

Setup for operative laparoscopy and videolaseroscopy

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The authors report a low rate of postoperative infection with their arrangement and claim unique advantages for video monitoring.

Endoscopic procedures enable surgeons to treat most pelvic and extra-abdominal diseases in an outpatient setting. Procedures vary greatly in complexity, from basic diagnostic procedures to bowel resections.¹⁻¹³

Although requirements for operative endoscopy are fairly standard, laser surgery involves additional instruments and equipment.^{1,14} The setup described below allows easy access by the surgical team performing operative laparoscopy or hysteroscopy for extra-abdominal, pelvic, or intrauterine pathologies.

Instruments easily accessible

We arrange the sterile instruments on two Mayo stands and one back table. They are placed to be readily accessible to the surgeon and first assistant (Figure 1).



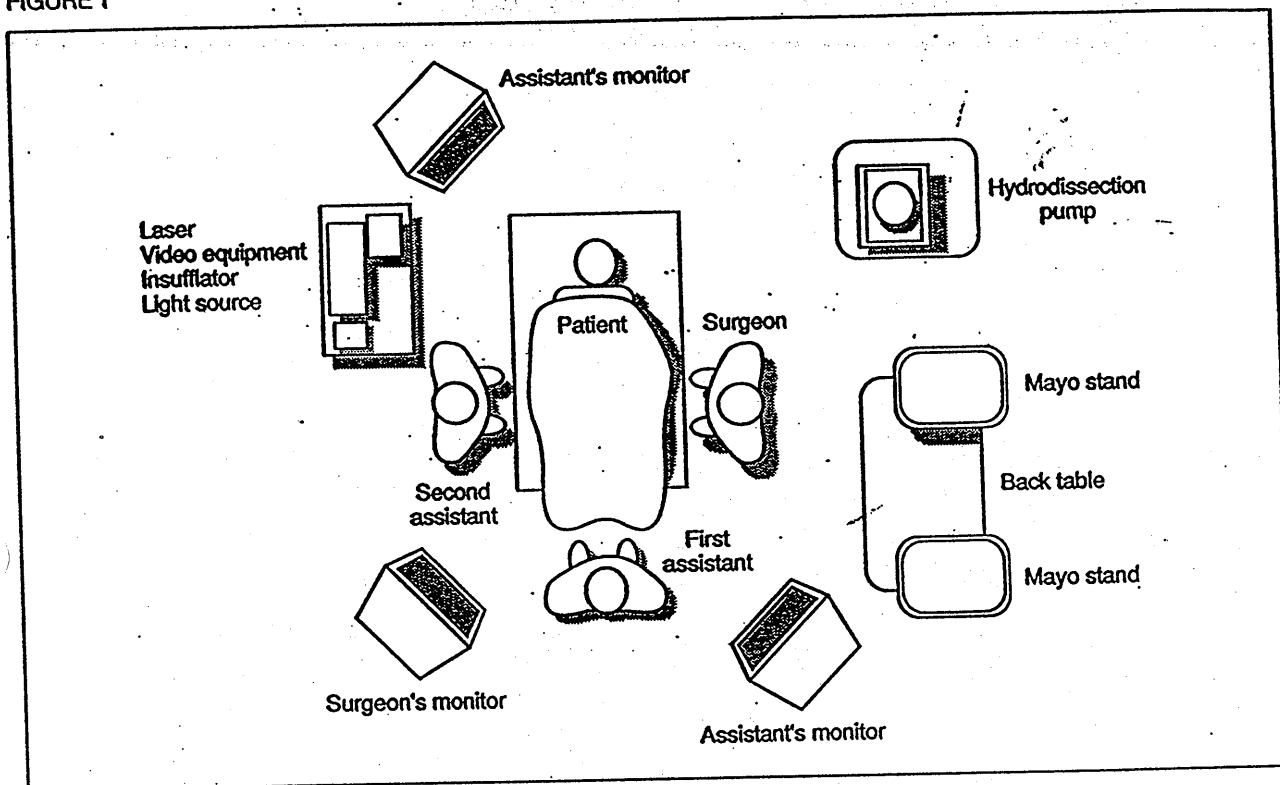
Mayo Stand No. 1 holds a D & C setup and instruments for video-hysteroscopy. Included are a weighted speculum, double-tooth or single tenaculum, dilators, uterine sound, small Kervorkian curette, uterine manipulator, Ratex sponge (Baxter Healthcare, Deerfield, Ill.), Telfa material (Kendall Healthcare Products, Mansfield,

Mass.), and a Foley catheter. For videohysteroscopy a Circon (Circon-ACMI, Santa Barbara, Calif.) or Storz (Karl Storz, Culver City, Calif.) diagnostic and operative hysteroscope with appropriate scissors and grasper are included. The adaptive sleeve is also available for placing scissors, grasper, electrocautery knife,

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LASEROSCOPY SETUP

FIGURE 1



With this simple arrangement, instruments are easily accessible to the surgeon and assistants.

needle, or fiber laser into the uterus. For more complicated procedures, such as resection of intrauterine leiomyoma or endometrial ablation, we add a resectoscope with electro-surgical wire loop and roller ball.

The back table, behind the surgeon and next to the first assistant, contains the necessary laparoscopy instruments. These include a Veress needle, scalper, Allis clamp, 11-mm trocar and sleeve, 10-mm laparoscope, fiberoptic light cord, 5.5-mm secondary trocars and sleeves, suction/irrigator probe

with irrigation holes (American Surgical, Del Ray Beach, Fla.) with irrigation and suction tubing, tubing for the CO₂ insufflator, CO₂ connector, atraumatic grasping forceps with teeth, bipolar forceps, cord, aspirating needles, 60-mL syringes, Telfa, and Rutex (Figure 2). Also on the table is 1 ampule of vasopressin (Pitressin) in 100 mL of bacteriostatic sterile water. This solution may be injected through the laparoscopic needle during surgery to reduce oozing before removing large fibroids or endometriomas. Also present is 3-0 su-

ture with a cutting needle for closing the primary trocar site and 0.5-inch Steri-Strip (3M Health Care, St. Paul, Minn.) bandages, Mastisol liquid adhesive (Ferndale Laboratories, Ferndale, Mich.) eye-pads, and 3M tape, for dressing. For bowel resections, a stapling device (ILS 33, Ethicon, Somerville, N.J.) is placed on this table (Figure 3).

Mayo stand No. 2, placed within reach of the surgeon and first assistant, holds endoscopic scissors, toothed and toothless grasping forceps, and other instruments, in-

continued on page 55

ing specimen bags (Endo-
Ethicon) (Figure 4).

Equipment

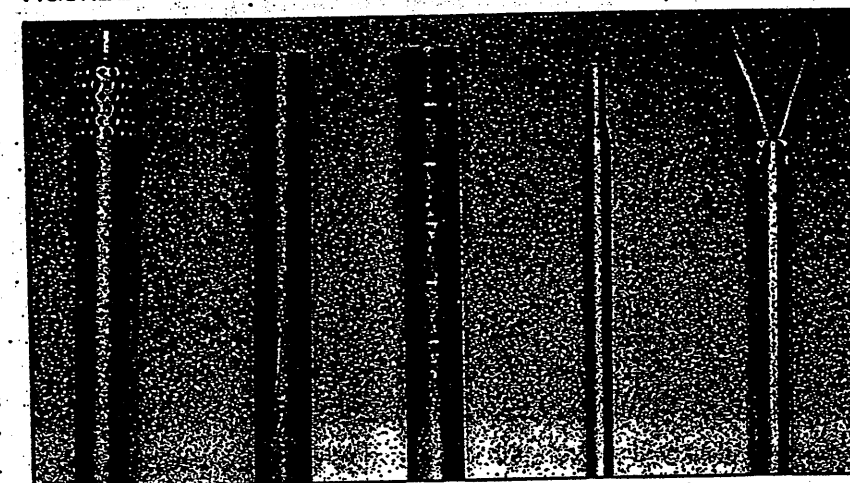
In the operating room is a low insufflator (Karl Storz, Elk City, Calif.) and bipolar electrocoagulator generator. Intention is achieved by introduction of CO_2 into the abdomen to establish pneumoperitoneum. Matters on the insufflator include kinetic insufflation pressure, intra-abdominal static pressure, and gas volume insufflated into the abdomen.¹⁴ Ball valves and shutters in the trocar ports help reduce the amount of gas.

Hemostasis is obtained with electrocoagulation when the surgical situation prohibits using the laser for this purpose. An example is when bleeding is too brisk or comes from an area too large to be sealed by the laser beam.¹²

A suction/irrigator pump (Zhat-Dorsey Hydrodissection pump, Karl Storz) that delivers a vacuum of 775 mm Hg is set at 300 mm Hg for routine irrigation during procedures combining laparoscopy with the CO_2 laser, a technique we have titled videolaseroscopy.^{2,5,11,12,15} Pressures up to 600 mm Hg are sometimes used during operative endoscopy to create a vacuum of fluid that protects key tissues, including the ureters and bowel.³

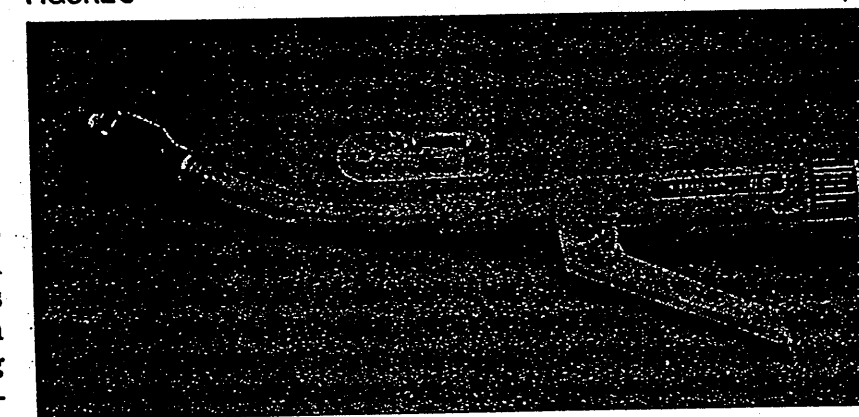
Irrigation fluid consists of warmed 1-L bottles of lactated Ringer's solution. Using wall suction, the contents are initially drawn into a Vac-Rite canister. A

FIGURE 2



Hydrodissection probes are among the necessary laparoscopic instruments.

FIGURE 3



A stapling device is available for bowel resection.

laser plume filter removes all particles that might impede suction.

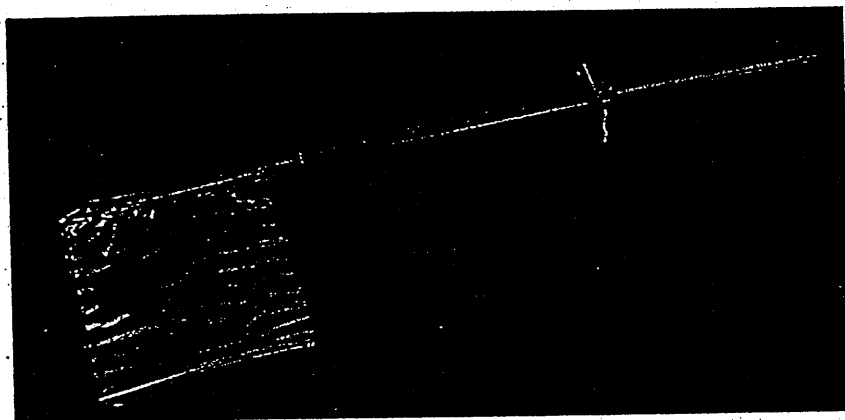
Positioning of equipment

The surgeon's preference dictates equipment positioning. We place the CO_2 laser with a direct lens coupler (Coherent, Palo Alto, Calif.), which we use most frequently, on the patient's right, opposite the

surgeon (Figure 5). The articulating arm is then extended so as not to weigh too heavily on the surgeon's hand. Other items kept on the side opposite the surgeon include the storage table holding the insufflator, electrosurgery equipment, and light sources. Video monitors should be positioned well within the view of the surgeon and assistants.

continued on page 56

FIGURE 4



Mayo stand No. 2 holds an atraumatic bowel-grasping forceps, needle holder/grasper cutter and, as shown, specimen removal bag.

The less frequently used neodymium-yttrium-aluminum-garnet (Nd:YAG) and argon lasers may be kept behind the first assistant, who stands between the patient's legs. This arrangement allows laser fibers to be easily passed from the back table through the second puncture site. The suction/irrigator is next to the back table and behind the surgeon.

While setting up the back table and going through the instruments the surgeon or a nurse familiar with this type of surgery should check all scissors, graspers, trocars, trocar sleeves, and other instruments to ensure they are clean, have no loose or broken tips, and are otherwise working properly. This check should be performed even if all instruments were used during a previous procedure.

Laser

After years of using different types of laser in a variety of proce-

dures, we now use the CO₂ laser almost exclusively. We prefer the CO₂ laser to scissors in treatment of endometriosis and other pathologic lesions.^{2,15} One advantage of the CO₂ laser when used as a long knife through the operative channel of the laparoscope is its ability to coagulate small blood vessels.¹¹ Another is that the CO₂ laser easily allows the surgeon to convert a diagnostic procedure to an operative one through the laparoscope. When compared with manual instruments, lasers offer an unobstructed view of the pelvic cavity.

The argon and Nd:YAG lasers require appropriate electrical outlets and special water hookups. Typically, an outlet supplying a 220-V, 30-A circuit is required. The Nd:YAG laser can be three- or single-phase and air- or water-cooled, depending on peak wattage needed for a particular procedure. In contrast, the CO₂ laser can be operated from a 100-V circuit, supplied

by any standard electrical outlet.

Individually wrapped sterile fibers are kept with the argon and Nd:YAG lasers, each with its own cleaver for keeping fiber tips sharp. Since the fibers break easily, they must be handled carefully and checked repeatedly.

When using lasers, strict adherence to safety precautions is mandatory. A unique risk of fiber-equipped lasers is the possibility of fiber breakage in or outside the patient's abdomen. In the CO₂ laser the beam is transmitted through and reflected off mirrors contained in the articulating arm.

When using a fiber laser, both patient and staff must wear tinted goggles. When using the CO₂ laser, the staff can wear clear goggles and the patient's eyes are covered with moistened pads.

Video

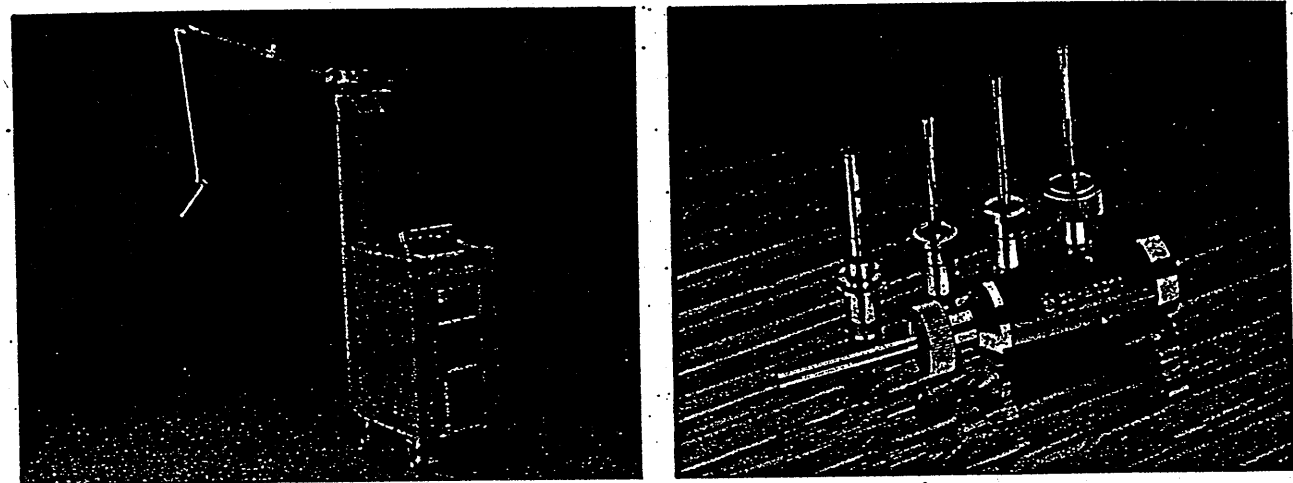
By providing a unique dimension of objectivity, video monitoring contributes much to the therapeutic objective.¹⁶ For videolaseroscopy, the monitoring equipment includes a sterile Circon or Storz video camera, microphone, and at least one video monitor with accompanying cables.

A poor monitor picture may indicate a problem with the camera cable. Therefore, an extra cable should be available.

The one-piece camera has a minimum of 375 horizontal lines of resolution and weighs about 2 oz, making it a comfortable attachment for the surgeon performing lengthy procedures (Figure 6). Designed specifically for gynecologic

LASEROSCOPY SETUP

FIGURE 5



The CO₂ laser (left) with a direct lens coupler is on the patient's right, opposite surgeon.

surgery, it is a marked advance on prototypes conceived for arthroscopic procedures. The original cameras were not only larger but also yellowed color transmission. This inaccurate hue transmission did not adversely affect black and white color transmissions. However, in gynecologic surgery, subtle variations in tissue color may indicate abnormalities.

The newer cameras are also more durable and easier to use. One can also replace detachable cables in the hospital rather than having to return the entire camera to the manufacturer in case of malfunction.

Digital "chip" cameras easily fit on the end of a small-caliber endoscope. The two types of solid state silicon chips are charge-coupled devices (CCD) and metal oxide semiconductors (MOS).¹⁶ Although most available cameras use the

MOS, we prefer the CCD-3, as it contains less glass between the telescope and the chip. This difference results in higher resolution, producing a brighter, sharper image. Both the CCD and MOS cameras use a matrix of light-sensitive pixels, which record the image and transfer the information electronically in digital form many times per second to the display and recording devices. This information can be stored either on magnetic tapes or laser-etched media.

The video monitor provides an excellent panoramic view of the abdomen, affording the surgeon complete control of the procedure. If possible, it is helpful to have two, or even three, monitors within view of the entire surgical team available to aid synchronization of the surgeon's and assistants' movements.

The video monitor's resolution

must match that of the camera. After conversion by a D-A converter, the camera electronically sends display signals on a cathode ray tube. Unfortunately, no camera currently available can match the high-resolution continuity and clarity of the analog monitor, capable of as many as 1,200 lines of resolution. In the future, more powerful cameras should allow the surgeon to view even the smallest lesions.

When the fiber laser is used, a shutter must be present between the camera and the eyepiece of the laparoscope. The shutter casts a hue when the laser is fired that distorts the tissue color. The Nd:YAG laser, because of its invisible light, can be used with a chip camera without a shutter but needs a shutter with a tube camera. It is crucial for eye safety that appropriate goggles be worn for each type

Operative endoscopy: key points

Perform techniques and instrumental procedures with a minimum of incisions and instrumentation.

Maintain operator comfort and keep all instruments and equipment within easy reach.

Make sure the entire surgical team is knowledgeable about the function of all instruments. Technologic development necessitates keeping pace with advances.

Because operative endoscopy instruments and equipment are extremely expensive, sensitivity to their care is mandatory.

Quality of the surgical assistant's performance directly affects overall success of surgery. Therefore, all staff must be well-trained and completely attentive throughout the procedure.

of laser.

Other video equipment in the operating room includes a 0.5-inch VHS video recorder with remote control. The remote allows the circulating nurse to regulate the laser and video recorder simultaneously. Some newer cameras have controls on the camera head, allowing the surgeon to regulate recording.

The videocassettes, including extras, should be easily accessible. Providing patients and referring physicians with a 0.5-inch cassette recording serves to document at least part of the procedure. Patients often find it helpful to see the possible cause of their infertility, pain, or other problems and how these were treated.

All nonsterile video equipment is kept in a separate cabinet that may be locked at the end of each day to eliminate equipment tampering. Video cabinets are manufactured with removable backs, making machines easily accessible for adjustments.

Recording technique

Before videotaping the procedure, the operating surgeon announces into the microphone the patient's name and date of surgery. Intermittently during the procedure, he or she comments on abnormalities found and their treatment. Because much of the procedure is videotaped, subjecting all voices in the operating room to recording, it

is wise to limit conversation to what is necessary and in good taste.

"Laser in use" and "videotaping in progress" signs may be placed on the operating room door. Unfortunately, people still occasionally enter the room. When they do, the circulating nurse nearest the door stops the videotaping and alerts them so that the surgeon is not distracted, allowing the taping and the procedure to continue.

Lighting

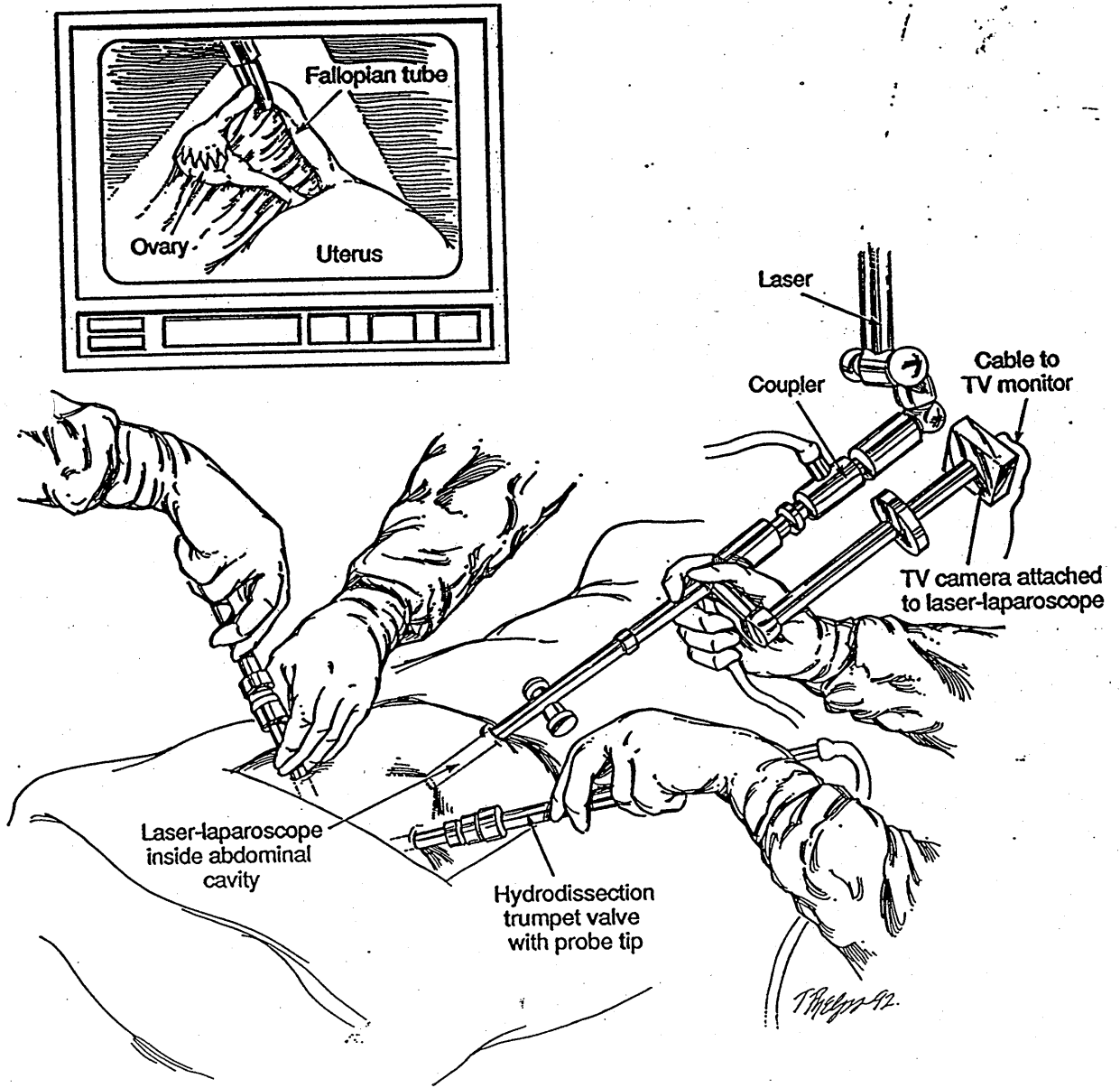
During videolaseroscopy and hysteroscopy, a powerful light source is required to provide a bright picture on the monitors. Both the light source and the accompanying sterile fiberoptic light cord are attached to the hysteroscope or laparoscope.

Available are a 150- or 300-W halogen light or a xenon light. In most procedures, a halogen light is adequate but does distort color. However, the xenon light provides greater intensity and approximates daylight, maximizing potential for translating true tissue colors.

The fiberoptic light cords should be checked periodically. Dimming often indicates the need for cord replacement. These cords must be handled with care, as the fibers they contain can be easily damaged. An extra sterile cord should be in the room in the event that replacement is necessary during surgery.

While operating, a sterile towel moistened in normal saline is placed near the operating field so

FIGURE 6



Use of the video camera provides a unique dimension of objectivity.

One of two circulating nurses in the operating room monitors use of irrigation fluid and aspiration. The other monitors the laser and video equipment.

the light cord can rest on it if temporarily disconnected from the laparoscope. Because of the heat produced by the cord, it should never rest directly on a paper drape, as might burn the patient. The Morz video camera reaches a temperature of 2,000° K. If the cord is left lying on the wet towel, it could inadvertently slip off. Therefore, it is best to connect it to the laparoscope during setup, after draping the patient.

Surgical procedure

After the patient is asleep and intubated, she is placed in the modified dorsal lithotomy position. Much care is given to positioning the legs to help prevent postoperative soreness. With the knees only slightly bent, the legs are placed in special foam-padded leg and stirrup rests (Mend Technologies, Dallas, Tex.). This posture is essential for easy manipulation of the ancillary instruments positioned in the lower abdomen.

The patient's arms rest on foam cushions, wrapped in disposable surgical towels and tucked into place flush against her body to prevent complications. One potential

complication is paralysis of the brachial plexus, which may be induced when the arms are extended from the body for a period. A Foley catheter is inserted and remains in place with a drainage bag throughout the procedure.

After videohysteroscopy is completed, the uterine manipulator is inserted and remains in place throughout the procedure, allowing adequate visualization of the posterior cul-de-sac. To permit total flexibility with the uterine manipulator, it is imperative that the patient's buttocks protrude several inches from the operating table. Before endoscopic surgery begins, Mayo stand No. 1 is moved aside and the surgeon goes to the side of the patient from which he or she will operate.

The anesthesiologist covers the patient's eyes with the moistened 4 × 4-inch pads when the laser is to be used. Additionally, a foam pad is put over the patient's neck to protect her if lightweight camera equipment is placed on the sterile field during the procedure.

Videolaparoscopy involves three to four incisions (Figure 6).¹² We place the first incision at

the umbilicus for an 11-mm trocar. A sleeve that holds the 10-mm laparoscope is introduced at this site. The second and third incisions—a fourth in more extensive procedures—allow insertion of the 5.5-mm trocars and sleeves for ancillary instruments. At the second puncture site, a 10-mm sleeve is used for cases involving the removal of large fibroids and other tissue.

CO₂ gas infused from the high-flow insufflator is used to establish pneumoperitoneum. A high-flow insufflator is preferable during operative endoscopy because the almost continuous irrigation and suction needed would otherwise also suction out the gas. After initial manual control, the insufflator is placed on automatic control at a recommended pressure of 12 to 16 mm Hg maximum.

The suction/irrigator probe (American Surgical) is placed in the second incision sleeve. The third and fourth incision sleeves accommodate graspers and other ancillary instruments, as needed. The number of ancillary instruments used underscores the need for assistants to change and hold them steady for the surgeon.

Two circulating nurses are required. One monitors use of irrigation fluid and aspiration and is primarily stationed on the side of the room designated for those duties. On the side containing the laser and video equipment, a second circulating nurse monitors these devices. Other responsibilities for a circulating nurse might include collecting pathologic specimens,

changing lasers during the procedure, sterilizing or setting up any additional equipment, and changing gas tanks.

Two assistants scrub with the surgeon. One, a nurse or operating room technician familiar with the instruments to be used during the procedure, stands between the patient's legs to pass instruments, work the uterine manipulator as necessary, and inject indigo carmine when required. The second stands opposite the surgeon to aid in holding instruments throughout the procedure. Such assistance is especially necessary when a third or fourth puncture site is used.

Operative endoscopy can last 30 minutes or, in cases of severe endometriosis and adhesions, several hours. Procedures of this length require patience and concentration, particularly when working near the bladder, bowel, or rectum or performing microsurgery on the tubes and ovaries. The assistants must be capable of standing still and viewing the monitors attentively as the surgeon performs the procedure.

When the rectum is being treated with the CO₂ laser, it is necessary for the first attendant to perform a rectal examination to help the surgeon assess depth of CO₂ laser penetration. The assistant should not be able to detect the CO₂ laser's heat. Thickness of rectal tissue often varies with degree of endometriosis, and the assistant's finger is a guide for that determination. The assistant performs this examination wearing two pairs of gloves and using lubri-

cant. Both pairs of gloves are replaced after completing treatment of the rectal area.⁶

The entire surgical team should become familiar with all instruments and equipment and each other's roles to allow surgery to proceed smoothly when a regular member is absent. Ultimately, better patient care will result.

Minimizing infection

Operative endoscopy, while clean, is not a sterile procedure. Draping the arm of the laser is not necessary. When the CO₂ laser is used, the circulating nurse who controls it can screw the direct lens coupler (Coherent, Palo Alto, Calif., or Cabot Medical Corp., Langhorne, Penn.) onto the laser laparoscope without the surgeon touching it. However, we believe our patients' low rate of postoperative infection is largely due to continuous irrigation and our attempt to provide a sterile environment in as many other ways as feasible.

Incisional care includes copious irrigation of the incision sites with normal saline. Dissolvable suture is used to close the primary incision at the umbilicus. The other incisions are closed with Mastisol, 0.5-inch Steri-Strips, and sterile eyepads. For a secure dressing, 1-inch pressure tape or 3M tape may be used.

In conclusion

More surgeons are becoming familiar with the various techniques and instruments used to perform operative endoscopy. Simultaneously, continuing development of

video cameras promises to provide resolution that will soon match the clarity of the naked eye. As surgical expertise and instrument quality progress, the use of video equipment in conjunction with endoscopic procedures can be expected.

To provide patients with the advantages of videolaparoscopy and videolaseroscopy, the operating room setup and proficient functioning of the surgical team are crucial. The arrangements we have described are an attempt to furnish these guidelines. □

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