9.1. Operating Room Setup and Patient Positioning for Laparoscopic Gastric Bypass and Laparoscopic Gastric Banding

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I. Introduction

Laparoscopic gastric bypass is one of the most technically challenging operations performed using a laparoscopic approach. It requires the completion of two intracorporeal anastomoses and advanced suturing and stapling skills. Excessive abdominal adiposity creates exposure challenges, and often instrument length may be insufficient to reach the target. To complete the operation safely and efficiently, proper patient positioning and operating setup are crucial. If these tasks are not performed optimally, the progress of the operation may be compromised and, in the worst case, patient safety jeopardized. The following recommendations regarding patient positioning and operating room setup are based on our experience of more than 1500 laparoscopic gastric bypass cases. We wish the reader to recognize that, although our approach has been proven to be safe and effective in our hands, many other approaches are suitable.

II. Operating Room Environment and Patient Positioning for Laparoscopic Gastric Bypass and Gastric Banding

A. Operating Room Equipment, Design, and Layout

An efficiently setup and organized operating room for laparoscopic bariatric surgery is critical for success. The room should be spacious enough to allow for

unencumbered transfer of the morbidly obese patient to and from the operating room (OR) table. The room must be large enough to hold all the necessary equipment and to permit the unencumbered movement of the OR staff. Much of the laparoscopic visualization and insufflation equipment can be grouped together on mobile towers. Specialized operating rooms specifically for minimally invasive surgery are gaining appeal. Some of these "endosurgery suites" employ boom technology that keeps the equipment off the floor and within easy reach of the surgeon or OR staff. Efficient design of these operating rooms will likely improve overall operating efficiency and safety.

1. Voice control technology: The authors make use of voice control technology (Hermes system, Computer Motion, and Stryker Endoscopy), which serves as a centralized and simplified interface that enables the surgeon to control, via spoken commands, medical devices compatible with the voice control system. Although this type of system facilitates laparoscopic procedures, it is by no means mandatory; most advanced laparoscopic procedures are done without such technology throughout the world.
2. Robotic assistance: The authors utilize an FDA-approved surgical robot capable of holding the laparoscope and altering its position in response to a surgeon's verbal commands **(AESOP)**. The robotic device consists of two main parts: the computer controller and the articulating robotic arm. It can store in its memory several set laparoscope positions, allowing the surgeon to rapidly return or advance to optimal viewing positions. Again, whereas such a system may be helpful, it is by no means mandatory. Most surgeons do not make use of this system.

B. *The Essential Equipment*

1. Laparoscope: Laparoscopes for bariatric surgery come in various diameters (5–10 mm), lengths (32–45 cm), and angles (0°–90° orientation). An extralong laparoscope (45 cm) is sometimes necessary and very helpful in superobese patients. Angled scopes provide more flexibility in viewing internal structures and provide access to areas that would be "blind" to 0° scopes. The angled scopes require additional skills to operate and decrease light transmission slightly. For the Roux-en-Y gastric bypass, the authors typically use a 5-mm, 30° scope initially at the 5-mm entrance site to visualize the other port placements. A 10-mm-diameter, 45° angled laparoscope is used for the balance of the procedure because we have found that it provides the best viewing flexibility, especially in extremely obese patients.
2. Light source and light cable: A high-intensity light source is a requisite for a satisfactorily bright laparoscopic image. Most units employ either a xenon or metal halide bulb; these sources provide exposure that falls within the range of daylight (5500 K). Light is transmitted from the light source to the scope through a fiberoptic light cable. Any cable with more than 15% broken fibers is not suitable for a video pro-

cedure and should be replaced. Improper connection of the cable to the light source or the telescope will result in loss of significant amount of light. Light cables must be sterilized in either ethylene oxide or glutaraldehyde and should not be autoclaved.

3. Video monitor: The monitors on which the laparoscopic image is viewed should be of the highest quality. The picture should be flicker-free, with enhanced black performance for better contrast and efficient white balance circuitry that can deliver more stable color and high resolution. We use two 19-inch high-resolution color video monitors, which are placed opposite the surgeon and the assistant on towers or booms. Flat panel monitors are gaining in popularity because they are lightweight and more mobile than the standard CRT monitors; however, resolution is not on par with CRT monitors yet. The room setup shown in Figure 9.1.1 depicts the locations of two laparoscopic monitors for gastric bypass and gastric banding procedures. Advanced and dedicated minimally invasive operating rooms usually have four or more monitors, several of which are usually flat panels.
4. Insufflator: The authors recommend a high-flow insufflator capable of delivering flow rates up to 30 L/min. The rate of insufflation can be adjusted from 1 up to 20 L/min. We usually set the intraabdominal pressure at 15 mmHg but will intermittently use higher pressure (16–18 mmHg) when better exposure is needed or lower pressure when instrument length is insufficient. Gas leakage is common during laparoscopic bariatric procedures and can be very troublesome. A high-flow insufflator is recommended to accommodate for gas leakage from small air leaks at port sites, instrument exchanges, and intraabdominal suction. We usually use two insufflators set at high flow during gastric bypass procedures to provide added compensation for gas leakage. Where available, centralized delivery of CO_2 gas as opposed to the use of individual CO_2 tanks is highly preferred to eliminate interruptions for tank exchanges.
5. Laparoscopic access instruments and trocars: A Veress needle is used to establish a pneumoperitoneum in the obese patients as it is technically very difficult to perform utilizing the open cut-down (Hasson) technique due to the thick layer of subcutaneous fat. A long length Veress needle of 150 mm is used through a subcostal incision in the left upper quadrant. Correct position of the Veress needle into the abdominal cavity after it has passed through the abdominal wall can be verified by various methods, such as the water drop test. In obese patients, opening intraabdominal pressures may be high (up to 10-12 cm H_2O), and anterior traction on the abdominal wall is sometimes required to facilitate gas flow. In addition to being safe and reliable, trocars and ports for laparoscopic bariatric surgery should minimize air leaks, secure readily to the abdominal wall, allow rapid exchange of instruments of various diameters, and be of sufficient length to reach the peritoneal cavity. We use disposable ports of three sizes: 5 mm, 11 mm, and 12 mm. A spiral cannula oversheath that screws into the fascia can be inserted onto the shaft of the trocar to reduce the risk of

dislodgment. We usually secure the trocars to the skin with sutures for added security. To prevent trocar site hernias, we close all ports that are 10 mm or greater with a strong absorbable suture such as O-polysorb.

6. Laparoscopic retractors and instrument stabilizers: To expose the esophagogastric region, anterior retraction of the left lobe of the liver anteriorly is required. Many types of retraction devices are available that work sufficiently well. Most importantly, they should be strong enough to retract large, heavy livers and not traumatize the liver in the process. We use a 5-mm-diameter endoflex retractor that assumes a triangular configuration when tightened. The retractor is usually held stationary by means of an external holding device attached to the OR table (Mediflex Universal Single Flexarm System). For extremely large livers, two retractors may be necessary.
7. Laparoscopic instruments: The hand instruments are available with many different features and preferences. In general, for all our hand instruments, we prefer an in-line (as opposed to a pistol grip), ratcheted (optional) handle with finger-controlled rotation of the shaft. Many instruments are available in extralong lengths for superobese patients. Atraumatic graspers, crocodile graspers, Babcock graspers, bowel clamps, and scissors make up the essential hand instruments. A suitable clip applier, either disposable or reusable, is used to secure hemostasis; these are available in 5-mm- and 10-mm-diameter sizes.
8. Endoscopic linear stapler: An endoscopic linear stapler that generates at least two rows of staples on each side of the transected tissue is an extremely important instrument required for laparoscopic gastric bypass. It can be used to transect hollow viscera, divide highly vascular tissue (i.e., mesentery), and create an anastomosis. We use a 12-mm-diameter disposable linear stapler that applies two triple rows of staples before dividing the tissue with an advancing knife. The stapler is fired by repeated compression of the handles after disengaging the safety device/button on the shaft. The stapler can be fired multiple times (25) using disposable cartridges of various lengths (30 mm, 45 mm, 60 mm) containing staples of various heights (2.0 mm, 2.5 mm, 3.5 mm, 4.8 mm) for use with varying tissue thickness. A finger-controlled knob can rotate the shaft of the stapler. Some staplers come with cartridges that can reticulate at 45° angles.
9. Circular stapler: An endoscopic circular stapler can be used to create the gastrojejunal anastomosis (end to end or end to side). The circular staplers on the market today create a double, circular row of staples with varying diameter sizes (the most commonly used stapler diameters for bariatric surgery are between 21 and 25 mm). For the gastrojejunal anastomosis, we prefer the 21-mm-diameter size resulting in a stoma diameter of approximately 12–14 mm. The endoscopic circular staplers can be inserted directly through a dilated port site or through a large trocar. Various methods of anvil insertion into the gastric pouch have been devised, including insertion through a gastrotomy or in-

sertion through the mouth and guided into the pouch through the esophagus using a pull-wire. The later technique requires a flexible endoscope, snare, and a pull-wire.

10. Other hand instruments: Conventional endoscopic suturing technique using standard laparoscopic needle drivers and sutures are suitable for laparoscopic bariatric surgery. Alternatively suturing devices such as the Endostich (United States Surgical) may be employed to facilitate endoscopic suturing. The 10-mm-diameter, disposable Endostich utilizes a double-pointed shuttle needle with the thread mounted at the center of the needle. Double-action jaws allow the needle to be passed back and forth by squeezing the handle and maneuvering the toggle switch. We use the Endostich during the gastric bypass for approximating the bowel for the enteroenterostomy and for oversewing the gastrojejunostomy (two-layer closure). An effective and reliable suction/irrigation instrument is critical to keep the surgical field clear of pooling blood and the abdominal cavity free from smoke and vapor.
11. Energy sources for coagulation and cutting: Standard unipolar or bipolar electrocautery can be used for hemostasis and dividing tissue. For extremely vascular tissue such as mesentery, alternative energy sources such as ultrasonic coagulation may be more suitable. The Harmonic Scalpel (Ethicon Endosurgery) and the Ultrasonic Shears (United States Surgical) are ultrasonically activated instruments that provide excellent hemostasis while eliminating the problem of electrical arc injury associated with unipolar electrocautery. The instruments have a stationary jaw and a blade that vibrates at a frequency of 55,000 Hz. The mechanical action denatures collagen, forming a coagulant that instantly seals small blood vessels. Although heat is generated in the tissue through friction, the lateral spread of thermal energy is minimal (1–2 mm) as compared to electrocautery. Another reliable means of securing hemostasis and dividing mesentery and other tissue (but not bowel) is with the Ligasure Instrument (Valley Lab), which provides hemostasis via bipolar electrocoagulation and then cuts the tissue in question with a built-in knife. This device comes in both a 5-mm and a 10-mm size. During gastric bypass surgery, the authors employ an ultrasonic scissors that is used for dissection, especially along the lesser and greater curves of the stomach for gastric pouch creation. It is also used to make enterotomies in the stomach and small intestine for stapler insertion and for creating the window through the transverse mesocolon.
12. Flexible endoscope: We routinely use a flexible gastroscope at the completion of the gastric bypass procedure to examine the gastrojejunal anastomosis. After submerging the anastomosis under water, we institute intraluminal insufflation and look for air leaks. The endoscope is also useful in assessing the size and patency of the anastomosis as well as to examine for bleeding and viability of the gastric pouch. To facilitate the simultaneous use of endoscopy and laparoscopy, we prefer the use of two camera systems; one each for the laparoscope and endoscope. Both camera systems are fed through a digital mixer

so that both images are displayed on the same monitor as a "picture-in-picture" format.

C. *Patient Positioning for Gastric Bypass*

Laparoscopic gastric bypass is typically performed on patients who weigh from 250 to more than 600 pounds and may require up to 3 to 5 hours to complete. Morbidly obese patients are particularly vulnerable to position-related injury because of their size; thus, the number one rule in positioning is to provide a safe and stable platform and environment. The second rule is to use positioning to provide optimal exposure.

1. Operating table: Patient positioning for laparoscopic gastric bypass (LGBP) begins with an appropriate operating room table that can accommodate the needs of the bariatric patient. Not only must it have the capacity to support superobese patients up to 350 kg but it must also provide the steep tilt and rotation required in laparoscopy to gain adequate exposure. Table width must also be adequate to handle various body shapes. Tables with electric motors as opposed to hand cranks are highly recommended to facilitate position changes. Although it is possible to perform minimally invasive morbid obesity surgery on some standard operating tables (500-lb maximum for most), if available, it is advised that a specialized table be used for obese patients. These tables can accommodate patients who weigh 800 lb. The acquisition of such tables is logical if these cases are to be done regularly. Some table models can be controlled by the surgeon via voice activation; this feature is particularly desirable because it allows the surgeon to rapidly change table positions without relying on other operating room personnel. Important bed accessories include footboards, straps, and padding to safely secure the patient to the bed and prevent pressure injuries. Patient transfer accessories such as air transport mats can greatly aid the transfer of even the largest patients to and from the operating table.
2. Patient position: (see Figures 9.1.1, 9.1.2) Most minimally invasive bariatric experts utilize one of two patient positions for both bypass and gastric banding: either the supine position or the supine position with the legs abducted on straight leg boards (the so called "French position"). The modified lithotomy position is not recommended. The authors utilize the supine position with the legs together. Regardless of which position is chosen, it is mandatory that well-secured and padded footboards be employed. Leg straps as well as waist straps are used to secure the patient to the table. These measures will help prevent the patient from sliding down the table when placed in the reverse Trendelenburg position or when turned from side to side. The patient's weight should be evenly distributed on the table without elements of the torso or limbs "hanging over the side." A urinary catheter is then inserted, and an electrocautery grounding pad is placed, usually on the anterior thigh. Before prepping and draping, all "pressure points"

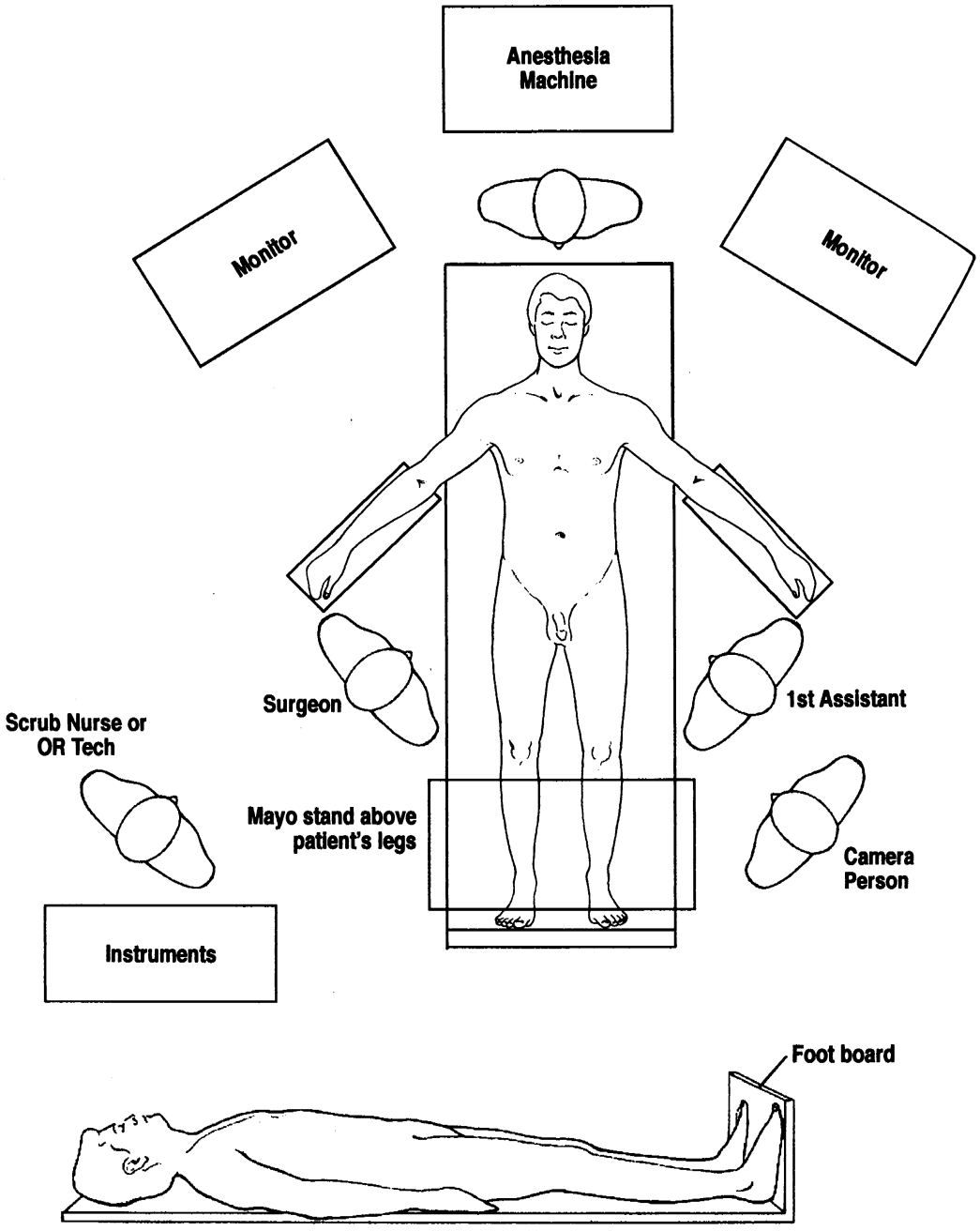
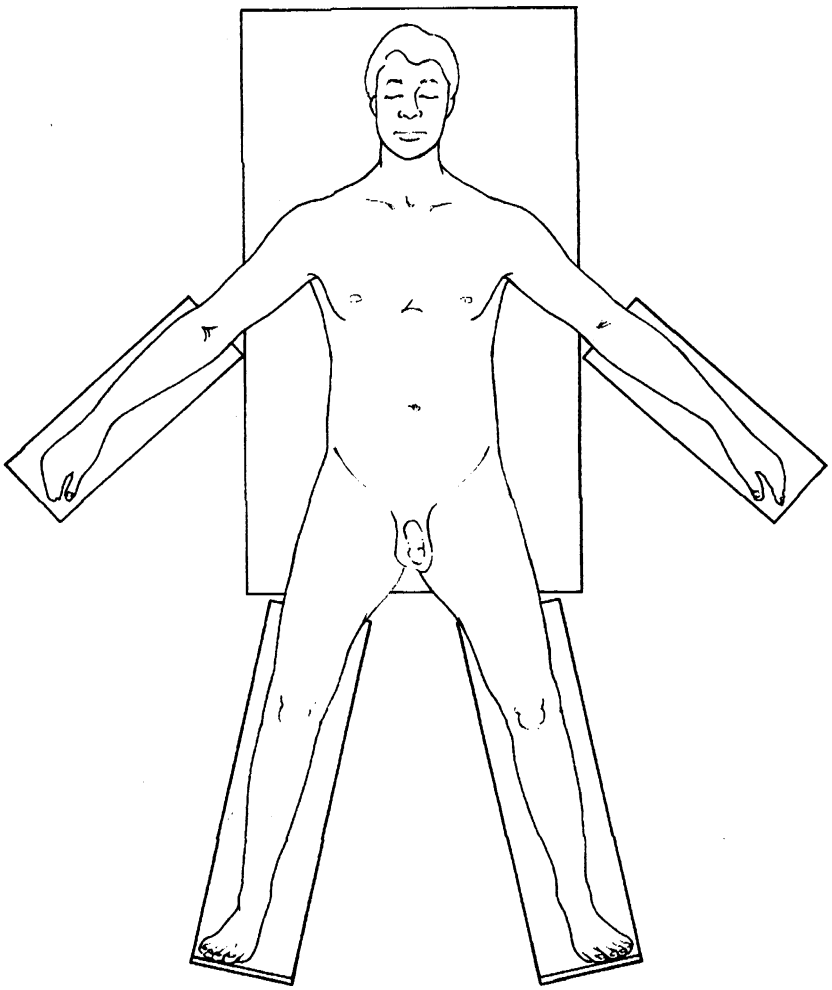


Figure 9.1.1. Operating room setup. Patient and operating room positions for laparoscopic band and laparoscopic gastric bypass. Inset shows footboard.

especially alongside the arms, hands, feet, and head should be examined and padded appropriately to avoid pressure or nerve injuries. A stationary retractor-holding device is often attached to the table and can be used to secure the liver retractor throughout the operation. It must not be in direct contact with the patient's skin to avoid pressure injury or electrocautery conduction.

a. Sequential pneumatic compression devices (SCDs) and deep vein thrombosis prophylaxis: SCDs are placed around the calves and



igure 9.1.2. Alternate position of patient with legs abducted and/or flat leg oards.

thighs preoperatively. They are used throughout the anesthetic induction and the operation. SCDs, along with perioperative, low-dose heparin or low molecular weight heparin, are highly recommended to prevent venous thrombosis and pulmonary embolus, which is a rare but potentially fatal complication of morbid obesity procedures.

b. Arm positioning: The authors, most often, place the arms in the abducted position on carefully padded armboards (Figure 9.1.1). Alternatively, the right arm may be adducted or "tucked" along the patient's right side. This allows the surgeon to stand near the patient's right shoulder to perform the jejunojejunostomy in the midabdomen. A metal or plastic limb holder or "sled" may be required to secure the arm at the side.

3. Dispersement of equipment in room: Figure 9.1.1 shows the arrangement of the equipment, patient, surgeons, and staff. The anesthesia machine and equipment are in the usual position at the head of the table. One of the laparoscopic monitors is placed off the patient's left

shoulder while the second is positioned in a similar position on the right side. The table holding the surgical instruments is at the foot of the table to the patient's right side. The scrub nurse or technician stands to the right of the patient. If the supine with legs adducted position is used, then the authors suggest that the mayo stand be placed over the patient's lower legs. If the legs are abducted then the mayo stand will be off to the right side.

4. Suggested positioning of surgeons: If the supine position with legs adducted is used, the surgeon stands on the patient's right side adjacent to the operating technician while the first assistant and second assistant (camera operator) stand on the patient's left side. If the legs are placed in the abducted position then the surgeon may stand between the legs and the surgical assistants stand one on each side of the patient; the scrub nurse or technician in this scenario is also off to the side and toward the foot of the table. Patient size may be a limiting factor with the French approach as there may be limited space between the legs.

D. Conclusion

It is of paramount importance that the surgeon carefully consider both the OR setup as well as the patient's position on the operating table. Careful attention to numerous details such as the use of footboards, securing the patient to the table, and the padding of the patient is mandatory, especially in this patient population. Poor planning and positioning may necessitate time consuming and cumbersome setup and positioning adjustments during the operation.

It is also necessary that the surgeon review with the OR staff the equipment, instruments (both reusable and disposable), staplers, and tissue-cutting devices that will be or might be required during the case. Failure to do this will likely lengthen the operation and/or jeopardize the safety of the operation.

III. Selected References

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