ORIGINAL ARTICLE

Malignant mediastinal mass in children: A single institutional experience from a developing country

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Abstract

Objective: To determine the clinical spectrum and management outcomes of paediatric patients with modiastinal mass in a Karachi hospital.

Methods: Medical records of all cases of mediastinal masses in children diagnosed and treated between January 2005 and December 2011 were retrospectively reviewed to evaluate the mode of presentation, histopathological diagnosis, radiologic findings and management outcomes at Aga Khan University Hospital, Karachi, Pakistan. SPSS 19 was used for data analysis.

Results: A total of 37 patients of mediastinal masses were identified, and malignancy was found in 32(86%) cases. The median age at diagnosis was 9 years (interquartile range: 4.7 years). Lymphoma 23 (72%) and leukaemia 8 (25%) were the most common causes of mediastinal mass. Nonspecific symptoms such as fever 26 (81%), cough 15 (47%) and dyspnoea 12 (37%) constituted the most commonly presenting complaints. Overall, 22 (68.7%) patients underwent surgical procedures (complete/partial resection of mass); local lymph node biopsy was performed in 5 (15.6%) cases; and computed tomography or ultrasound-guided biopsy was done in 2 (5.4%) patients. Besides, 27 (84.4%) patients were admitted to paediatric intensive care unit for supportive care, and assisted ventilation was required in 20 (62.5%) patients. The mean length of hospital stay was 9.3±6 days. None of the patients died due to complications related to mediastinal mass or diagnostic procedure.

Conclusions: Although mortality rate has reduced significantly with refinements in the management protocols, but a high index of suspicion and comprehensive multidisciplinary approach is crucial to improve the morbidity and mortality.

Keywords: Mediastinal mass, Children, Lymphoma, Leukemia. (JPMA 64: 386; 2014)

Introduction

Children with mediastinal mass represent a potentially serious and life-threatening cardio-respiratory emergency that requires immediate and coordinated efforts by a multidisciplinary team.[1,2] Primary mediastinal tumour is uncommon in infants and children with a morbidity of 0.4%.[3] With various pathologic types and clinical manifestations, 34%-41% of primary mediastinal mass were diagnosed as malignant by means of cytomorphology and flow cytometry.[4] Most paediatric patients with mediastinal masses are symptomatic as compared to adults.[5] Symptoms may include cough, dyspnoea, dysphagia, orthopnoea, wheezing, hoarseness, facial oedema, headache and chest pain.[6-8] Superior vena cava syndrome (SVCS) are found in 6% of paediatric cases of mediastinal malignancy, two-thirds of these being lymphoma and acute lymphoblastic leukaemia (particularly T cell phenotype).[9] Therefore, early recognition of these life-threatening clinical signs and timely intervention to manage such patients in collaboration with paediatric intensivists, surgeons, anaesthesiologists and oncologists is crucial to improve the outcome.[2,10]

There are several reports available on the anaesthetic implications, surgical management, paediatric intensive care unit (PICU) course and short-term outcomes of children with mediastinal masses from developing countries, but data from developed countries is lacking. The purpose of this study was to describe our institutional experience of these high-risk patients in a developing country.

Patients and Methods

The retrospective study was conducted after due approval from the ethical review committee at the Aga Khan University Hospital (AKUH), Karachi, Pakistan, and comprised all paediatric patients identified in the hospital medical record database as having a mediastinal mass at presentation between January 2005 and December 2011. Paediatric patients were defined as those under 15 years of age. Patients were excluded if the mass was subsequently found to be of benign pathology.

Eligible patient medical records were reviewed to collect parameters, including demographics, presenting features, diagnostic studies, pathology findings, procedures, management, and outcomes. Demographic data collected

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for each patient included age, gender and primary diagnosis. Clinical features at presentation were identified and recorded. The report of the chest radiograph (CXR) or computed tomography (CT) scan of the chest at the time of diagnosis was reviewed to evaluate the location of the mass within the mediastinum, involvement of the trachaea, carina and mainstem bronchi, and to determine whether there was any cardiac or great vessel involvement by the tumour. The preoperative echocardiogram (ECG) was assessed for pericardial, cardiac and great vessel involvement. Records were also examined to identify patients who developed complications during hospital stay and their outcomes were also noted.

Data was analysed using SPSS 19.0. Results were presented as mean ± standard deviation or median (interquartile range) and frequency plus percentages.

Results

A total of 37 patients met the initial criterion, but 5 (13.5%) had to excluded; 3 (8%) had reactive lymphadenopathy, and 2 (5.4%) had benign histology. The final sample, as such, had 32 (86.5%) patients (Table-1). The median age at diagnosis of this cohort was 9 years (interquartile range;4.7 years). There were 22 (68.8%) males, with male-to-female ratio being 2:1.

The most common diagnosis was lymphoma 23 (72%). Hodgkin's lymphoma (HL) and Non-Hodgkin's lymphoma (NHL) was found in 13 (40.6%) and 10 (31.3%) children respectively. Leukaemia was identified in 8 (25%) cases and all of them had T-cell leukaemia. One (3.1%) patient had neuroblastoma. A comparison of relative frequencies of mediastinal tumours between age groups was significant. Almost all cases of lymphomas (n=22; 95.65%) occurred after 5 years of age and acute lymphoblastic leukaemia (ALL) was more commonly identified in early life (<10 year). The mean age of the lymphoma patients was 10.5±4.5 years; children with leukaemia were slightly younger at presentation, with mean age of 7.5±3.8 years. There was no gender predilection. Considering the location of mediastinal masses, the anterior mediastinum was the most common site 23 (71.3%) followed by middle 8 (24.8%) and posterior 1 (3.1%). Common tumours of anterior, middle and posterior location was ALL, lymphoma and neuroblastoma respectively.

Table-1: Demographic characterstics.

Characteristic	n (%) (n=32)
Gender	
Male	22 (68.8%)
Primary diagnosis	
Acute Lymphoblastic Leukaemia	8 (25%)
Hodgkin Lymphoma	13 (40.6%)
Non-Hodgkin Lymphoma	10 (31.3%)
Other Solid tumours	1 (3.1%)
Location of Mediastinal Mass	
Anterior mediastinum	23 (71.3%)
Middle mediastinum	8 (24.8%)
Posterior mediastinum	1 (3.1%)

Table-2: Symptoms and signs.

Symptoms and Signs	N (%)
Symptomatic	24 (75.2)
Dyspnoea	12 (37.5)
Cough	15 (46.9)
Wheeze	3 (9.4)
Weight loss	4 (12.5)
Fever	26 (81.3)
Fatigue/Lethargy	7 (21.9)
Poor appetite	4 (12.5)
Facial puffiness	8 (25)
Palpitation	2 (6.2)
Engorged neck vessels	11 (34.4)
Chest pain	2 (6.2)
Lymphadenopathy	22 (68.75)
Visceromegaly	14 (43.75)

Table-3: Diagnostic imaging finding.

Diagnostic Radiology	(n=32)
Trachealbronchial compression or deviation present	15 (46.9%)
Pleural effusion	17 (53.1%
Venous engorgement	17 (53.1%
Great vessels/cardiac compression (SVC) present	6 (18.75%)
Lung parenchymal changes	5 (15.6%)
Echocardiography	(n=27)
Normal	17/27 (63.0%)
Pericardial Effusion (PE)	6/27 (22.2%)
Right ventrilcular outlet obstruction(RVOT)	1/27 (3.7%)
Both RVOT & PE	3/27 (11.1%)

Regarding symptomatology 12 (24.8%) patients were completely asymptomatic (Table-2). Nonspecific symptoms such as fever 26 (81.3%) cough 15 (46.9%) and dyspnoea 12 (37.5%) constituted the most commonly presenting complaints followed by engorged neck vessels, facial puffiness, poor appetite, wheeze/stridor, fatigue/lethargy, pain and palpitation. Lymphadenopathy was observed in 22 (68.7%) cases while visceromegaly was noticed in 14 (43.7%) cases.

Diagnostic imaging and tracheobronchial and cardiovascular compression finding were noted separately (Table-3). Airway compression or deviation was seen in 19 (59.3%), 17 (53%) had pleural effusion and venous

engorgement, 5 (15.6%) also had lung parenchymal changes secondary to atelactasis, collapse, consolidation and pneumothorax. Six (18.7%) children had superior vena caval (SVC) compression, but none had complete SVC syndrome. Echocardiograms (ECG) were obtained in 27 (84.4%) children. It was normal in 17 (63%); pericardial effusion (PE) was seen in 7 (25.9%), right ventricular outlet obstruction (RVOT) in 1 (3.7%) and both in 3 (11%) cases. Mild diastolic dysfunction was also observed in 2 (5.4%) children.

Overall, 22 (68.7%) patients underwent surgical procedures: excisional biopsy was done in 6 (27.27%) patients, 4 (18.2%) underwent complete resection of the tumour, and 7 (31.8%) partial or near-total resection. Of these, 11 (50%) were emergency procedures. Local lymph node (cervical, axillary node) biopsy was performed in 5 (15.6%) cases. CT or ultrasound-guided biopsy was done in 2 (5.4%) patients.

Besides, 27 (84.4%) patients were admitted in PICU and assisted ventilation was required perioperatively in 20 (62.5%) patients. The remaining 5 (15.6%) patients were admitted in the special case unit (SCU). Mean length of total hospital stay was 9.3±7.5 days and for patients who required PICU stay, mean PICU stay was 3.3±2.3 days. None of the patients died intraoperatively or post-operatively due to complications related to mediastinal mass or diagnostic procedure.

Discussion

Mediastinal masses in children belong to a heterogeneous group of malignant and benign tumours. It is relatively rare in paediatrics, but requires a high index of suspicion and organised emergency care by a multidisciplinary team. Most common age for presentation varied according to underlying diagnosis. Lymphoma is more common in later age group and ALL is common in earlier life. Demographic data in our study showed the mean age at diagnosis was 8.8 years which is slightly higher than reported in other studies.[11] This is probably due to the high proportion of lymphoma and the near absence of neuroblastoma. This may also account for the male predominance in our study as well. In our study, most of the mediastinal masses were malignant (86.5%) and haematologic (97%) in origin. This is slightly different form studies done previously.[12,13] Corresponding rates in the previous two series of mediastinal mass have reported the malignancy rate of around 72%.[12,13] Grosfield et al. reported that the mass is either haematogenous in nature (47.3% versus 97% in our study) or neurogenic.[13] The anatomical locations of tumours previously reported were different from our series. The reported range for anterior lesions was 49-59%, for middle mediastinal masses 18-25%, and for posterior mediastinal tumours 23-27%.[14] Considering the location of mediastinal masses in our study, the anterior mediastinum was the most common site (71.3%), followed by middle (24.8%) and posterior (3.1%).

Lymphoma are the most common etiology of a mediastinal mass in the paediatric age group, accounting for 46-56% of all mediastinal mass in most series[15] and this is what we have seen in our study as well. Between 50-70% of children with lymphoblastic lymphoma present with an anterior mediastinal mass. Over one-third of NHL have their primary sites in the mediastinum and overall two-thirds of patients with HL presented with mediastinally lymphadenopathy.[15-17]

The sign and symptoms of a mediastinal tumour may vary from patient to patient and depends on its site, size and involvement of the other organs. Preoperatively, airway obstruction or cardiovascular collapse can occur during physical or radiologic evaluation if the patient lies supine. Airway obstruction can also provoke sudden asphyxia concomitant with postural changes, precluding an initial biopsy. Some patients may need intubation before chest CT, which is done in the supine posture. In our experience, a significant proportion of patients (75.2%) was symptomatic at presentation, with fever, lymphadenopathy, and respiratory distress, which is consistent with other reports in the literature.[13] SVCS was rare 6% in our study in children and occurs commonly with T-cell acute lymphoblastic leukaemia or NHL.[18]

The diagnosis of a mediastinal mass is suspected on clinical presentations followed by imaging and laboratory investigations. It is then confirmed by imaging studies. The initial examinations include CXR, ultrasound or CT scans; and occasionally, magnatic resonance imaging (MRI), angiography, and scintigraphy.[10] These studies should be followed by thoracoscopy, mediastinoscopy, and appropriate biopsy techniques.[19] All patients in this study followed the similar diagnostic and management approach. Many authors advocate the need of an institutional management plan algorithm in place for the evaluation and treatment of children with mediastinal masses.

The radiographic appearance of the mediastinal mass can be misleading with regard to the presence of airway narrowing,[20] and the severity of the pulmonary symptoms is not a reliable indicator of the degree of tracheobronchial compromise.[21] CT scans can identify the exact location and extent of involvement of the mass.

Piro and associates[21] in a large series of patients with Hodgkin's disease, noted a 10% frequency of life-threatening airway complications during general anaesthesia. Airway compression caused by mediastinal mass is a serious problem during anaesthesia and associated with a high risk of morbidity

and mortality. Careful consideration should be given to perform a biopsy under anaesthesia.[22] Recommendations for preoperative evaluation of children with an anterior mediastinal mass include assessment of compressive signs and symptoms, CT imaging, echocardiography, and pulmonary function testing to assess dynamic airway compression.[22] While radiotherapy or corticosteroid treatment before biopsy may improve perioperative risk, they also may adversely impact diagnostic histological accuracy.[23] However, Ferrari et al. in a review of 163 children with anterior mediastinal mass stressed the importance of tissue diagnosis before initiation of treatment.[24] They concluded that in the absence of life-threatening preoperative airway obstruction and severe clinical symptoms, general anaesthesia may be safely induced before the start of therapy.

In our study, 24 (75%) patients were admitted to PICU and 20 (62.5%) needed assisted ventilation. In this review no mortality and little morbidity occurred. Azarow et al. reported two intraoperative deaths due to airway compression in 62 paediatric patients with mediastinal tumours.[18] In the past, death was usually related either to the mass effect of the tumour or the complications of general anaesthesia, but with refinements in surgical technique and anaesthetic management, the mortality rate significantly decreased.[3] As far as Pakistan is concerned or in similar contexts, we need a high index of suspicion and a multidisciplinary team to improve the outcome in these patients. Ideally there should be collaboration across a network of centres in order to enable referral of these difficult cases to facilities where appropriate specialist teams are available.

Conclusion

Malignant mediastinal masses are not uncommon in children. Lymphomas and leukaemias are predominantly malignant. Respiratory complaints are the most common manifestation and airway compression is the most serious complication, especially in patients with lymphomas. A high index of suspicion and a comprehensive multidisciplinary team is crucial to improve the outcome in such high-risk patients.

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