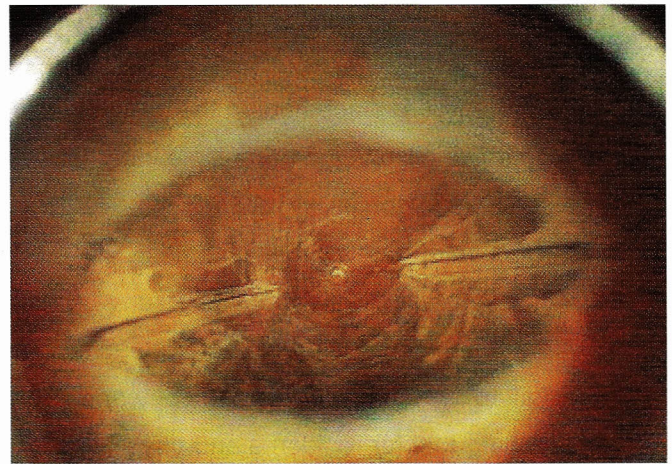


Figure 7. Direct view of vascular preperitoneal tissues.

found to have bowel adhesions in front of the advancing optical trocar, but by redirecting the trocar it was feasible to bypass the intact bowel. In three instances, where pneumoperitoneum could not be established with the Veress needle, direct insertion of the instrument still permitted proper intra-abdominal entry. No postoperative complications have yet been noted.

#### COMMENTS

Despite widespread use of safety shields and other modifications, all traditional trocars share a common characteristic. They blindly penetrate with sharp cutting edges. The optical trocar provides two distinct advantages over these currently employed instruments. The new system offers an opportunity for the surgeon to verify all tissues visually before advancement and it provides a less traumatic dissection through its blunt conical tip and tissue separator design. Our clinical experience suggests that these features yield numerous ad-

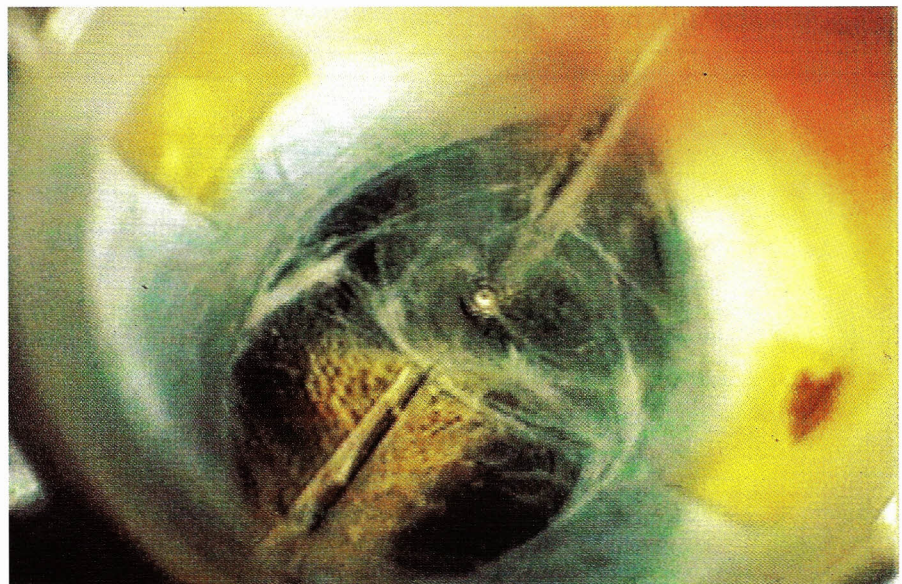


Figure 8. Partial entry through the peritoneum into the abdominal cavity.

vantages for utilizing this optical trocar (Table 1). Most of these advantages stem from the simple fact that the operator enjoys continuous visual control throughout

the blunt dissection. At the present time, Endopath Optiview is the only commercially available penetrating instrument which provides this level of visualization

throughout the insertion process.

It is essential that the surgeon become thoroughly familiar with the contact view of each tissue layer of the abdominal wall while it is separated during the penetration. Entering the abdominal cavity will allow a conventional laparoscopic view when pneumoperitoneum is present. For

this reason it is advisable that pneumoperitoneum be established initially. After sufficient experience has been gained recognizing all tissues on contact view, direct insertion of the optical trocar may be recommended, thus eliminating the need for a blind Veress needle use. Although the peritoneum may lay over intra-abdominal

organs, maneuvering with the instrument and adequate elevation of the abdominal wall can help to reveal the proper anatomy.

As an unanticipated additional benefit, it has been noted that trocar placement with the optical trocar appeared much tighter in the abdominal wall. This phenomenon provides greater stability while minimizing intraoperative displacement of the trocar sheath. It has been postulated by Barad et al. that atraumatic separation of the tissues encountered during the insertion process are known to create a more physiological seal, and suturing the fascial defect may in the future prove unnecessary.<sup>5</sup>

Our experience suggests that visually guided blunt dissection provided by the Optical trocar may emerge as a new standard of care to penetrate the abdominal wall during laparoscopy. **STI**

### Table 1. Advantages of Endopath Optiview

1. Direct visualization of each layer in the abdominal wall
2. Highly controlled eye-hand coordinated guidance during entry
3. Immediate visual assurance of proper intra-abdominal placement
4. An opportunity to stop and redirect the instrument in any given moment
5. A tighter trocar placement in the abdominal wall
6. A potential elimination of multiple insertions and a reduction of failed laparoscopies
7. Reduction of unrecognized injuries
8. Increased safety with direct insertion
9. A potential reduction of distant abdominal organ injuries
10. An alternative for open laparoscopy and mini-laparotomy
11. Teaching tool for residents and physicians
12. Continuous video documentation of the entire procedure for medico-legal protection

### REFERENCES

1. Kaali SG, Bartfai G. Direct insertion of the laparoscopic trocar after an earlier laparotomy. *J Reprod Med* 1988;33:739-40.
2. Yuzpe AA. Pneumoperitoneum needle and trocar injuries in laparoscopy. A survey on possible contributing factors and prevention. *J Reprod Med* 1990;35:485-90.
3. Kaali SG. Introduction of the Opti-Trocar. *J Am Assoc Gynecol Laparosc* 1993;1:50-3.
4. Kaali SG, Barad DH, Merkatz IR. Comparison of visual and tactile localization of the trocar tip during abdominal entry. *J Am Assoc Gynecol Laparosc* 1994;2:75-7.
5. Barad DH, Witt RW, Levy J, et al. Abdominal wall stability of Optical Trocar compared with that of a reusable laparoscopic trocar. *J Am Assoc Gynecol Laparosc*. In press.