CLINICAL STUDY AND THE ROLE OF THORACOSCOPY TO EVALUATE MEDIASTINAL MASSES IN CHILDREN

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ABSTRACT

BACKGROUND

Mediastinal masses in infants and children comprise a heterogenous group of lesions which range from embryonic to neoplastic origin. The various surgical approaches to mediastinal masses include mediastinoscopy, Video-assisted Thoracoscopic Surgery (VATS), anterior thoracotomy, median sternotomy, and standard posterolateral thoracotomy. Of these, Video-assisted Thoracoscopic Surgery (VATS) is advantageous for evaluation and treatment of mediastinal masses.

MATERIALS AND METHODS

A prospective case series was conducted over a period of 3 years from March 2013 to August 2016 on 15 patients with mediastinal masses who presented to the tertiary care hospital. The patients underwent detailed clinical assessment. Depending on the anatomic location, clinical presentation and resectability noted in radiological investigation, a decision was taken on the type of intervention. All patients were operated under general anaesthesia, 10 patients underwent open thoracotomy through posterolateral and anterolateral thoracotomies, done for posterior or anterior mediastinal masses respectively. Five patients underwent Video-assisted Thoracoscopic Surgery (VATS). Two patients had masses in posterior mediastinum and three in anterior mediastinum. The patients with severe respiratory distress and those with evidence of compression of trachea were excluded. All patients were followed up to a 3-year period with chest x-ray, Ultrasound, tumour markers if indicated.

RESULTS

The study was statistically analysed on 15 children with mediastinal masses. Of the 15 children, 8 were boys & 7 were girls and the masses were located mostly in the anterior mediastinum in 8 (53%). The mean age was 15.65 months. The mediastinal masses were benign in 12 patients, malignant in 3. Air leaks stopped at a median time interval of 1 ± 1.66 days and pleural drainage at 2 ± 1.4 days in VATS; on contrary air leaks stopped at a mean interval of 2 ± 1.46 days and pleural drainage at 3 ± 1.46 days following open thoracotomy. The lung expanded clinically 1 ± 1.48 days and radiologically 2 ± 1.08 days earlier in VATS cases. The postoperative pain was less in VATS and requirement of analgesia was minimal when compared to open thoracotomy. The postoperative hospital stay was longer in open thoracotomy cases when compared to VATS.

CONCLUSION

Mediastinal masses are comparatively rare and most of the lesions came to attention before one year of age. Neurenteric cysts and tuberculosis are the common aetiologies. This study concludes that Video-assisted Thoracoscopic Surgery is far superior to open thoracotomy.

KEYWORDS

Mediastinal Masses, VATS, Children.

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BACKGROUND

Mediastinal masses in infants and children comprise a heterogenous group of lesions which range from embryonic to neoplastic origin. These lesions are present in a central thoracic space which is subdivided into superior, anterior, middle, and posterior mediastinum. The anatomic subdivision provides insight into the contents of the region with simplified differential diagnosis.

The space occupying lesions in a closed space would lead to the possibility of infection, respiratory difficulty and airway obstruction. The lethal consequence of a mass in a closed space makes it mandatory for expeditious evaluation and frequent intervention of mediastinal mass in infants and children.

The present prospective study includes 15 patients who attended the Department of Paediatric Surgery in a tertiary care hospital. From March 2013 to August 2016, of these 15 patients with mediastinal masses, ten underwent thoracotomy and Video-assisted Thoracoscopic Surgery (VATS) was done in five. The aim was to evaluate the clinical spectrum, pathology, biological behaviour & prognosis of mediastinal mass in children.

The various surgical approaches to mediastinal masses include mediastinoscopy, Video-assisted Thoracoscopic Surgery (VATS), anterior thoracotomy, median sternotomy, and standard posterolateral thoracotomy. Of these, Video-assisted Thoracoscopic Surgery (VATS) is advantageous for evaluation and treatment of mediastinal masses.

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Video-assisted technique offers distinct advantages in the accurate staging and resectability of the disease, effectiveness of management of mediastinal masses, postoperative patient comfort and cosmesis. With thoracoscopy, the essentials of open Thoracotomy and resection can be achieved under vision, albeit with less trauma and better cosmesis. The present study also evaluates the role of Video-assisted Thoracoscopy Surgery in mediastinal masses in infants and children.

Objectives

1. To study the incidence and distribution of the mediastinal masses in children.
2. To study the prognosis of various mediastinal masses in children.
3. To study the mode of treatment and comparison between open thoracotomy and Video-assisted Thoracoscopy.

MATERIALS AND METHODS

A prospective study was conducted over a period of 3 years from March 2013 to August 2016 on 15 patients with mediastinal masses presented to the tertiary care hospital. The study design was a case series.

The patients underwent detailed clinical assessment. Diagnosis was made after assessing the patient's age, clinical presentation, radiological investigations and tumour markers. The radiological investigations done include chest x-ray, ultrasonography and contrast-enhanced Computed Tomogram (CECT) of chest. The 4 views of chest x-ray taken include anteroposterior, lateral, right and left oblique views. The x-ray of chest was done to locate the mass and to look for the presence of calcifications. The tumour markers like alfa-fetoprotein, VMA (vanillylmandelic acid), HCG (Human chorionic gonadotropin) were done as and when indicated.

Depending on the anatomic location, clinical presentation and resectability noted in radiological investigation, a decision was taken on the type of intervention.

All patients were operated under general anaesthesia, 10 patients underwent open thoracotomy through posterolateral and anterolateral thoracotomies, done for posterior or anterior mediastinal masses respectively.

Five patients underwent Video-assisted Thoracoscopic Surgery (VATS). Two patients had masses in posterior mediastinum and three in anterior mediastinum. The patients with severe respiratory distress and those with evidence of compression of trachea were excluded.

Of the five patients of mediastinal masses, one underwent biopsy and four are treated with complete thoracoscopic resection.

Postoperatively, the patients were monitored in the recovery ward for 6-12 hours. All the patients received chest physiotherapy and breathing exercises. Chest x-ray was done on the 2nd postoperative day, to visualise the condition of the ipsilateral and contralateral lung.

The criteria for removal of chest tube included absence of drainage or minimal drainage of less than <20 mL/day serous drainage, adequate expansion of the ipsilateral lung and stoppage of movement of fluid column in the intercostal tube drain. All patients were followed up to a 3-year period with chest x-ray, ultrasound, tumour markers if indicated.

Data collected from all 15 patients (who underwent open thoracotomy and VATS) included preoperative symptoms, duration of symptoms, imaging, and laboratory results. Additionally, operative findings, pathology, and length of stay (LOS), as well as postoperative lung status were collected. Results are reported as mean & median ± standard deviation, unless noted otherwise. The results of open thoracotomy patients were analysed and compared statistically with VATS cases.

RESULTS

The study was statistically analysed on 15 patients with mediastinal masses admitted between March 2013 and August 2016, at the tertiary care hospital. Of the 15 children, 8 were boys & 7 were girls.

The masses were located in the anterior mediastinum in 8 (53%) patients, 6 (40%) cases had posterior mediastinal masses and one patient was with a mass in anterior & middle mediastinum.

The study includes patients with age ranging from 1 day of life to 10-year-old. Nine patients (5 boys and 4 girls) were below 1 year and the mean age was 15.65 months.

The most common clinical presentation in the present study was respiratory distress (73.33%); the dyspnoea associated with chest retractions was seen in 6 (40%) patients. Cough was present in 6 (40%) patients, and recurrent LRTI in 6 cases (40%). Three had feeding difficulty and one patient presented with cyanosis.

Open thoracotomy was done in ten patients. Children less than 5 months of age with severe respiratory distress and large tumours underwent open thoracotomy.

VATS was done in five patients and one underwent biopsy by VATS. Four patients underwent excision of mediastinal masses. Children with ≥ 5 months, small masses, with moderate respiratory distress were included in this procedure.

The mediastinal masses were benign in 12 patients, malignant in 3. The histopathological examination confirmed the diagnosis as Tuberculosis in 3 patients, 2 with Thymomas, 1 patient had Lymphoma (NHL) and Immature Teratoma in anterior mediastinum was diagnosed in one patient.

In the posterior mediastinum two patients had bronchogenic cysts and duplication cyst, Neurenteric cysts were found in one and three cases respectively.

One case of mature teratoma occupied the anterior and middle mediastinum.

Air leaks stopped at a median time interval of 1 ± 1.66 days and pleural drainage of 2 ± 1.4 days in VATS; on contrary air leaks stopped at a mean interval of 2 ± 1.46 days and pleural drainage at 3 ± 1.46 days following open thoracotomy. The lung expanded clinically 1 ± 1.48 days and radiologically 2 ± 1.08 days earlier in VATS cases.

The postoperative pain was 4 ± 2.28 days in VATS and requirement of analgesia was minimal when compared to open thoracotomy. The median interval of postoperative pain was 9 ± 4.54 days in open thoracotomy.

The postoperative hospital stay was longer in open thoracotomy cases with a median interval of 8 ± 2.3 days when compared to VATS with a median interval of 3 ± 2.28 days.

DISCUSSION

Mediastinal masses include benign developmental lesions (thymic cysts, foregut duplications, thoracic meningocoele), inflammatory conditions, benign and malignant lesions. The mediastinum is divided into anterior, middle and posterior mediastinum.

Anterior mediastinal lesions are thymic lesions, teratomas, and cystic hygromas. The middle mediastinum masses are commonly lymphatic cysts. Neurogenic tumours are seen in posterior mediastinum in infants and children less than 2 years.[1]

The present study is done at a tertiary care hospital, Srikakulam over a period of three years. In this study, 15 cases with mediastinal masses were evaluated and managed surgically. Of these Video-assisted Thoracoscopic Surgery was done in 5 cases.

The age of presentation varies from one day of life to 10 years of age. The mean age of presentation was 15.65 months. 60% (9) of patients were less than 1-year-old in present study.

In the present study, out of 15 patients, 8 (53%) were male and 7 (47%) were female.[1]

Most of the children presented with respiratory distress, chest retractions. In R. M. King et al study, infants less than 2-year-old presented with symptoms of tracheal compression.[2]

All the patients were evaluated with chest radiograph and computer tomography of chest. Three patients of teratoma and germ-cell tumours were evaluated with alfa-fetoprotein, beta-HCG. Alfa-fetoprotein was elevated in immature & mature teratoma patients and beta-HCG in germ cell tumour patients.

Anterior mediastinal masses in infants are usually either a teratoma or thymic enlargement. Foremost in evaluation of masses the anterior mediastinum is assessment of the risk of malignancy. In the present study, 53% of mediastinal masses were located in the anterior mediastinum. In the present study, anterior mediastinal masses are in the mean age of 23.1 months. In these, 75% were less than one year. Out of these masses, 3 were malignant. In Grosfeld et al study, the tumours were located in the anterior mediastinum in 44.2% cases.

In the present study, two cases of thymic cysts (25%) were identified. In R. M. King et al study out of 188 cases, two cases of thymic cysts, two cases of thymomas were noted and in Grosfeld et al study, three cases of thymomas were noted.

One case of Hodgkin's lymphoma presented at the age of 2 years was found in the present study. In the Grosfeld et al study, 47 patients (196 cases) had Hodgkin's lymphoma with mean age of presentation 12.6 years. In the King et al study, 33 cases of Hodgkin's lymphoma and 54 cases of Non-Hodgkin's lymphoma noted. Lymphoid tumours (NHL, HL) occurred in older children and teenagers.[2,3]

In the young patients, teratomas are benign. Only 25% are malignant in all age groups.[4] In the present study, a 3-day-old newborn presented with immature teratoma. Alfa-fetoprotein levels were elevated in this patient. Complete resection was done by open thoracotomy. Teratomas were found in 18 cases in Grosfeld et al study.[3]

One case of germ cell tumour was present in this study. Three children had germ cell tumours in Grosfeld et al study.[3]

Three patients were identified as tuberculosis in anterior mediastinal masses. Two were presented below one year with respiratory distress and cough but without signs of compression. These babies did not have the perinatal exposure and histopathological examination confirms tuberculosis. The patients were treated with ATT.

One child with mature teratoma was located in anterior and middle mediastinum combinely.[5]

The posterior mediastinum is the site of a heterogeneous group of cysts, neoplasms, and inflammatory processes in children. Most common of these lesions is the spectrum of benign to malignant neurogenic tumours of the sympathetic nervous system. In the present study, 40% of mediastinal masses were in the posterior mediastinum. All were benign. Mean age of presentation was 6.67 months. In Grosfeld et al study, 35.8% tumours were found in posterior mediastinum.

Three cases of neurenteric cysts were identified in the present study. In these, two were presented with respiratory distress and cough, one patient was found incidentally. In Cohen et al study, 3 cases out of 62 were noted.[6]

In the present study, two patients with bronchogenic cysts were found. In King et al [3] study, cases of bronchogenic cysts were noted. In Simpson et al[7] and in Cohen et al[7] studies, cases were identified with bronchogenic cysts.

A 10-month-old infant with oesophageal duplication cyst with dysphagia was noted in the present study.

Out of 8 children with anterior mediastinal masses, thoracoscopy was done in three (tuberculosis, lymphoma, germ cell tumour). All three had chest tube drain with minimal drainage. Drain was removed within 36 hours. Postoperative complications were minimal and early recovery noticed compared to open thoracotomy.

In posterior mediastinum, two patients underwent VATS. All had minimal chest tube drainage, early lung expansion, less postoperative pain and attained good cosmesis compared to open thoracotomy.

The patients with neurenteric cyst underwent open thoracotomy and complete excision. Two needed laminectomy. Postoperative recovery of these patients was good.

Two patients with bronchogenic cyst presented with cough, respiratory distress. Complete excision was done by VATS. These patients recovered early with 36-hour chest tube drainage. Lung expansion radiologically achieved within 3 days.

Following VATS, patients were closely observed in the postoperative period for clinical and radiological improvement. Air leaks stopped at mean time interval of 1 ± 1.66 days and pleural drainage was for 2 ± 1.4 days. The mean time interval for expansion of the lung clinically and radiologically was 1 ± 1.48 and 2 ± 1.08 days respectively. The mean postop hospital stay was 3 ± 2.28 days. These observations highlight the beneficial role of VATS in mediastinal masses for biopsy and resection of masses. Frederick et al[7] in their randomised controlled trial found that VATS is a safe and effective primary and secondary procedures in children resulting in short length of ICD drainage and length of stay in hospital. David A. Patric et al[8] in their prospective randomised trial suggested that thoracoscopy is a safe and effective method in management of mediastinal masses.

During this study, out of 15 patients with mediastinal masses, only 5 patients underwent thoracoscopy because most of patients were below the age of 1 year with severe respiratory distress. Comparative analysis was done with 10 cases of open thoracotomy performed during the same period from March 2013 to August 2016 at a tertiary care hospital.

Following VATS, air leaks stopped at a mean time interval of 1 ± 1.66 days and pleural drainage at 2 ± 1.4 days. On contrary, air leaks stopped at a mean interval of 2 ± 1.46 days and pleural drainage at 3 ± 1.46 days following open thoracotomy. The lung expanded clinically after 1 ± 1.48 days and radiologically 2 ± 1.08 days in patients who underwent VATS, which was earlier when compared to open thoracotomy.

The patients underwent VATS had less postoperative pain with mean time interval of 4 ± 2.28 days. The postoperative hospital stay was longer in open thoracotomy cases with a mean interval of 8 ± 2.3 days when compared to VATS with a mean interval of 3 ± 2.28 days. The above observations emphasises that VATS is superior to open thoracotomy in terms of chest tube drainage, clinical, radiological improvement, postoperative pain and length of hospital stay. Good cosmesis of scars in VATS was noted which was highly acceptable by parents in comparison to open thoracotomy.

CONCLUSION

Mediastinal masses are comparatively rare and most of the lesions come to attention before one year of age. The most common presenting symptom was respiratory distress and located mostly in anterior mediastinum.

Neurenteric cysts and tuberculosis are the common aetiologies of mediastinal masses. Malignant lesions were noted in 3 patients.

This study concludes that Video-assisted Thoracoscopic Surgery is far superior to open thoracotomy in the management of mediastinal masses in children. The duration of air leaks, pleural drainage, time taken for lung expansion clinically & radiologically, postoperative pain relief duration and hospital stay are comparatively less in VATS.

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