Laparoscopic Staging of Malignancies

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Although laparoscopic techniques were first used for the treatment of abdominal malignancy in the late nineteenth and early twentieth centuries, it is only because of the excitement generated by therapeutic laparoscopy in the past 10 years that this endoscopic modality is once again being considered for the staging and management of patients with abdominal malignancy. Beginning in the 1920s and 1930s, a concerted effort was made by physicians throughout the world to develop a staging system that would allow a “world-wide dialogue” about the interpretation and classification of solid tumors. This work was crystallized by Pierre Denoix in the 1940s, who first advanced the concepts of the tumor, node, metastasis (TNM) system. During the 1940s and 1950s, further work was done by committees throughout the world on both the clinical and the pathologic staging of cancer. Throughout the 1960s and 1970s, staging systems were in use (i.e., Dukes's system for colorectal cancer), but the language of cancer staging was not really delivered from the “land of Babel” until the 1980s when the decision was made by committees of the International Union Against Cancer (UICC) and the American Joint Committee on Cancer (AJCC) to adopt a system based on tumor status, nodal involvement, and metastatic findings (TNM).

The development of the TNM system and the rebirth of laparoscopy occurred almost simultaneously. As a result of this rebirth, endoscopic staging can, in fact, complement other modalities, such as computerized tomography, ultrasound, nuclear medicine scanning, and magnetic resonance imaging. It is also important to realize that the goal of pathologic staging has generally been to determine the advisability of open surgical procedures on the major body cavities. It is becoming clear that many patients who may not benefit from major exirrative procedures may derive benefit from palliative nonoperative procedures. The laparoscope can be understood as a tool that will allow safe retrieval of pathologic material and the performance of palliative procedures in the management of cancer patients.

Historical Overview

The first documented examination of the abdominal cavity by laparoscopy was by Ott in 1901. The work of this Russian gynecologist predated the work of Kelling of Dresden, who utilized a cystoscope to evaluate the abdominal cavity of dogs. These early pioneers realized that the only way the abdominal cavity could be visualized was if techniques were developed to expand the abdominal wall, allowing the safe introduction of optical devices. During the early twentieth century, the concept of the pneumoperitoneum was developed, which led to the work of Jacobaeus, who introduced the term, “laparoscopy.” In addition, Jacobaeus first described the diagnosis of cirrhosis, metastatic tumors, and tuberculous peritonitis using the laparoscope. During the next two decades, laparoscopy was introduced into the United States by Bernheim. Although the technique had potential, visualization was hampered by limited optics. Later, Ruddock advocated “peritoneoscopy” and demonstrated improvements in diagnostic accuracy. The further application of laparoscopic techniques to abdominal cancer was reported by Benedict, who discovered that gastric and colonic neoplasms together with gynecologic disease were causes of ascites. The safety of pneumoperitoneum was improved when Fervers advocated the use of oxygen or carbon dioxide rather than room air in the 1930s. Greater safety in the instillation of gas was achieved by Veress who developed a spring-loaded needle that could safely be introduced into the peritoneal cavity in the late 1930s.

Since then the application of laparoscopic techniques to routine cholecystectomy, appendectomy, and other
classical operations of the abdominal cavity have led to the development of videoendoscopy and high-resolution television monitors. Today’s outstanding optical resolution allows for safer inspection and biopsy in cancer patients and more complete interpretation of abdominal findings.

Patient Selection and Monitoring

Although diagnostic laparoscopy has an associated morbidity and mortality, problems can be limited by careful selection of patients. Several studies have documented adverse cardiopulmonary effects of pneumoperitoneum and, therefore, it is important to carefully screen patients who have underlying pulmonary and cardiac disease. Since many older patients with potential neoplasms have associated chronic obstructive pulmonary disease and coronary artery disease a full work-up including appropriate laboratory and imaging studies should be done prior to diagnostic laparoscopy. Similarly, laboratory evaluation for coagulation defects is extremely important, especially in patients who may be nutritionally depleted or have underlying liver disease. Patients who have an elevated partial thromboplastin time or protime will require fresh frozen plasma or vitamin K to correct these defects. It is also important to assess the platelet count preoperatively and to achieve platelet levels of at least 20,000 to 30,000 per mm$^3$ prior to diagnostic laparoscopy.

Although abdominal assessment for cancer may be achieved without laparoscopy, this technique will be helpful when studies have been unrevealing or equivocal. Patients with unexplained ascites, abdominal pain, weight loss, or palpable masses would be better treated with early laparoscopy and directed biopsy than with multiple scans and blind biopsies.

Throughout the last several decades, there have been advocates for the use of local anesthesia during diagnostic laparoscopy. This would certainly be appropriate in cooperative patients where limited inspection is anticipated. It is our view that general anesthesia is necessary to achieve proper abdominal relaxation, to create an adequate pneumoperitoneum, to permit appropriate monitoring of patients, and to allow the surgeon to undertake unhurried inspection and biopsy. Because of the use of general anesthesia, it is critical that patients undergo laboratory, cardiac, and pulmonary evaluation before surgery to avoid problems related to the additive effects of general anesthesia and creation of a pneumoperitoneum.

Monitoring during laparoscopy should include electrocardiographic monitoring, end-tidal CO$_2$ monitoring, blood-pressure evaluation using either a cuff or an indwelling arterial line, and bladder catheter that allows the urine output to be evaluated and decompression of the bladder for trocar insertion. A nasogastric or orogastric tube should routinely be passed, in order to facilitate gastric emptying during the procedure. If previous studies, such as computerized tomograms or ultrasound studies, have been obtained, these should be readily available in the operating room so that the surgeon can use them to determine the site of trocar insertion that will minimize potential injury and untoward results.

The surgeon endoscopist who undertakes laparoscopic examination should also have available accessories needed for biopsy or cytologic studies. Acquaintance with two-and three-trocar approaches will also be helpful, depending on the information to be obtained. A percutaneous core biopsy needle should be available if directed biopsy is anticipated. The primary accessory instruments required for diagnostic laparoscopy are: noncrushing biopsy forceps;atraumatic graspers for manipulation of bowel and omentum; intra-abdominal retractors for lifting hepatic lobes; or, if the retrogastric area is entered, the stomach, and the usual array of equipment for controlling bleeding resulting from biopsy. In addition, either elastic stockings, leg wraps, or sequential compression stockings should be applied to reduce the risk of venous stasis, especially when the patient is in the steep reverse Trendelenburg position. It is also important to position the feet at a 90° angle on a footboard to avoid neurologic injury during prolonged laparoscopic examination.

Techniques of Diagnostic Laparoscopy

The choice of an insertion site for the trocar to be used in the creation of the pneumoperitoneum depends on whether there are healed abdominal incisions, abdominal masses, organomegaly, or ascites. The Veress needle is used for most patients, but we prefer an open technique using the Hasson cannula, especially if the patient has had other operations. The periumbilical approach is usually selected, but evaluation of the abdomen with ultrasound may indicate the presence of intra-abdominal adhesions that make an alternative trocar site more attractive. If ascites is present, the classic Trendelenburg position for establishment of pneumoperitoneum must be avoided. It is suggested that the patient be placed in reverse Trendelenburg position; the gastrointestinal contents will float cephalad on the surface of the ascitic fluid, which will cushion them during the introduction of the needle into the pelvis. Carbon dioxide should be introduced above the level of ascitic fluid to avoid bubbles, which can be created when CO$_2$ is introduced directly into the ascitic collection. Drainage of ascitic fluid prior to the introduction of CO$_2$ is recommended.