CHAPTER

TALLAL M. ZENI, CONSTANTINE T. FRANTZIDES, AND RONALD E. MOORE

Instrumentation in Laparoscopic Surgery

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VIDEO MONITOR SYSTEM AND CAMERA

In 1985 the charge-coupled device (CCD) three-chip camera was developed such that visualization on a video monitor allowed freedom of the surgeon's hands to perform therapeutic surgery. Furthermore, it allowed the assistance of other members of the surgical team. Certainly, performance of advanced laparoscopic procedures, in which at least four or more trocar sites are used at any particular instant, would not have been achievable without this major advancement.

Continued advancements in imaging have now progressed to include high-definition signal boxes and monitors. Fundamentally, the system has five main components: the laparoscope, the fiberoptic light cable and light source, the camera head and video signal box, the insufflator, and the monitor. Thorough familiarity on the part of the surgeon and operating room staff can minimize poor and inadequate imaging.

The laparoscopes now in use vary from the typical 10-mm size to 5-mm scopes and the smaller micro 2-mm scopes. Newer 5-mm scopes provide images that are full screen and comparable to 10-mm laparoscopes. Although the imaging provided by a 2-mm scope is limited, it can be used in some instances such as the placement of a peritoneal dialysis catheter. Varying degrees of angled laparoscopes are also available including 0, 30, and 45 degrees. Most advanced laparoscopic cases are performed primarily using a 30-degree angled scope. Extraperitoneal surgery such as inguinal hernia repair is facilitated by use of the 45-degree scope to compensate for the limited space. The dual-channel laparoscopes used by the Da Vinci robotic system provide a three-dimensional (3D) view.

The light sources typically now utilize a xenon bulb but previously halogen bulb or metal halide bulbs were used. The fiberoptic cable transmits the light from the light source to the laparoscope and can become degraded over time. Replacement is incumbent in those cases to preserve picture quality.

Camera systems utilize the three-chip devices. A prism in the camera head splits the laparoscopic image into its three primary colors—red, blue, and green—and each color falls onto its own CCD chip. This provides the most accurate color reproduction available. Current high-definition systems are capable of producing more than 1080 lines of resolution provided that a high-definition monitor is connected. Currently, cables have become long enough to conduct the high-definition signal. Flat panel monitors are ideal for endosuite room construction.

Endosuites, through the presence of fixed equipment placement upon booms that do not require significant manipulation, ultimately preserve the equipment in the long term and ensure an efficient operating room environment (Fig. 33-1). Monitors can then be manipulated to a position at the eye level of each individual surgeon. This can avoid neck strain and cervical disk injury.

In addition, current systems (Stryker, San Jose, CA) may capture infrared emissions (for example, a bougie used for Nissen fundoplication or ureteral stents used for sigmoid colectomies). Also important, and particularly well illustrated in this book, is the capability to record surgical procedures. Multiple methods of final storage exist whether it be onto a DVD, CD (older versions), or USB flash drives.

The pneumoperitoneum provided by insufflators can be provided via high-flow tubing allowing for 40 L/minute, which is ultimately limited by the caliber of the connection to the trocar. The air can also be heated and humidified, although most studies do not show significant benefit. It should be noted that vigilance to ensure adequate patient paralysis by anesthesia and patient positioning to facilitate visceral retraction by gravity also assist significantly in visualization and performance of the intended procedure. Liver retraction can be done via many devices (Fig. 33-2) including the Soft-Wand balloon retractor (Gyrus-ACMI, Southborough, MA) or Nathanson retractor (Cook, Bloomington, IN) among others. This is frequently critical particularly in gastric bypass and other procedures performed at the hiatus. The balloon retractor can also be used to retract the mesocolon (in identifying the ligament of Treitz) or other structures atraumatically.

TROCARS AND ABDOMINAL ACCESS

Although Jonas Veress described his blunt spring-loaded needle in 1938, it was not until the 1980s that the Veress needle became routinely employed to achieve access into the abdominal cavity. After the needle enters the peritoneal cavity, the resistance to entry of the Veress needle subsides, resulting in protrusion of the blunt obdurator shielding the sharp outer sleeve. Most often it is placed in the infraumbilical position, but it can be placed in the left or right upper quadrants immediately below the costal margin, making it especially useful in patients who have undergone prior surgeries. Although theoretically this will prevent injury to intra-abdominal viscera, in fact there still exists a low but significant risk. It is important to lift away the abdominal wall