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Original Article

Laparoscopy as a Primary Investigatory Tool in Pediatric Abdominal Masses

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Abstract

Background: Management of abdominal masses still pose a major challenge for pediatrician and surgeons with many controversy as regards the best investigatory tools.

Aim of the Work: This study was designated to evaluate the role of diagnostic laparoscopy in investigating equivocal pediatric masses that had undergone other imaging modalities.

Patients and Methods: A combined prospective and retrospective multicenter study over a period of 12 years from January 2005 to December 2016 was undertaken. This study included all children aged from 3 months to 15 years. Those having a documented diagnosis through other imaging modalities such as sonographic and/or computed tomography (CT) guided biopsy were excluded. All patients underwent multiport diagnostic laparoscopy for biopsy of the mass. All specimens were histologically assessed basically using Hematoxylin and Eosin (H and E) staining; some specimens had been immunohistochemically studied.

Results: One hundred and thirty–two patients were recruited in the study. They were 69 males and 63 females with a male to female ratio of 1.1:1. The age ranged from 3 months up to 15 years with the mean age of 2.7 ± 0.8 years. Out of the total studied group, 54 patients were diagnosed with neuroblastoma (40.9%), while 66 (50%) were having nephroblastoma. The remaining 12 (9.1%) were having non–Hodgkin’s abdominal lymphoma. Not all patients showed any complication related to the procedure. The mean follow up period was 3.6 years.

Most of the cases (n=121) despite having a different diagnosis, were clinically staged as grade I to grade II (91.7%). Neither intraoperative nor postoperative complications were recorded during this technique. The mean operative time was 72 mins ± 20 in the earliest group; yet, it has declined to be 32 ± 12 minutes in the latest group due to the advancement of the learning curve.

Conclusion: Laparoscopy is accurate and safe for investigating pediatric solid abdominal masses. It should be used as the sole tool for biopsy of solid abdominal tumors in pediatrics.

Keywords: Laparoscopy, Abdominal Masses, Biopsy

Introduction

An accurate histopathological assessment of a biopsy obtained from solid abdominal pediatric tumors is indispensable in planning their best multimodal line of treatment.1 Management of pediatric malignancies traditionally involved the open surgical procedure/s as a tool to obtain a tissue for histopathological assessment or even for tumor resection.1–2
The management of pediatric abdominal malignancies using minimally invasive surgical techniques (MIS) has an inappropriately slower pace of evolution compared to adults. This may be attributed to some factors such as loss of tactile ability and/or owing to the lack of acquaintance with some advanced techniques.

However, this valuable procedure is currently considered to be an effective and a safe tool for diagnosis of abdominal malignancy in pediatrics. It may act as a useful modality in assessing the tumor pathology, confirming the presence and/or the extents of abnormal findings on CT scan. Additionally, it may help to obtain tissue samples with high accuracy either by sampling the appropriate tissue or by using needle/localization methods.

MIS has been used for management of many pediatric abdominal tumors including; neuroblastoma, nephroblastoma when suspecting local recurrence as well as different varieties of other malignant abdominal masses such as hepatoblastoma, ovarian teratoma, rhabdomyosarcoma, lymphoma and other types of tumors such as mesothelioma, primitive neuroectodermal tumor (PNT) and histiocytoma.

The aim of the current study was to critically evaluate a 12–years’ experience of multi–institutional practice of laparoscopic biopsy for pediatric abdominal malignancy.

Patients and Methods

A combined prospective and retrospective multi-institutional study for a period of 12 years from January 2005 to December 2016.

This study enrolled children with an age ranging from 3 months to 15 years, who showed an equivocal or inaccurate diagnosis by different imaging modalities such as sonography and/or CT. Excluded from this study were those with an accurately documented diagnosis through other imaging modalities including sonographic and/or computed tomography (CT)-guided biopsy. All patients experienced multiport diagnostic laparoscopy for biopsy from the mass as previously described. The pathologist further evaluated all specimens histologically using Hematoxylin and Eosin (H & E) staining, yet, some specimens were immunohistochemically studied, whenever necessary. Interpretation of the results was done by experienced pathologists. Surgical data including the mean operative time, inter-procedural blood loss, conversion into open surgery, postoperative complication/s, and hospital stay were all determined. Data are presented as Mean ± SD.

Results

This 12–year multi–institutional prospective–retrospective study recruited 132 patients, who underwent abdominal laparoscopy for diagnosis of abdominal tumors. They are composed of 69 (52.3%) males and 63 (47.7%) females. Patients’ age ranged from 3 months up to 15 years with a mean age of 2.7 ± 0.8 years.

Out of one hundred and twenty (91%) patients with solid abdominal tumors, the diagnosis proved to be neuroblastoma in 54 patients (40.9%) and nephroblastoma in 66 (50%). The remaining 12 (9.1%) patients had a soft abdominal malignancy in the form of non–Hodgkin’s abdominal lymphoma.

The indications for biopsy ranged from the diagnosis of newly discovered masses, to evaluation of recurrence or residual mass post–therapy as well as judging mass resectability before performing the formal traditional surgery as in cases of nephroblastoma (Table 1).

Initially, the operative time ranged from 45 minutes up to 125 minutes, as the mean was reported to be 72 ± 20 minutes in the earliest group; yet, it had declined to be 32 ± 12 minutes in the latest group.

Table 1: Overall indications of laparoscopic biopsy

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue diagnosis of a newly discovered mass</td>
<td>111</td>
<td>84</td>
</tr>
<tr>
<td>Evaluation of a residual mass after previous</td>
<td>10</td>
<td>7.6</td>
</tr>
<tr>
<td>treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determination of resectability before laparotomy</td>
<td>11</td>
<td>8.4</td>
</tr>
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</table>

Table 2: Patient’s demographic characteristics and diagnosis
Laparoscopy as a Primary Investigatory Tool in Pediatric Abdominal Masses, Ossama M. Zakaria, et. al.

Most of the cases (n=121), despite having another different diagnosis, were clinically staged as grade I to grade II (91.7%).

Laparoscopy was converted into an open technique in only one patient with nephroblastoma in our early series due to large size of the obtained biopsy that was difficult to be intra-abdominally handled and for fear of substantial tumor rupture.

Neither intraoperative nor postoperative complications were recorded during this technique as none of our patients showed any complication during or following the procedure. The mean follow-up period was 3.6 years.

Patients’ demographic data and diagnosis are shown in Table 2.

Discussion

Intra-abdominal mass biopsy in pediatrics is a crucial initial step for setting the multimodality in motion to deal with intra-abdominal tumors. Laparoscopy has been established as an effective tool for obtaining a biopsy from abdominal tumors whether soft or solid. Furthermore, laparoscopic diagnostic accuracy for attaining biopsy in abdominal malignancies had shown an excellent result.

We had performed a laparoscopic biopsy procedure on 132 children. They included 66 (50%) with nephroblastoma, 54 (40.9%) neuroblastoma and 12 (9.1%) with a soft abdominal mass that was proven to be a non-Hodgkin abdominal lymphoma. The mean operative time has significantly decreased from 72 ± 22 minutes in our initial early procedures compared to 32 ± 12 minutes in the latest cases. This may mainly depend on the advancement of the surgeons’ learning curve, together with high-resolution monitors and cameras as well as the newly developed instruments.

Substantial complications were practically absent in our series. Only in one case of huge nephroblastoma, conversion to open surgery was mandatory in order to avoid substantial tumor rupture and subsequent dissemination. The safety and complication of our data were compared to those previously published in the literature (Table 3). Pediatric laparoscopic procedure could entail many complications; including hypothermia, hypercarbia, air embolism, visceral injury, tumor spillage, trocar-site herniation, bowel-obstruction, or port-site recurrence.

Herein we report laparoscopic biopsy to be feasible with almost no complication, apart from a conversion rate of 0.76% in only one case of nephroblastoma. This is coinciding with previously published data, emphasizing the feasibility and accuracy of laparoscopic biopsy, though they showed a higher conversion rate of laparoscopic biopsy up to 15%. Actually, the conversion to open surgical procedure per se is not a complication. It could be regarded as a failure or even limitation of the technique rather than a true complication. However, our primary concern is the patient’s safety and not trying to prove our ego.

Overall, we did not show any relevant complication with this technique, in agreement with what has been previously reported. Furthermore, we have not encountered any port-site metastasis nor any change in the proliferation rate of the mass. It was conveyed, however, that significant, reduction of tumor proliferation may take place due to carbon dioxide exposure.

In conclusion, laparoscopy, besides having a superior cosmetic appeal, may have inferior rates of post-biopsy morbidity. Principally, it may bestow the patients a quicker recovery, less pain, scarring and a shorter hospital stay, hence enabling them to quickly obtain their therapeutic regimes than with open surgery. It proved more feasibility with low limitations. This may give the green light for further studies, investigating the laparoscopic feasibility, rules, and outcomes not only in biopsy of different pediatric abdominal malignancies but also for their definitive surgical treatment.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Type of study</th>
<th>Total no. of laparoscopic Biopsies</th>
<th>Conversion rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holcomb</td>
<td>1995</td>
<td>retrospective</td>
<td>9</td>
<td>—</td>
</tr>
<tr>
<td>Saenz</td>
<td>1997</td>
<td>retrospective</td>
<td>39</td>
<td>6</td>
</tr>
<tr>
<td>Waldhausen</td>
<td>2000</td>
<td>retrospective</td>
<td>9</td>
<td>not reported</td>
</tr>
<tr>
<td>Lima</td>
<td>2002</td>
<td>retrospective</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Sailhammer</td>
<td>2003</td>
<td>retrospective</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Sporbeck</td>
<td>2003</td>
<td>prospective</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Iwanaka</td>
<td>2004</td>
<td>retrospective</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>Metzelder</td>
<td>2007</td>
<td>prospective</td>
<td>41</td>
<td>16</td>
</tr>
<tr>
<td>Our own series</td>
<td>2018</td>
<td>Prospective Retrospective</td>
<td>132</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3. Literature data on laparoscopic surgical biopsies and their conversion rate in pediatric abdominal malignancy.
References


