Early in the 1970s, two pediatric surgeons assisted in the development of the first endoscopic instruments suitable for use in children.\(^1\) In his 1973 landmark paper, Dr. Stephen L. Gans reported on the use of a miniaturized telescope with a Hopkins rod lens optical system to perform peritoneoscopy in 16 children, including five cases of sexual identity problems, four cases of possible biliary atresia, four cases of hepatomegaly, one intraabdominal foreign body, one newborn with ascites, and one child with deep jaundice.\(^1\) In 1976 Dr. Bradley M. Rodgers reported on his use of thoracoscopic biopsy for nine children.\(^3\)

Gans saw early on the potential role of laparoscopy in the management of pediatric malignancies. He commented on its possible role in (1) diagnosing some primary tumors, (2) establishing the nonoperability of some malignant lesions, and (3) performing second-look procedures.\(^1\) In 1976, Karamanovic and colleagues\(^5\) reported their 5-year experience to the XXIII annual meeting of the British Association of Paediatric Surgeons with 59 laparoscopies from the University Children’s Hospital in Zurich. Included in those cases were three oncologic applications of laparoscopy, all involving successful diagnosis of primary or secondary liver tumors. No complications were reported, and all children were discharged the following day.

Rodgers and Talbert\(^4\) described their initial experience with thoracoscopic biopsy, under local anesthesia, on nine patients, five of whom had cancer. Rodgers et al\(^6\) later described a 92% accuracy for thoracoscopic biopsy of intrathoracic tumors in children, with no procedure-related morbidity or mortality. The importance of this technique was further emphasized by Ryckman and Rodgers\(^7\) in their report on their experience with 25 thoracoscopic procedures for intrathoracic neoplasia in children. Their experience included the evaluation of parenchymal, pleural, and mediastinal disease, and the diagnostic accuracy was 92% with only minor complications.

Despite the success of these techniques as noted in those early reports, subsequently few papers describing the utilization of laparoscopy and thoracoscopy appeared in the pediatric surgical literature.\(^1\) Many pediatric surgeons initially harbored justifiable concerns about the morbidity of this modality, owing to the cumbersome nature of the instruments and the technical difficulty associated with two-dimensional surgery and the loss of tactile sensation. Minimal access surgery did not gain its immense popularity, for either children or adults, until after the first reports of successful laparoscopic cholecystectomy.\(^12\) Since then, vast improvements in video technology and endoscopic instrumentation have made it possible to perform elaborate minimal access procedures in the abdomen and chest.\(^14\) Application of these techniques to various aspects of pediatric surgical care, including malignant disease, is ever increasing. This chapter reviews the technique, indications, complications, and caveats of minimally invasive surgery (MIS) as it is applied in pediatric oncology.
Technique

Other than for some minor alterations, basic pediatric laparoscopic and thoracoscopic principles apply when managing childhood malignancies. These principles involve (1) achieving cavitary access, (2) visualizing the disease process, (3) dissecting and extracting tissue, and (4) achieving hemostasis.

Instrumentation

Cavitary Access

With the increasing miniaturizing of equipment, very few procedures require instruments larger than 5 mm, and instruments as small as 1.7 mm are now being used routinely. With smaller instrumentation, 5-mm and smaller trocars are now almost exclusively used (unless an endoscopic stapler is required), decreasing postoperative pain and improving cosmesis. For most laparoscopic cases, cavitary access is achieved through the umbilicus, either using an open Hasson technique or a percutaneous method. My approach is to use an infraumbilical cutdown technique in the vast majority of children, leaving the percutaneous approach for the obese child (where the open technique would be quite difficult). However, an increasingly popular percutaneous method involves the Step II system from InnerDyne (Salt Lake City, UT). Using an expandable sleeve with a blunt dilator and cannula, this trocar dilates the tract created by the insufflation access needle. This holds the cannula firmly in place without the use of threaded anchors, and leaves a slit-like wound half the size of the wound left by similar-sized trocars.

Shorter cannulas with blunt obturators and rubber caps are available for use in thoracoscopic surgery, and are particularly helpful when insufflation is required. In general, introduction of the initial cannula into the chest is very safe, particularly when single-lung ventilation is achieved. Single-lung ventilation can be accomplished most easily when a dual-lumen endotracheal tube is used. However, the smallest dual-lumen tube is roughly 28 French, making application of this technique difficult in children younger than 13 years old. For them, selective intubation of the opposite mainstem bronchus (with or without a cuffed endotracheal tube) can be performed, with flexible bronchoscopy as a helpful aid to ensure correct tube placement. If this technique is not successful, the addition of a bronchial blocker on the ipsilateral side may be effective. Finally, insufflation can be added, with pressures limited to 2 to 3 mm Hg, realizing the potential cardiovascular effects of insufflation because a child’s mediastinum is very mobile.

Visualization

Visualizing the disease process requires the now-standard Hopkins rod-lens endoscope. Hopkins initially combined a novel glass rod-lens endoscope with coherent bundles of sheathed glass fibers of high refractive index. Various improvements have subsequently been made, including the addition of an intensely bright xenon light source and a computer chip to produce the superb visual images with which we are now familiar. Though now taken for granted, this visual revolution has paved the way for the advancement of all minimally invasive procedures.

There are a variety of laparoscopes available. Though the 10-mm endoscope provides a large field of view and excellent light intensity, the majority of procedures can be performed with a 5-mm scope. In addition, laparoscopes provide a 90-degree field of view and magnification, and they are angled at 0, 30, 45, and 70 degrees and at even more acute angles. Though initially more difficult to use, the angled telescopes provide greater flexibility in most operative procedures.

Dissection, Biopsy, and Extraction

Exposure of the mass in question is performed by standard laparoscopic dissection techniques, using a variety of dissectors, forceps, and scissors. Once exposure of the lesion has been achieved, biopsy can be taken in a variety of ways. Incisional biopsy can be performed using cup biopsy forceps, which, in comparison to ordinary grasping forceps, preserve a