

Technique of Laparoscopic Appendectomy Assisted by A Robotic Laparoscopic Positioner

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Abstract

This paper describes a technique of laparoscopic appendectomy assisted by a robotic laparoscopic positioner called AESOP (Automated Endoscopic System for Optimal Positioning).

The three-trocar technique operates with a 10 mm-port at umbilicus, two 5 mm-ports at left and right suprapubic hairline and lateral to rectus muscles. The first port is made at umbilicus by semi-open technique. AESOP is fixed to the left upper part of the operating table and the 10 mm-laparoscope is positioned under surgeon's voice control. Two-hand technique conducts the operation by left-hand grasper and right-hand cauterized dissector, 5 mm-clip applier, ligature and scissors. The appendiceal stump is ligated by double chromic endoloops or single chromic endoloop with a purse string suture. Occasionally when needed, 10 mm GI-stapler (endoGIA[®], EZ35[®]) is applied through the umbilical port. The 5 mm-laparoscope instead of 10 mm-laparoscope is then inserted through the left lower port. The specimen of the appendix is removed through the umbilical port.

Early experience in 20 cases showed no conversion rate and mortality. Only 2 cases of wound infection were encountered.

This paper intends to describe only the technical aspect of a laparoscopic appendectomy technique assisted by a robotic laparoscopic positioner called AESOP (Automated Endoscopic System for Optimal Positioning). The advantages, disadvantages and cost-effectiveness of this robotic assistance are not discussed in this presentation.

AESOP is an advanced technology of voice controlled laparoscopic positioning robot. It has been many reports describing its use as a feasible assistant in many laparoscopic surgery.¹⁻⁴ Early experience with the setup of this procedure in 20 cases showed no conversion rate and mortality. Only 2 cases of wound infection were encountered.

AESOP Technique

The technique includes the following 7 steps; (1) AESOP installation, (2) Operating room lay out, (3) Trocars placement, (4) AESOP voice control system check-up, (5) Appendectomy technique, (6) Appendix specimen removal, and (7) Wound closure.

1. AESOP installation (Figures 1, 2a). In the initial step, AESOP is installed to the operating table.



Fig. 1 AESOP installation



Fig. 2 a&b Operating room lay out

For laparoscopic appendectomy, AESOP is preferably fixed to the left upper part of the operating table, close to the left shoulder of the patient.

2. Operating room lay out (Figure 2b). The monitor, central processing unit (CPU), light source, gas insufflator and cauterizer are all positioned on the right side of the operating table. The surgeon, wearing a headset microphone for voice control, stands on the left side close to the AESOP which is covered with a sterile plastic bag.

3. Trocar placement (Figure 3). The three-trocar technique is preferred. The first trocar employed is a 10-mm umbilical port. The other two are the 5 mm-ports introduced at the left and the right suprapubic hairline which are lateral to the rectus muscles. The wound of the instrumental ports are positioned and designed as for better cosmetic result. The umbilical port is made using semi-open technique.⁵

Pneumoperitoneum is created at a pressure of about 13-15 mmHg by a carbon dioxide insufflator system. The 5 mm ports are placed under laparoscopic visualization in order to decrease the risk of intra-peritoneal organ injury. Care must be exercised to avoid inferior epigastric vessel injury during this step. Laparoscopic collar is attached to the collar holder of the AESOP arm by a magnetic system (Figure 4a).

4. AESOP checking voice control system (Figure 4b). Voice control interface is activated when the surgeon voice card is inserted and detected. The voice control system must be satisfactorily tested before operation to assure for the perfect function of the system.⁶ AESOP can recognize individual surgeon's verbal command, so each surgeon must create a

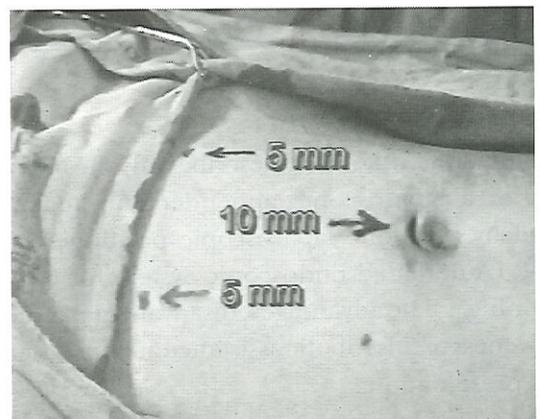


Fig. 3 Trocar placement

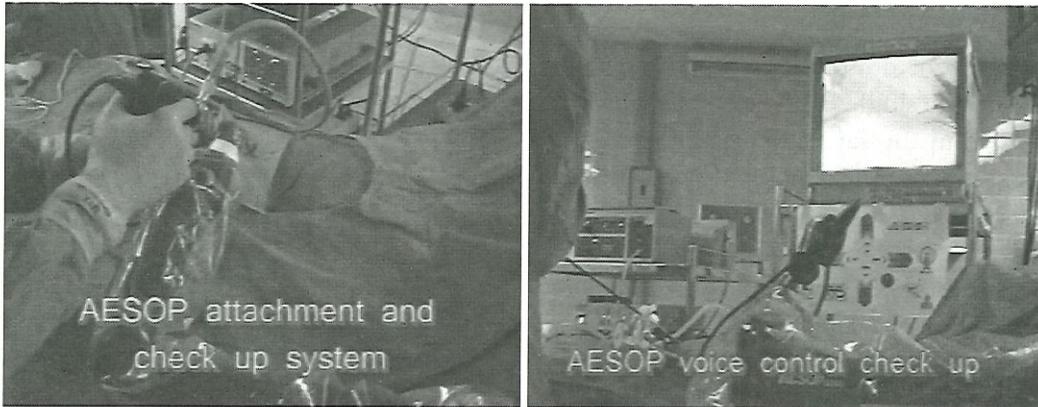


Fig. 4 a. AESOP attachment and check up system
b. AESOP voice control check

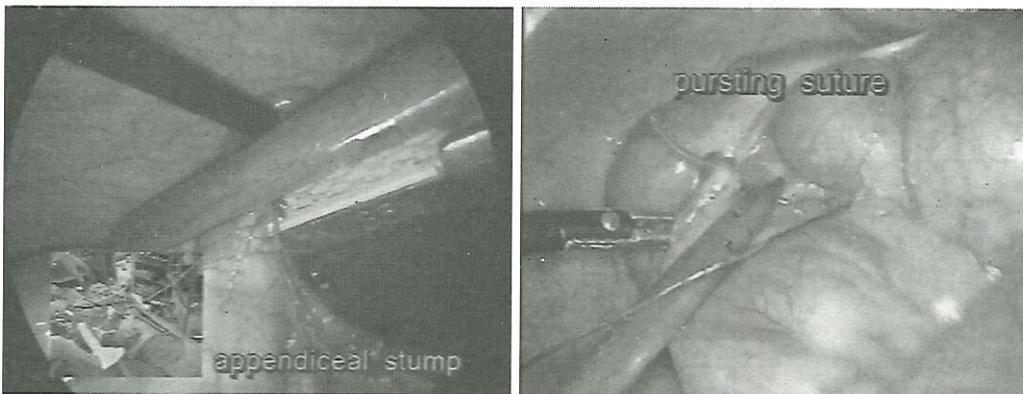


Fig. 5 a. Stapler appendectomy
b. Purstring suture of appendiceal stump

personal voice card.

In each direction, there are two functions of each voice command, the step and continuous movement. For example, left and move left, right and move right, back and move back, up and move up, down and move down. The system can also memorize each position as: save 1, save 2, save 3; and return to the saved position by return 1, return 2, return 3.⁷

5. Appendectomy technique⁸ The first step of appendectomy is dissection of the mesoappendix. Two hand-technique conducted by the surgeon's left hand grasper holds the mesoappendix. Surgeon's right hand holds a cauterized dissector for dissection and stop bleeding point. It can be changed to a 5 mm-clip applicator, endoloop ligature, scissors or suction-irrigation instrument. The operating table may be rotated to right side up and headside down for better exposure of the appendix.

During dissection, be careful of appendiceal vessels and cecal injury. After making a mesoappendiceal window near the base of appendix, one must clearly identify the site of base of the appendix and the appendiceal vessels that will be transected. Double clips are applied to the appendiceal vessels by the 5 mm clip applicator and then transected in between the two clips by a scissors.

There are various techniques to close the appendiceal stump. Figure 5a depicts a laparoscopic GI stapler. Using this 10 mm instrument, it must be accommodated through the 10 mm port at the umbilicus. In this setting, another 5 mm laparoscope for visualization is necessary, making this technique very expensive but it can significantly reduce the operative time. It has been reported as the most fantastic procedure that can accomplish an appendectomy within 5 minutes by using GI stapler.^{9,10}

Closure of the appendiceal stump can be done using the technique of double ligation by chromic endoloop. However, a single ligature combined with purse string suture in the same way as the standard open appendectomy may be used. Figure 5b illustrated the technique of a purse string suture with intracorporeal knot tying. It is a useful technique for securing of a troublesome appendiceal stump, for example the perforation near appendiceal base or a friable appendiceal stump.

6. Appendix specimen removal. To remove the specimen of appendix, a sterile condom is passed through the 10 mm port and the appendix specimen is placed inside the condom. Then holding the condom upright with a grasper and push it into the distal opening of the 10 mm trocar and railroading the trocar out of the abdomen with the specimen delivered inside the condom bag. Clamp the condom ring and remove the appendix within the condom.

7. Wound closure. Closure of the wounds is simple. Only one stitch is needed for closure of the fascia at the umbilical wound and subcuticular suture or sterile-strip for approximating the skin incision.

CONCLUSION

A step-to-step technique of Automated Endoscopic System for Optimal Positioning (AESOP) is described for laparoscopic appendectomy. Early experience using this procedure with AESOP in 20 cases was satisfactory with two cases had wound infection. This operative technique appears to be a feasible method in employing

a robot as surgical assistant for appendectomy. The advantages, disadvantages and cost-effectiveness of the robotic assistance are the issues of further investigation.

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