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Thoracoscopic resection of neurogenic tumors in children

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Abstract

Purpose: The aim of this study was to evaluate the feasibility of thoracoscopy in neurogenic tumors in infants and children.

Materials and Methods: From January 2000 to October 2005, 21 patients aged 7 months to 14 years (mean, 6 years) underwent thoracoscopy for tumor resection in 5 French institutions. One 10-mm optical port and 2 operative 5-mm ports were needed. Selective intubation was required for 3 patients aged about 12 years. Tumor was removed with an endoscopic bag in all cases.

Results: All procedures were completed successfully without any incomplete resection or recurrence. One conversion was necessary because of a huge mass. A chest tube was left for a mean of 2 days for 17 children. Two children had not had any drainage. Two postoperative chylothorax required chest drainage for 12 days. Only 5 of the 6 older patients (mean age, 12 years) needed a patient-controlled analgesia. The mean operative time was about 100 minutes. Hospital stay ranged from 4 to 12 days. Tumors were neuroblastoma or ganglioneuroblastoma in 16 cases and ganglioneuroma in the 5 other cases.

Conclusion: Thoracoscopy for resection of thoracic neurogenic tumors in children is a feasible, safe, and efficient procedure. The surgeon has a better visualization of the tumor and its anatomic connections. Resection can be as complete as an open procedure without having to complicate the operative technique in the same operating time. It avoids cosmetic and functional disorders because of thoracotomy. It allows a good cosmetic resection without spillage.

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Thoracic neurogenic tumors are mostly represented by neuroblastomas, which are commonly less aggressive in the thorax than when under the diaphragm [1]. Traditional approach for the treatment of thoracic neurogenic tumors in infants and children was posterolateral thoracotomy. This surgical access is traumatic with a significant surgical morbidity and a long recovery time but with a very good prognosis. In the 1970s, Rodgers et al [2,3] introduced thoracoscopy for diagnosing intrathoracic pathologies in children. Advances in smaller endoscopic instrumentation have allowed pediatric surgeons to

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progress; more and more thoracic surgeries have been performed under thoracoscopic procedures in infants and children. These techniques seem to be perfectly suited for pediatric patients, thus leading to a better control of postoperative pain, a shorter hospital stay, and very good cosmetic results [4]. Surgeons have a better visualization of the anatomy. All those considerations bring surgeons to propose thoracoscopy for children with chest diseases.

This report is a review of a French experience in resection of thoracic neurogenic tumors in infants and children, using thoracoscopy. Five French institutions have collected their data. In each center, a surgeon with good experience in thoracoscopic surgery operated between 2 and 7 cases and selected some data that could be entered in this study: 2 patients were chosen by 2 centers, 4 by 1 center, 6 by another, and 7 by the last one.

1. Materials and methods

We reviewed data of 21 children with thoracic neurogenic tumor. These children underwent a thoracoscopic resection in 5 French institutions between January 2000 and January 2005. The screening included diagnostic data, surgical data, and the postoperative patient history. Preoperative evaluation of these patients included chest x-ray, computed tomographic (CT) scan, and tumor markers. The size of the tumor, its localization, and its presumed stage were evaluated; thoracoscopic resection was allowed or not. We included patients with a thoracic neurogenic tumor without any N-*myc* amplification, showing no signs of invasion on biological, radiologic, and scintigraphic examinations. None of them had a biopsy before resection and N-*myc* status was defined postoperatively.

Patients were placed in a lateral decubitus position or modified prone position. More often, anesthesia was obtained using a nasotracheal tube and ventilation was maintained manually without selective intubation. Selective one-lung ventilation (OLV) was not possible in infants and the coordination of the anesthetist was very important. Three ports were placed in triangulation; one 10-mm and two 5-mm ports for older children, and three 5-mm ports for younger ones. The first port was positioned under visual control, usually in the seventh intercostal space on the mid-axillary line. Ipsilateral lung was collapsed by insertion of a low pressure and low flow of carbon dioxide (4 mm Hg). Exceptionally, the ipsilateral lung was collapsed by the insertion of a nasotracheal tube in the contralateral main bronchus in the older patients. Electrocoagulation or ultrasonic scalpels were needed to perform the procedure. Tumor was removed in an endoscopic bag through a port site that was enlarged in a non–rib-spreading thoracotomy of about 2 cm. That is why the biggest tumors had to be split up in the endobag before being pulled out. The lowest port site allowed positioning of a chest tube at the end of the surgery. A postoperative evaluation with CT scan and tumor markers was carried out.

2. Results

Tumors were revealed by respiratory symptoms for 10 children, neurologic symptoms or dorsal pain for 8 children, and fortuitously for 3 children who were asymptomatic and had radiologic examinations in another context. Tumor sizes ranged from 3 to 10 cm in diameter (mean, 6 cm). All tumors were classified postoperatively as International Neuroblastoma Staging System stage I (stage I: localized tumor with complete gross resection and without lymph node migration).

All the procedures were performed entirely under thoracoscopy, except for one 3-year-old child who needed a conversion because of a huge mass; dissection could have been dangerous because of the adjacent large vessels. None of them presented a dumbbell tumor. All tumors were removed with an endoscopic bag. Because of the size of the tumor, 4 of them were cut in 2 or 3 parts in the bag, 8 needed an enlargement of a portal site into a limited non–rib-spreading thoracotomy for extraction (incision <2 cm). Fragmented tumors were reconstituted before histological examination to have a perfect analysis of microscopic margins. The mean operative time was about 100 minutes. Histologic results ranged from 9 cases of neuroblastoma, 9 of ganglioneuroblastoma, to 3 of ganglioneuroma. Diagnoses of ganglioneuroma did not correspond to asymptomatic patients and were unknown before surgery despite biological or radiologic examinations. Resection was complete in all cases according to the pathologist. A chest tube was left for a mean of 2 days for 17 children. It remained in situ for 12 days in 2 cases to treat a chylothorax. Two patients had not had any drainage. A partially regressive Horner syndrome was present in 4 young patients after dissection of an apical tumor. Nourishment began the day after surgery. Hospital stay ranged between 4 and 12 days. No difference was found among the 5 centers regarding surgical data or the follow-up. Finding from a CT scan performed 1 month later was normal and so were the tumor markers. None needed an adjuvant treatment, that is, neither chemotherapy nor radiotherapy. The follow-up ranged from 18 months to 6.5 years, and none of those patients has had any recurrence or relapse.

3. Discussion

Most of the morbidity in thoracic surgery is because of the trauma of the access wound. That is one of the reasons why minimally invasive surgery is showing an exponential development [5,6]. With advances in endoscopic instruments for children [7,8], thoracoscopy takes the place of thoracotomy in many diagnostic and therapeutic procedures [9]. Moreover, thoracotomy in a neonate is associated with the development of scoliosis in more than 30% of patients [10,11]. Resection of neurogenic tumors located in the posterior mediastinum required wide exposure via a

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