

Use of Endoluminal Illuminated Bougie During Laparoscopic and Thoracoscopic Surgery of the Esophagus

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Newly developed endoscopic instruments and devices, along with advanced endoscopic surgical techniques, have made it possible to perform an increasing variety of endoscopic procedures. These procedures consist of the same steps employed in the open procedure that preceded them but avoid their large incisions. This in turn eliminates many of the disadvantages associated with laparotomy and thoracotomy incisions. Postoperative pain is greatly decreased, postoperative hospital stay is shortened, and return to normal activities is expedited. Postoperative complications as well as early and late morbidity related to the surgical wound (e.g. wound infection, incisional hernia, wound dehiscence) are minimized. The incidence of intra-abdominal adhesions and both early and late postoperative intestinal obstruction are decreased. Cosmesis is dramatically enhanced.

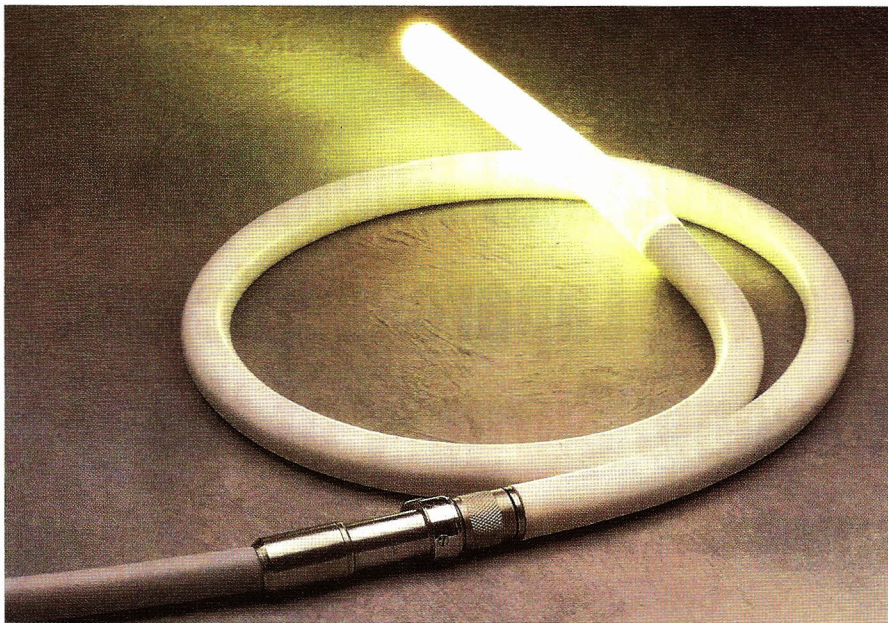


Figure 1. Illuminated Bougie (Endolumina™ BioEnterics Corp.)

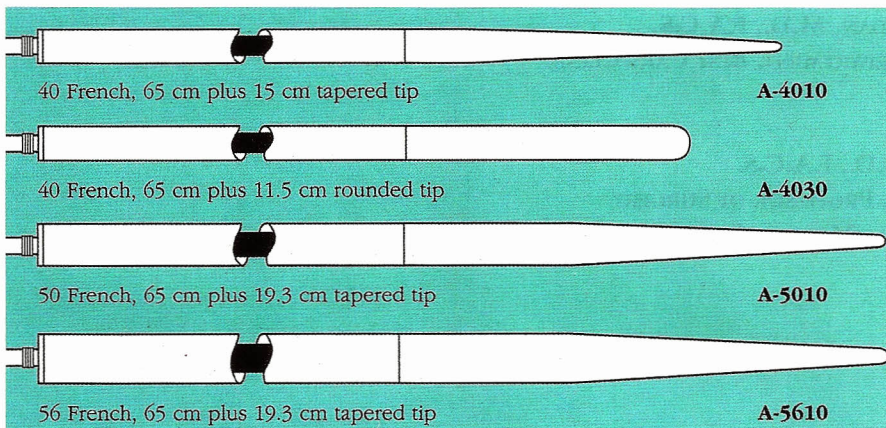


Figure 2. Bougies are available in various sizes and tips.

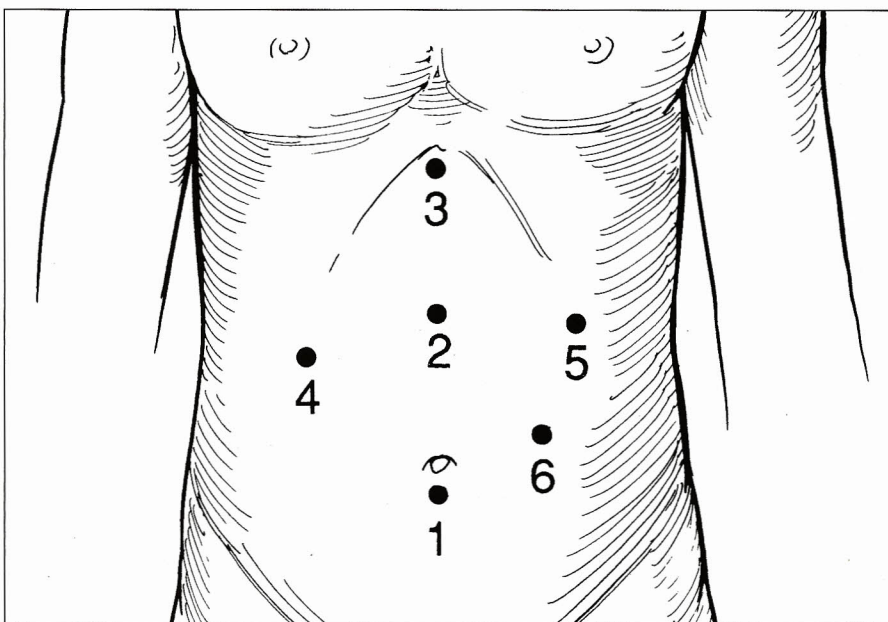


Figure 3. Trocar placement in laparoscopic technique. No.1 is used for camera and laparoscope, No. 2 and 3 are used by the surgeon for dissection and the main part of the operation. No. 4 is used for liver retraction held by a mechanical arm. No. 5 and 6 are used by the assistant to retract.

Laparoscopy is used for a number of procedures related to the esophagus. These include anti-reflux procedures such as the Nissen fundoplication,^{1,2,3,4,5} transabdominal truncal vagotomy,⁶ transthoracic truncal vagotomy,^{7,8} transthoracic repair of hiatal hernia,⁹ Heller myotomy,¹⁰ and repair of diaphragmatic hernia.¹¹

Performance of endoscopic surgery of the esophagus requires a precise identification of its anatomy since its inherently fragile wall is easily perforated. The use of an endoluminal illuminated bougie during endoscopic surgery of the esophagus is a very helpful visual clue that allows more precise identification of its anatomy and increases the safety and the speed of the procedure.

The endoluminal illuminated bougie (Endolumina™ BioEnterics Corporation, Carpinteria, CA., U.S.A.) is a reusable gas- or steam-sterilizable silicone elastomer tube containing a glass fiber optic bundle which transmits light into a clear soft flexible silicone tip (Figure 1). The bougie is available with either tapered or round tip and in a variety of sizes (Figure 2). The adapter end of the bougie is designed to be attached via a long fiber optic cable to a 300 watt light source commonly available in operating rooms. The fiber optic bundle transmits the light to the bougie's tip without generating any significant heat. The light transilluminates the esophagus during endoscopic procedures and clearly delineates the walls of the esophagus. The bougie can easily be placed by the anesthesiologist during the operation and manipulated back and forth as needed. The bougie can be left in place during the entire operation.

The Laparoscopic Approach to the Esophagus

The patient is placed under a general anesthetic, in the supine position. Both arms are extended on arm boards at 90° to the torso. The stomach is decompressed with a nasogastric tube and the bladder is drained by an indwelling Foley catheter. An infraumbilical incision is made and a standard technique previously described is used to establish a safe pneumoperitoneum.¹² A primary trocar, (10-11 mm. disposable) is introduced into the peritoneal cavity via the infraumbilical incision. Videolaparoscopy is then used to visualize the peritoneal cavity and to guide the placement of multiple secondary trocars as shown in Figure 3. A multi-bladed endoscopic liver

retractor is introduced through the right upper quadrant trocar and is used to elevate the left lobe of the liver and to displace it to the right. This exposes the hiatus of the diaphragm. Then the nasogastric tube is removed and an illuminated bougie of appropriate size is inserted by the anesthesiologist. Under instruction from the surgeon, and while viewing the esophageal hiatus on the video screen, the anesthesiologist positions the

lighted tip of the bougie at the gastroesophageal junction.

The surgeon elevates and incises the peritoneum overlying the esophagus at the hiatus, identifying the underlying anterior vagus nerve. The anterior surface of the esophagus is dissected. Then the avascular space of the gastrohepatic omentum is opened and the right crus of the diaphragm is dissected from the esophagus. This dissection can be con-

tinued posteriorly and if necessary the illuminated bougie can be retracted into the thoracic esophagus. At this point in the dissection the posterior vagus can be dissected out and a segment removed if desired (Figure 4). The esophagus then is elevated and the posterior (retroesophageal) dissection is completed. The left crus of the diaphragm is then dissected and the left lateral aspect of the esophagus is dissected away from the left

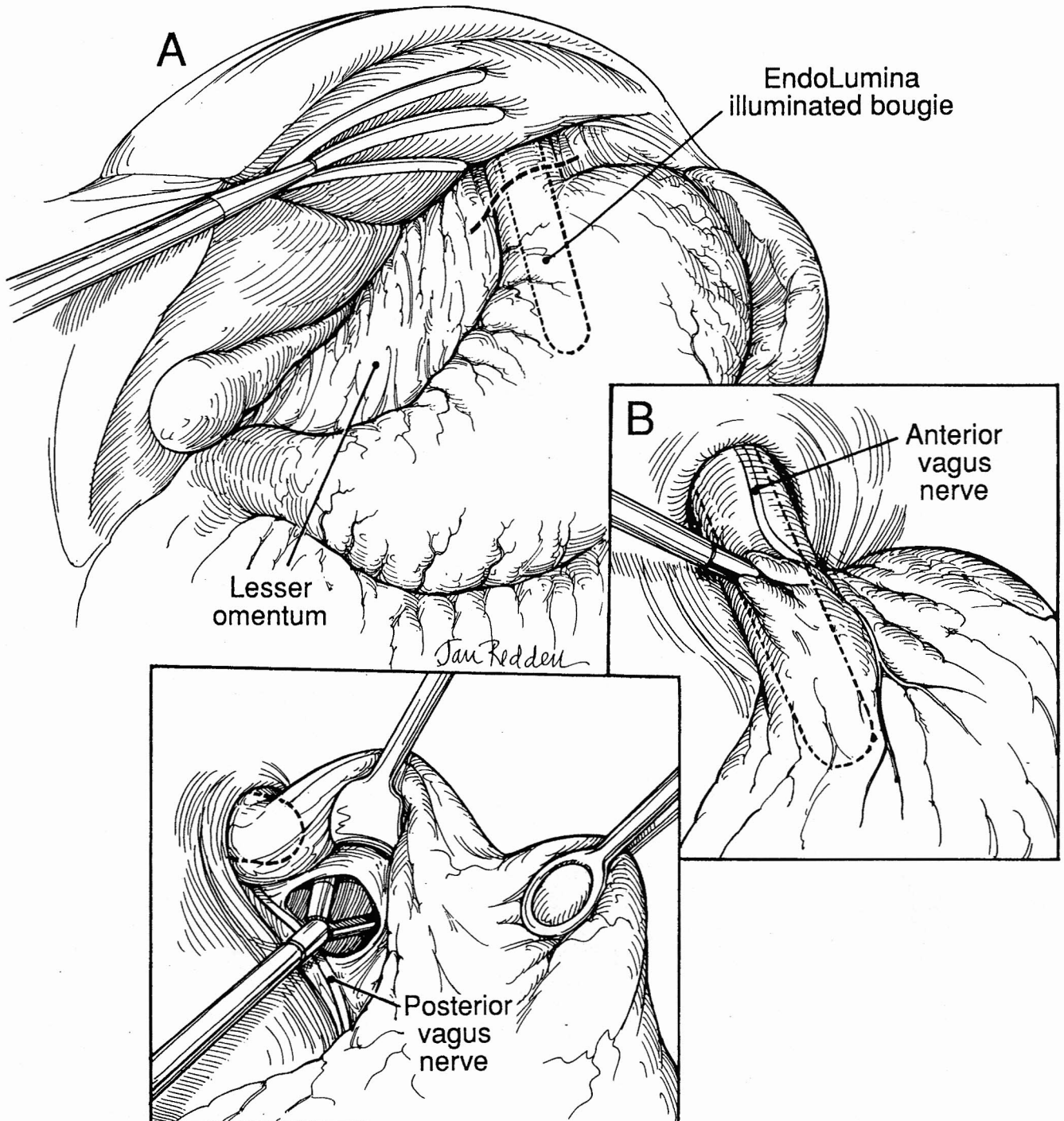


Figure 4. Dissection of abdominal portion of esophagus.

crus of the diaphragm. The esophagus is then encircled by a 1/4 inch Penrose drain and the drain used to elevate and manipulate the esophagus.

Thoracoscopic Approach

The procedure is performed with the patient under general anesthesia and in the lateral decubitus position. Either a double-lumen endotracheal tube is used to permit selective collapse of the ipsilateral lung, or the lung is collapsed by carbon dioxide insufflation of the left

hemithorax. Usually 6-8 mm. Hg. pressure is sufficient for collapse of the lung.

A four trocar technique is used, with two trocars placed in the anterior axillary line and two trocars in the posterior axillary line at the fifth and seventh intercostal spaces (Figure 5). With the aid of videothoracoscopy the left lung is retracted and the inferior pulmonary ligament is divided. The mediastinal pleura is opened near the diaphragm and the illuminated bougie is inserted into the esophagus by the anesthesiologist. The

bougie is positioned in the lower esophagus and the esophagus is transilluminated. The esophagus is easily visualized and dissected, freeing it anteriorly and posteriorly (Figure 6). Both vagus nerves are identified. The bougie is then retracted up the esophagus to the hiatus and the dissection of the esophagus is continued by encircling the esophagus with a Penrose drain.

CONCLUSION

While the time-honored principles of open surgery such as exposure, hemostasis, traction and countertraction all apply to endoscopic surgery, a new set of limitations is encountered with the endoscopic surgical modality. The endoscopic approach restricts the surgeon to an indirect view of the operative field that is monocular and lacking in depth perception. The appearance of the organ and its apparent size are dependent on the distance from the viewing optics. The endoscopic view is also different in direction, providing a close-up view from angles that are not possible in open surgery and that can be confusing. Also, endoscopic instruments are crude and long-shafted so that both tactile discrimination and force feedback are limited and only visual clues allow estimation of depth and accurate coordination of instruments.

Prior to the availability of the illuminated bougie, a flexible gastroscope was employed to reveal the boundaries of the esophagus in difficult cases. While the illuminated bougie can easily be placed by the anesthesiologist, the use of a flexible gastroscope requires either the surgeon or his assistant to abandon the operative field in order to place the endoscope. Also, the gastroscope requires air insufflation for insertion into the esophagus, with resultant gastric distention that interferes with the surgeon's visualization of the esophagus thereafter. In some instances the dissection of the esophagus can be time consuming and keeping the gastroscope in the same position may require the repeated efforts of the surgeon or his assistant. Furthermore, the intense light at the tip of the gastroscope has a tendency to transilluminate not only the esophagus but also several layers of tissue beyond, so that the exact border of the esophageal wall is not as well defined. The illuminated bougie presents none of these disadvantages. **STI**

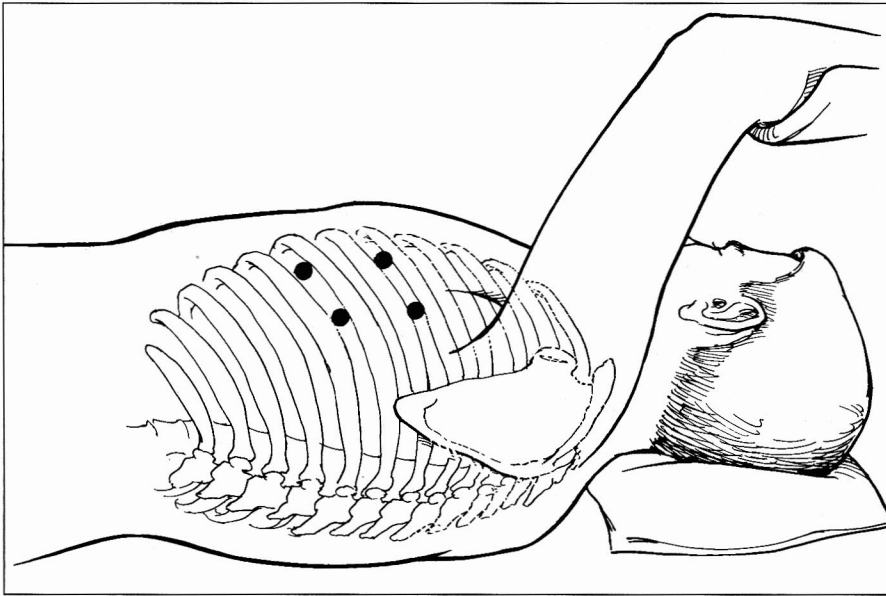


Figure 5. Trocar placements in thoracoscopic technique

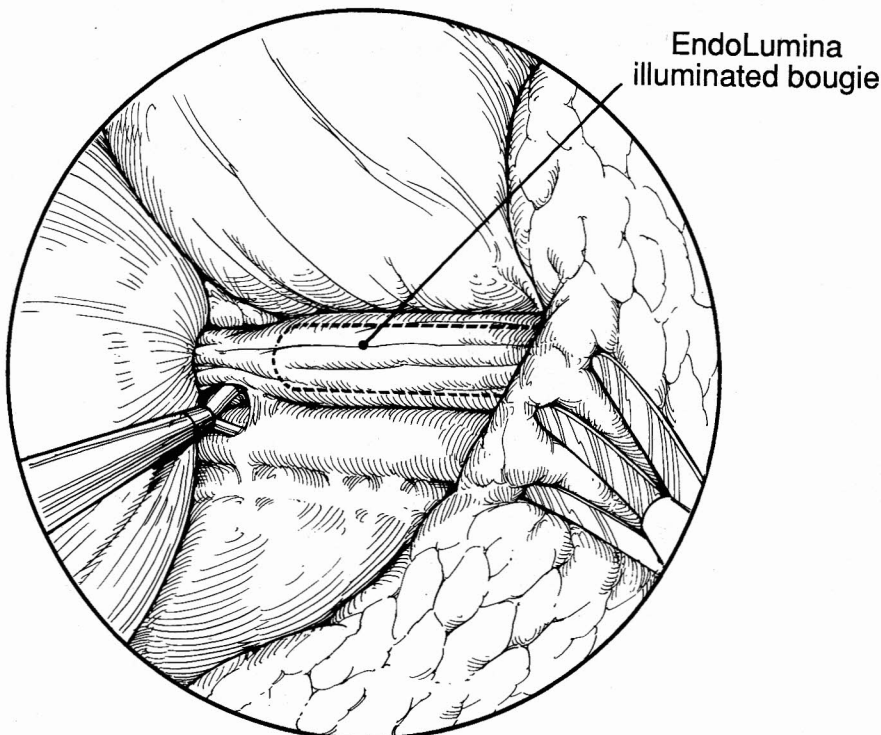


Figure 6. Thoracoscopic dissection of esophagus

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