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Laparoscopy in the Management of Pediatric Intraabdominal Tumors

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ABSTRACT

Background and Objectives: Unresectable intraabdominal tumors pose a challenge to the pediatric oncology team. Tumor tissue is needed for diagnostic and prognostic analyses. Laparotomy is quite invasive and computerized tomography-guided needle biopsies, though less invasive, may not procure enough tissue for a complete analysis. This study aimed to evaluate our experience with laparoscopy in managing these tumors.

Methods: Nine children underwent laparoscopy: 6 for primary tumor biopsy, 2 for tumor resection, and 1 for tumor dissection followed by laparotomy for tumor resection.

Results: The study included 7 females and 2 males with a median age of 5 years (range, 3 to 15 years). Three patients had neuroblastoma, 2 had mature ovarian teratomas, 2 had rhabdomyosarcoma, 1 had erythrophagocytic histiocytosis, and 1 had T-cell hepatosplenic lymphoma. In each case, adequate tissue was procured for diagnostic and prognostic analyses. No perioperative complications occurred. Both patients with ovarian teratomas are well. Four patients continue to receive anti-cancer therapy. The patient with erythrophagocytic histiocytosis underwent a cord-blood stem cell transplant. One patient with neuroblastoma was lost to follow-up, and 1 patient with rhabdomyosarcoma died of progressive disease.

Conclusions: Laparoscopy is a valuable technique in the management of pediatric intraabdominal tumors. It allows for tumor biopsy under direct vision, and adequate tissue is procured for all analyses. Moreover, it allows the surgeon to dissect the tumor and determine resectability.

Key Words: Laparoscopy, Abdominal neoplasms, Pediatrics.

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INTRODUCTION

The advent of laparoscopic techniques has placed minimally invasive surgery as the preferred procedure for thoracic and intraabdominal conditions. Patients treated with this approach have decreased needs for narcotic analgesics, shorter hospitalizations, quicker recovery, and excellent cosmetic results. Because of these desirable outcomes, the applications of laparoscopic minimally invasive surgery are expanding.

Childhood intraabdominal tumors pose a diagnostic and technical challenge to the pediatric oncology team. The correct diagnosis and appropriate treatment are dependent on adequate tissue procurement for histologic, karyotypic, and molecular analyses. These tumors may be deemed unresectable by diagnostic imaging at diagnosis, and therefore a biopsy procedure is undertaken to obtain the tumor. Computerized tomography-guided needle biopsies may not yield enough tissue for all studies. Therefore, laparoscopy now plays an important role in the management of these challenging tumors. Adequate tissue can be procured, and tumor resectability can be assessed.

The present report describes our experience with 9 pediatric oncology patients who had intraabdominal tumors and who underwent laparoscopic primary tumor biopsy or second-look surgery.

PATIENTS AND METHODS

Nine children were referred for evaluation: 6 for an abdominal mass, 2 for pelvic masses, and 1 for fever and pancytopenia. Each patient underwent a physical examination, laboratory evaluations, and diagnostic imaging. The laparoscopic procedure was used either as a primary means of determining tumor resectability or of procuring tumor specimens, or both; in 6 patients, at second-look surgery to aid in tumor dissection in 1 patient; and for resection of an ovarian mass in 2 patients. The same pediatric surgeon (GS) performed all operations.

Technique

The operations were performed using general endotra-

cheal anesthesia. The patient was usually in the supine position, but was turned at 45 degrees when necessary to facilitate the procedure. The abdomen was entered through a small infraumbilical incision, under direct vision. A pneumoperitoneum was created to a pressure between 12 mm Hg and 14 mm Hg. Only 3-mm and 5-mm ports were usually used. One of the ports was converted to 12 mm in 2 cases in which the automatic endoscopic stapler (Endo GIA, U.S. Surgical Corporation, Norwalk, CT) was needed. In all cases, the tumor was identified, and a careful search for metastases was done. Resectability was assessed by evaluating anatomical location, fixation of the tumor, and involvement of contiguous organs. An avascular representative area was selected for biopsy. Mobilization of the right or left colon was necessary in order to expose retroperitoneal tumors. A combination of needle and wedge biopsies was used in 3 cases. A needle biopsy was necessary in order to obtain a deep specimen.

The wedge biopsy was taken by sharp dissection with endoscopic shears. Special effort was made to avoid using electrocautery or other forms of coagulation around the specimen in order not to damage the tissue sample. The problem with this technique was the brisk bleeding that would follow, especially in cases involving hypervascular tumors. The surgeon had to be prepared to apply pressure or follow with hemostatic maneuvers after retrieval of the specimen. Use of monopolar current was generally avoided, and preference was given to bipolar coagulation and the Harmonic scalpel (Ethicon, Johnson and Johnson Corporation, Somerville, NJ). The endoscopic clip applier was readily available. The application of fibrinogen glue or similar hemostatic agents was helpful. The specimen was retrieved using a plastic specimen-retrieval bag (Endo Catch, U.S. Surgical Corporation, Norwalk, CT). Each procedure was coordinated with the hematology-oncology service and the pathology department, in order to ensure that the specimen was adequate and representative of the tumor, and that all the appropriate studies were done.

RESULTS

Seven girls and 2 boys with a median age of 5 years (range, 3 to 15 years) were included in the study. Three children had stage IV neuroblastoma; 2 had clinical group III, stage III rhabdomyosarcoma; 2 had mature ovarian teratomas; 1 had erythrophagocytic histiocytosis; and 1 had Epstein-Barr virus associated T-cell hepatosplenic lymphoma **(Table 1)**. Six patients underwent primary diagnostic laparoscopic biopsy of the tumor. One patient with neuroblastoma underwent an open retroperitoneal biopsy followed by chemotherapy. At second-look surgery, laparoscopy aided in the dissection of the tumor off vital structures, and then laparotomy was performed for complete tumor resection. Two patients underwent laparoscopic-assisted removal of a mature ovarian teratoma. In each case of primary diagnostic laparoscopy, adequate tissue was procured for diagnostic and prognostic analyses. No intra- or postoperative complications occurred. Both patients with ovarian teratoma are well. Four patients continue receiving anti-cancer therapy (2 with neuroblastoma, 1 with lymphoma, and 1 with rhabdomyosarcoma). The patient with erythrophagocytic histiocytosis underwent a cord-blood stem cell transplant. One patient with neuroblastoma was lost to follow-up, and 1 patient with rhabdomyosarcoma died of progressive disease.

DISCUSSION

Our experience with laparoscopy demonstrates the feasibility of determining tumor resectability and procuring sufficient tissue for diagnostic and prognostic analyses. Moreover, in 1 case at second-look surgery, laparoscopy aided in tumor dissection, which resulted in a much smaller abdominal incision.

Laparoscopy for pediatric intraabdominal tumors has been mostly utilized for neuroblastoma.[1-4] In cases of neuroblastoma, most were identified through mass screening and, therefore, small lesions. In a series of 37 children with abdominal neuroblastoma, the length of hospitalization and the time to feeding or the initiation of chemotherapy, or both, were significantly shorter in the laparoscopic group, compared with those in the open surgery group. Operative time and estimated blood loss were similar. In our series, the intraabdominal tumors were large and deemed inoperable by diagnostic imaging and at laparoscopy in all but 1 patient.

The conventional surgical wisdom is to approach adnexal lesions through laparotomy; however, laparoscopy is becoming the preferred procedure. Indeed, infants, children, and adolescents are being managed laparoscopically with excellent results.[5-9] As with other laparoscopic procedures, the operative time and hospitalization are shorter and the cosmetic results are superior to those of laparotomy. In our series, 2 patients were treated for

Table 1.
Patient Characteristics

Patient	Age (yr)/Sex	Presenting Symptoms	Diagnosis/Stage	Laparoscopic Procedure
1	3/Female	Abdominal mass	Neuroblastoma/IV	Primary biopsy
2	4/Male	Bone pain and fever	Neuroblastoma/IV	Second-look dissection
3	5/Female	Abdominal pain	Rhabdomyosarcoma/III	Primary biopsy
4	5/Male	Abdominal pain	Rhabdomyosarcoma/III	Primary biopsy
5	5/Female	Fever and pancytopenia	Erythrophagocytic histiocytosis	Primary liver biopsy
6	8/Female	Abdominal mass and fever	Hepatosplenic lymphoma	Primary liver biopsy
7	9/Female	Pelvic mass and pain	Mature teratoma–ovarian	Primary tumor resection
8	12/Female	Abdominal mass and pain	Neuroblastoma/IV	Primary biopsy
9	15/Female	Pelvic mass and pain	Mature teratoma–ovary	Primary tumor

mature teratoma. The tumor was diagnosed and treated laparoscopically. A small abdominal incision was necessary to retrieve the tumor because of its size. No perioperative complications occurred.

In a series of pediatric and young adult oncology patients at Memorial Sloan-Kettering Cancer Center, laparoscopy (46 procedures) allowed for adequate tissue procurement and was found to be safe.[10] The most common procedure was liver biopsy followed by diagnostic tumor biopsy and other procedures. We had a similar experience with our patients. In addition to routine histologic analyses, all biologic protocol requirements were satisfied.

What are the potential pitfalls of laparoscopy used in the management of intraabdominal tumors? One may be tumor spillage, especially in the case of Wilms' tumor. We encountered tumor spillage during video-assisted thoracoscopic biopsy of a thoracic, paraspinal Wilms' tumor.[11] Unresectable or bilateral Wilms' tumors may be better approached for biopsy through a small retroperitoneal incision. Perhaps laparoscopy can be used to determine the resectability and aid in the dissection of a large Wilms' tumor.

CONCLUSIONS

Our experience with laparoscopy in the management of pediatric intraabdominal tumors demonstrates that laparoscopic minimally invasive surgery is an important addition to the armamentarium against these tumors. Biopsies are performed under direct vision, and adequate tumor tissue is procured for diagnostic and prognostic analyses. Moreover, dissection of the tumor is feasible, and its resectability can be determined as well.

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