ARTICLE

Intrathoracic masses in children and adolescents: a single tertiary pediatric institution experience

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OBJECTIVES: The Cancer and Hematology Division of the PCMC receives an average of 24 cases of pediatric intrathoracic masses annually. Comprehensive data on the demographic status, clinical profile, management, and outcome are still not available. This study aims to determine the clinical features, diagnosis, management and outcome of children and adolescents with intrathoracic masses from 2017 to 2019.

MATERIALS AND METHODS: Descriptive study design was utilized. Data were collected by doing a chart review. Possible associations between the clinical features and outcome were described.

RESULTS: Sixty-eight (68) cases were referred from January 2017 to December 2019. Mean age at diagnosis is 8.8 years with a 2.4:1 male to female ratio. Severe wasting was seen in 21%. All subjects were symptomatic at presentation, 50% with respiratory compromise. Anterior mediastinal lesions are observed at 82% of cases. Elevated LDH was seen in 50% of the patients. Malignant hematologic lesions are the most common etiology. Steroid pretreatment was given in 40% of patients. Only a small percentage (<20%) underwent definitive treatment. Patients were symptomatic for 18 days on average before consult. It took an average of 18 days for a case to be diagnosed definitively, and 10 days from the diagnosis to start of directed treatment. Mortality rate was high at 57.4%.

CONCLUSION: Patients with intrathoracic mass and malnutrition are 1.4x more likely to die. Diagnosis is the most significant factor associated with death. Observed data can be used as basis to formulate protocols which can streamline the diagnostic and therapeutic approach in these patients.

KEYWORDS: *pediatric mediastinal mass, leukemia, lymphoma*

INTRODUCTION

The Philippine Children's Medical Center (PCMC) is one of the largest tertiary hospitals in the country which caters to pediatric illnesses. In the past three years, the Cancer and Hematologic Division received an average of 24 referrals per year for pediatric thoracic masses. Comprehensive local data on the patient's demographic status, clinical profile, management, and outcome are still not available.

Thus, there is a need to report data on these patients in order to appreciate unique clinical characteristics, challenges in diagnosis, management and outcome.

The estimated incidence of mediastinal masses in the general population is 1 case per 100,000 persons per year (1). There are only a handful of published literature regarding intrathoracic tumors in the pediatric age group worldwide because of the rarity of the condition. Observational studies have a range

of 26 to 204 subjects over a period of 1 to 25 years. Thoracic tumors are mostly located in the mediastinum and are rare in children and adolescents (2). They may have different origins in the embryonic tissues. They can vary from the most benign cysts to the most aggressive malignant lesions (3). The location from where the tumor arises may provide a clue on the nature of the mass. The challenge in the management of these tumors in children starts from the time of consultation, approach to diagnosis, initial administration of emergency measures and definitive treatment to complications. Difficulty in establishing the diagnosis in this subset of tumor arises especially with the need for sedation vis a vis impaired cardiopulmonary function. A careful assessment before an invasive procedure is of utmost importance to minimize the risk of cardiopulmonary collapse (2). Review of previous studies showed T-cell acute lymphoblastic leukemia and Hodgkin's Lymphoma as the most common diagnosis of these thoracic masses (4).

This study aimed to review and describe the different patient related factors and clinical presentations, as well as the diagnostic process, initial management, and outcome of children presenting with intrathoracic tumors in a pediatric tertiary hospital from 2017 to 2019. Possible associations between the clinical features and outcome were examined. Analysis of collated data can provide a basis for formulation of treatment guidelines which may improve the overall outcome of intrathoracic masses in the pediatric age group.

Methodology

This study utilized a retrospective, descriptive and analytical design. Children and adolescents 0-18 years old who were referred to the Cancer and Hematology Division for evaluation and management of intrathoracic masses from January 2017 to December 2019 were eligible for the study. This included charity or service patients only. Since the condition of subjects for inclusion is rare and the number of referrals is small, all subjects were included and sampling was not employed. No subjects were excluded.

Data were collected by doing a chart review of in-patient and out-patient medical records who fulfilled the inclusion criteria. All the private information of these patients were kept confidential. Each patient was assigned a corresponding number for anonymity written on a master list. These numbers served as their code and were used to de-identify the patients.

Patients' data such as demographics, clinical features, and outcome were collected. The information collected was reviewed. The age at the time of referral, gender, nutritional status, and region of origin were collected for demographics. Clinical features such as symptomatology, anatomic location, initial laboratory findings, associated radiologic findings, and the diagnosis were reviewed. Initial treatment modalities used, clinical timeline, and the outcome was noted. Laboratory findings between tumor types was compared. Possible associations between the demographic, clinical parameters, diagnosis, and timelines were explored. Ethical approval to conduct the study was obtained from the PCMC Institutional Research-Ethics Committee.

Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Frequency and proportion were used to summarize categorical variables, as well as mean, standard deviation and range for numerical variables. Microsoft Excel was used to encode the responses and generate the summary statistics. All valid data were included in the analysis. Missing variables were not replaced nor estimated. For the inferential statistics, Pearson's Chi-square or Fisher's Exact test was used to determine significant differences in proportions across groups, whichever was appropriate. Kruskal-Wallis test was used to determine significant differences in ranks of timelines in days across outcomes. Epi Info for Windows (CDC) was used to generate the statistical analyses.

RESULTS

A total of 68 cases of intrathoracic masses were referred to the Cancer and Hematology Division from January 2017 to December 2019. The mean age of presentation at diagnosis is 8.8 years, with more than half (36/68, 53%) of the patients being less than 10 years of age and the majority (48/68, 71%) males. The male to female ratio is 2.4:1. Almost two-thirds (44/68, 65%) of them had normal nutritional status, while 35% (24/68) of the subjects had malnutrition, with 21% (14/48) being severely wasted. It is expected that majority of the patients were living in the National Capital Region and its neighboring provinces (65/68, 96%), but a small percentage came from as far as the Visayas region (3/68, 4%).

The most prevalent presenting symptom was cough (59/68, 86.8%), with associated dyspnea and easy fatigability in 60.3% (41/68) of patients. clinical evidence of respiratory compromise was noted. Constitutional symptoms such as fever and decreased appetite were reported by 61.8% (42/68) and 35.3% (24/68) patients, respectively. Nine patients (13.2%) were noted to have facial edema upon presentation, of which 6 patients (8.8%) also presented with neck vein engorgement.

Figure 1 shows that the mass was located at the anterior mediastinum for most of the children and adolescents (56/68, 68%). Masses were less commonly seen in the middle mediastinum (7/68, 9%) and posterior mediastinum (11/68,15 %).

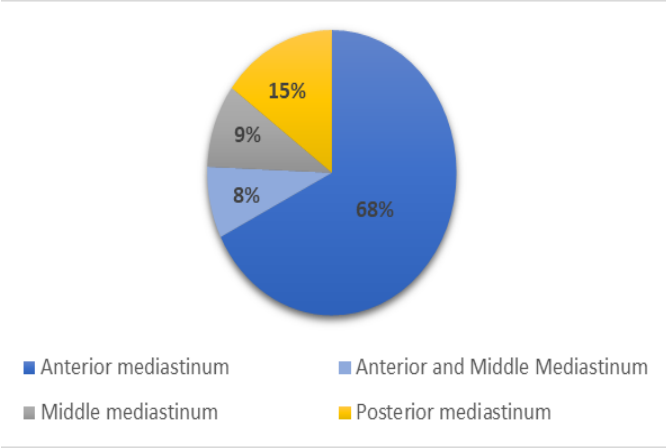

Figure I. ANATOMIC LOCATION OF THE MASS, n=68

Certain laboratory parameters were not requested for some patients. All included subjects had a complete blood count (CBC) while only 93% (63/68) had lactate dehydrogenase (LDH), potassium, and calcium. Only 88% (60/68) had creatinine and 77% (52/68) and 74% (50/68) had phosphorus and blood uric acid determination respectively. Tumor markers for GCT, alpha fetoprotein (AFP) and b-human chorionic gonadotropin (b-hCG) determination were done in only 57.4% (39/68) of patients. The unavailability of uniform laboratory parameters may mask the actual frequencies had all the patients had complete findings.

Half (50%) of them had an elevated LDH value of >500 U/L. Hyperkalemia is present in only 4% (3/68) of the subjects. Potassium and calcium levels were normal in 74% (50/68) and 91% (62/68) of the patients, respectively. None of the subjects present with hypocalcemia. Elevated phosphorus levels were seen in 38% (26/68) while phosphorus level was normal 25% (17/68) of them. Hyperuricemia was seen in only 13% (9/68) of the subjects with normal uric acid level in 60% (41/68) of the patients. Almost three-fourths (74%, 50/68) of the patients had low creatinine level.

Anemia was present in 46% (31/68) of the patients. Leukocytosis was present in 65% (66/68) of the patients with 6% (4/68) having hyperleukocytosis. Thrombocytopenia was present in 18% of the patients (12/68) while 28% (19/68) presented with thrombocytosis. Only 13% (9/68) had bicytopenia, none had pancytopenia.

Table 1 shows that the most common associated radiologic finding was pleural effusion (28/68, 41%), followed by pericardial effusion (14/68, 21%). Parenchymal lung masses (7/68, 10%) and tracheal deviation/compression (10/68, 15%) were less common.

Table 1. ASSOCIATED RADIOLOGIC FINDINGS WITH INTRATHORACIC MASS

	No.	%
Parenchymal lung masses	7	10.3 %
Pleural Effusion	28	41.2 %
Tracheal deviation/compression	10	14.7 %
Pericardial Effusion	14	20.6 %

Table 2 shows the frequency of the masses based on the etiology. More than two-thirds (46/68, 68%) had malignant intrathoracic mass, while less than one-third (22/68, 32%) had masses that were non-malignant. Among patients with a malignant mass, majority (31/46, 67%) were diagnosed to have hematologic malignancies. The most common hematologic malignancy was non-Hodgkin lymphoma (NHL) comprising 22% (15/68) while majority (8/15, 53.3%) of non-hematologic tumors were GCTs. For non-malignant intrathoracic lesions, the most prevalent was tuberculosis (10/22, 45.4%).

Table 2. CLASSIFICATION OF INTRATHORACIC MASSES (n=68)

	No.	%
Malignant Hematologic	**31**	45.6%
T Cell ALL	8	11.8%
Lymphoma		
Non-Hodgkin Lymphoma	15	22.0%
T Lymphoblastic Lymphoma	7	10.3%
ALCL	2	2.9%
DLBCL	2	2.9%
Mature B-Cell	2	2.9%
Hodgkin's Lymphoma	6	8.8%
Not otherwise classified	2	2.9%
Malignant Non-hematologic	**15**	22.1%
Germ Cell Tumors	8	11.8%
Neuroblastoma	5	7.4%
Malignant Peripheral Nerve Sheath Tumor	2	2.9%
Non-Malignant	**22**	32.4%
Tuberculosis	10	14.7%
Pneumonia	6	8.8%
Mature Cystic Teratoma	3	4.4%
Thymoma	2	2.9%
Bronchogenic Cyst	1	1.5%

Table 3 shows the initial diagnostic and therapeutic approach for the patients. Majority of patents was given chemotherapy as initial management (42/68, 62%). Biopsy of the primary tumor was done in 19% (13/68) of the patients while biopsy of extrathoracic lymph nodes was done in 37% (25/68) of the patients. Surgical excision and radiation therapy were done in only 4% (3/68) and 3% (2/68) of the patients, respectively.

Table 3. INITIAL MANAGEMENT OF PATIENTS WITH INTRATHORACIC MASS

	No.	%
Surgical Excision	3	4.4%
Biopsy only	38	
Intrathoracic Mass	13	19.1%
Other sites (Lymph nodes- Cervical, Inguinal)	25	36.8%
Steroid pretreatment	27	39.7%
Chemotherapy	42	61.8%
Radiation therapy	2	2.9%

Table 4 shows the outcome of patients. Majority (39/68, 57.4%) died. Among those who were reported alive were non-malignant (12/68, 17.6%) and were referred back to their respective admitting services, while 13% (9/68) were undergoing treatment at the time the data were gathered. Over 7% (5/68) of the patients were lost to follow up.

Table 4. OUTCOME OF PATIENTS WITH INTRATHORACIC MASS

	Malignant (n=46)		Nonmalignant (n=22)		Total	
	No.	%	No.	%	No.	%
Alive	12	26.1%	12	54.5%	24	35.3%
Not treated	0	0.0%	12	54.5%	12	17.6%
Ongoing treatment	9	19.6%	0	0.0%	9	13.2%
Completed treatment	3	6.5%	0	0.0%	3	4.4%
Died	32	69.6%	7	31.8%	39	57.4%
Lost to follow up	2	4.3%	3	13.6%	5	7.4%

Patients were brought for consultation an average of 18 days (ranging from 2 to 60 days) after symptoms were observed. Diagnosis was confirmed 18 days on average (ranging from 1 to 120 days) after consultation. While treatment was provided 10 days on average (ranging from 1 to 107 days) after diagnosis. It was noted that 7.4% (5/68) of the patients who were brought to a physician for consultation had symptoms for more than 30 days already. Definitive diagnosis was made 30 days after the first consultation for 19% (13/68) of the patients while directed treatment was initiated for more than 30 days in 7.4% of the patients (5/68).

Comparison of laboratory findings between subjects with malignant and non-malignant tumors. Malignant lesions presented with elevated LDH, hyperuricemia, and hypokalemia. Hyperkalemia was seen more in non-malignant lesions. Hyperphosphatemia was seen in similar proportions for both malignant and non-malignant cases. Calcium level is normal in most of the patients and comparable between patients with malignant and benign tumors, as well as creatinine levels. The CBC picture is also comparable between those with malignant and non-malignant lesions in that half of each group has anemia, elevated WBC counts, and normal platelet counts.

Table 5 shows the possible association of clinical parameters and outcome of patients. Higher proportion of death was noted in older children (>10 y/o), as 70% (21/29) of them expired. It was noted that a high proportion of severely wasted patients died (11/13, 85%). In terms of the anatomic location of the mass, those with masses at the posterior mediastinum has the highest proportion of deaths at 70% (7/10). Non-malignant masses also have high proportion of deaths as seven of the eight patients diagnosed with a non-malignant mass died.

Table 5. ASSOCIATION OF CLINICAL PARAMETERS AND OUTCOME

Demographic characteristics	Died (n=39)		Alive (n=24)		Total (N=63)		p-value*
	No.	%	No.	%	No.	%	
Age							
<10 years old	18	55%	15	45%	33	100%	0.207
≥10 years old	21	70%	9	30%	30	100%	
Sex							
Male	28	61%	18	39%	46	100%	>0.999
Female	11	65%	6	35%	17	100%	
Nutritional Status							
Normal	23	56%	18	44%	41	100%	0.287
Wasted	3	60%	2	40%	5	100%	
Overweight	2	50%	2	50%	4	100%	
Severely wasted	11	85%	2	15%	13	100%	
Anatomic location of the mass							
Anterior mediastinum	32	62%	20	38%	52	100%	>0.999
Middle mediastinum	3	43%	4	57%	7	100%	0.412
Posterior mediastinum	7	70%	3	30%	10	100%	0.729
Radiologic findings							
Parenchymal lung masses	3	50%	3	50%	6	100%	0.666
Pleural Effusion	17	63%	10	37%	27	100%	>0.999
Tracheal deviation/ compression	5	56%	4	44%	9	100%	0.721
Pericardial Effusion	8	62%	5	38%	13	100%	>0.999
Diagnosis							
Malignant	32	78%	9	22%	41	100%	0.004
Hematologic	18	69%	8	31%	26	100%	
Non-Hematologic	14	93%	1	7%	15	100%	
Non-Malignant	7	88%	1	13%	8	100%	
* Chi-square test of Fisher's exact test was used, whichever was appropriate.							

Table 6 shows the possible association of nutrition and outcome of patients with intrathoracic mass. In general, it is noted that malnourished patients were 1.4x more likely to die than those with normal nutritional status. All subjects with malignancy and with some form of malnutrition died. Patients with non-malignant lesions and with malnutrition is 2.7x more likely to die. The trend suggested that malnourished patients with wasting had a higher risk of death, but it did not approach statistical significance.

Table 6. ASSOCIATION OF OUTCOME AND NUTRITIONAL STATUS AMONG PATIENTS WITH INTRATHORACIC

NUTRITIONAL STATUS	Malignant (n=44)				Nonmalignant (n=19)				Total (N=63)			
	No. of deaths	%	RR (95% C.I.)	p-value	No. of deaths	%	RR (95% C.I.)	p-value	No. of deaths	%	RR (95% C.I.)	p-value
Normal	21	64%	*Reference*	-	2	25 %	*Reference*	-	23	56 %	*Reference*	-
Overweight	2	100 %	1.57 (1.21-2.03)	0.850	0	0%	0.00 (0.00-?.??)	>0.999	2	50 %	0.89 (0.32-2.46)	>0.999
Wasted	2	100 %	1.57 (1.21-2.03)	0.850	1	33 %	1.33 (0.18-9.86)	>0.999	3	60 %	1.07 (0.48-2.30)	>0.999
Severely wasted	7	100 %	1.57 (1.21-2.03)	0.127	4	67 %	2.67 (0.71-10.05)	0.312	11	85 %	1.51 (1.06-2.154)	0.120
Malnourished (wasted or severely wasted)	9	100 %	1.57 (1.21-2.03)	0.065	5	56 %	2.22 (0.58-8.44)	0.436	14	78 %	1.39 (0.96-2.00)	0.193

Table 7. ASSOCIATION OF CLINICAL TIMELINE AND OUTCOME AMONG PATIENTS WITH INTRATHORACIC MASS (n-63)

Timeline in days, mean ± SD (range)	Died (n=39)	Alive (n=24)	Total (n=63)	p-value
Symptomatology to health seeking behavior	18.4 ± 11.9 (2-60)	18.3 ± 13.2 (2-60)	18.4 ± 12.3 (2-60)	0.981
Consult to diagnosis	17.7 ± 24.9 (1-120)	17.1 ± 23.0 (2-90)	17.5 ± 24.0 (1-120)	0.922
Diagnosis to start of definitive treatment	11.1 ± 17.8 (1-68)	10.5 ± 22.4 (1-107)	10.8 ± 19.5 (1-107)	0.908

Table 7 shows the possible association of the timeline from development of symptoms to treatment and outcome. Timelines for both dead and alive patients are comparable.

Discussion

This study attempted to provide a comprehensive description and analysis of outcomes among pediatric patients with intrathoracic masses from a tertiary pediatric institution in the country. It is limited by its retrospective design, incomplete data sets, and small sample size available for statistical analysis.

The mean age at diagnosis was 8.8 years old, which is younger than that seen in most existing literature (2,5,6,7). In this study, intrathoracic mass was found to be 2.4 times more prevalent in males compared with females. This gender distribution was observed by Kashif et al (2019) in Pakistan, but not by Garey et al (2011) in the United States, which showed equal proportions of boys and girls in their cohort.

Majority of the patients (44/68, 65%) had normal nutritional status while 28% (19/68) presented with malnutrition. Poor nutritional status has been shown to correlate with increased treatment-related side effects and reduced survival (9). Almost one-fifth (21%) of our patients were severely wasted. Other studies in the Asian region showed a higher percentage of undernourished patients as high as 65.6% (3,10). Highest rate of death was seen among those who were severely wasted at 85% (11/13). All malignant cases who were malnourished died. Patients with wasting, especially those with malignancy, exhibit reduced dietary intake, malabsorption or maldigestion of food, or altered energy and nutrition needs (11). Malnutrition appears to contribute to the infectious and immunologic morbidities associated with malignant lesions and adds insult to from treatment modalities.

Majority of the patients (43/68, 63%) came from outside National Capital Region (NCR). Patients from the far northern and southern provinces of Luzon, as well as Visayas were seen. The proximity of the patients' residences may play a role in their health-seeking behavior and the protracted clinical course prior to a definitive diagnosis. Aside from the proximity, availability of health institutions and specialists catering to this subset of patients are limited and is mostly concentrated in the NCR.

All of the subjects were symptomatic at presentation, either with respiratory symptoms or constitutional symptoms, but mostly both. In our cohort, majority presented with respiratory symptoms. Cough, dyspnea and easy fatigability were present in more than 60% of the patients. Nasir et al., (2020) analyzed medical records of 61 pediatric patients in Pakistan who presented with anterior mediastinal mass. In this study, most of the children presented with nonspecific symptoms such as fatigue (63.9%), followed by weight loss. Similarly, this was observed by Garey et al., (2011) in a US study where the mean age of the subjects was 11.3 years.

Compartmentalization of mediastinal masses is often cited as a helpful distinguishing feature that facilitates diagnosis and possible prognosis. Anterior mediastinum lesions were found in 82.4% of our patients (56/68). In this study, majority (46/68, 67.6%) were diagnosed with a malignant lesion. Almost half, 46% (31/68) were diagnosed with a hematologic malignancy which is consistent with most reviewed literature wherein lymphomas and leukemias are the most common lesions found in the anterior mediastinum (7). Middle mediastinum lesions are usually seen in association with anterior

mediastinum tumors and are rarely isolated (5). In our study, four of six patients with middle mediastinum lesions have associated anterior mediastinum lesions. Isolated middle mediastinum lesion was seen in two patients which was eventually diagnosed as T-cell lymphoblastic lymphoma and TB disease. Neurogenic tumors are usually found in the posterior mediastinum. Among our subjects with posterior mediastinal mass, four out of seven are of neurogenic origin (neuroblastoma, malignant peripheral nerve sheath tumor).

There were no significant differences in the blood chemistry results between those with malignant and non-malignant lesions. Elevated LDH (> 500 U/L) was seen in a greater proportion of those with malignant tumors compared with those with non-malignant lesions (57% vs 48%). LDH levels that are two times greater than the upper limit of normal (ULN) poses a risk for tumor lysis syndrome (TLS) and this was seen in 29% of our patients (20/68)

Laboratory parameters such as electrolytes and uric acid were requested for diagnosis and monitoring of a possible TLS. TLS is associated with large tumor burdens, those with high cell proliferation, chemotherapy sensitive tumors, and those with high pretreatment LDH levels (12). The mentioned risk factors are usually associated with hematologic malignancies especially Burkitt's Lymphoma, Tcell ALL, and acute myeloid leukemia (AML) (11).

Hyperkalemia (>5.10 mmol/L) is present in only a small percentage of patients 2% and 11% for malignant and non-malignant lesions respectively. None of the patients presented with hypocalcemia (<1.76 mmol/L) while only one patient presented with hypercalcemia. Hypocalcemia was associated with a poor prognosis among cancer patients (13). Hypercalcemia was also shown to be associated with malignancy, with the risk increasing if it is associated with high levels of lactate dehydrogenase, alkaline phosphatase, WBC, platelet, or CRP. Majority of the patients, comprising 50% of those in both groups showed hyperphosphatemia (>1.45 mmol/L). Only a small portion had hyperuricemia (>448 umol/L), 20% for malignant cases and 10% for non-malignant. A study by Nicholson et al (2021) suggested that combinations of simple blood tests abnormalities could be used to identify patients with cancer. Laboratory parameters included in their study were albumin, alkaline phosphatase, liver enzymes, C-reactive protein, hemoglobin, platelets, and total white cell counts. Our study did not include albumin, alkaline phosphatase, liver enzymes, and CRP.

Anemia was present in 45.6% (31/68) of the patients. In a study by Naeser et al in 2017, high probability of cancer was noted in patients with anemia. This was different from the observation in our study, where only 44% (20/46) of patients with malignancy had anemia at presentation compared to the 50% (11/22) of those with non-malignant lesions. Malignancy-related anemia is multifactorial but is usually associated with tumor infiltration of the bone marrow (18). Other contributory factors include nutrition, the release of inflammatory cytokines, and treatment regimen. Leukocytosis, defined as a WBC count >50,000/mL warrants an investigation especially for clinical signs and symptoms of leukocytosis as it is associated with early morbidity and mortality. Hyperleukocytosis, WBC greater than 100,000/mL can be seen in children with leukemia and lymphoma. In our study, elevated WBC count was present in 65% of the study population.

Four patients who were diagnosed with T-cell leukemia presented with WBC count > 50,000/mL with 3 of the four presenting with hyperleukocytosis (WBC >100,000). Naeem et al. (2015) described in their study that anemia and leukocytosis were equally common. Cancer incidences for patients with normal platelet counts were lower than those reported for patients with thrombocytosis (6). In our cohort, thrombocytosis was seen in 28% of the patients (19/68). It is more common among those who had non-malignant intra-thoracic masses (8/22, 36%) compared to those with malignant lesions (11/46, 24%). On the other hand, thrombocytopenia was seen in 18% (12/68) of the patients. This was found more commonly in patients with hematologic malignancies compared to those non-malignant cases, 20% and 14% respectively.

Malignant lesions (68%, 46/68) were the most common cause of intrathoracic masses in our cohort of patients. This is consistent with several studies done both in Asia and America. Chen et al (2019) reported a diagnosis of lymphoma in 47.5% of children with mediastinal tumors while Kashif et al (2019) reported that 70% of their subjects were diagnosed with malignant lesions (35% T-cell ALL, 30% lymphoma). In one prospective cross-sectional study (5) in Iran however, they reported non-malignant lesions in 51.5% of the subjects. In this study by Alamdaran et al. majority of the thoracic masses were located in the parenchyma and hydatid cyst were the most frequent mass seen. Hematologic malignancies such as T-cell ALL and lymphoma comprised 44% of our cohort and were twice more prevalent compared to non-hematologic malignancies such as GCT and neuroblastoma (15/68, 22%). The majority of patients with hematologic malignancies were diagnosed with NHL (n=9 lymphoblastic lymphoma, n=2 DLBCL, n=2 ALCL), followed by T-cell ALL (n=7) and Hodgkin lymphoma (n=6).

Pleural and pericardial effusion were among the most commonly associated radiologic findings in our cohort of patients (41.2% and 20.6% respectively). Pleural effusion is seen in 31% to 54.5% of other cohorts. Pericardial effusion was seen in 25% to 31% in other studies. The presence of these findings may further impair their respiratory capacity. Tracheal deviation or compression is seen in 15% (10/68) of the population. This was identified as a factor associated with anesthetic complications (8). However, some studies found a poor correlation between symptomatology and radiologic airway compressions (5). They noted that obstruction may be present even without radiologic evidence. Caution should be practiced in these patients; it is probably prudent to presume that those with cardiorespiratory symptoms may be at higher risk for respiratory problems.

Patients with intrathoracic masses may present with significant airway compromise that can be life-threatening hence there is an urgency to establish accurate diagnosis. However, patients in critical condition may not be good candidates for mediastinal surgery requiring general anesthesia. In these cases, a less invasive procedure would be preferable. In many of the clinical reports on mediastinal masses in the pediatric age group, a biopsy of lymph nodes determined the diagnosis and mediastinal tissue biopsy was rarely employed (3,8,10). This observation was also seen in our subset of patients as only 24% (16/68) had either a biopsy or excision of the primary intrathoracic mass. Excision of the

mediastinal mass was done in 14% of those with benign lesions, and none in those diagnosed with malignancy. Mediastinal mass biopsy was done in 24% (11/46) and 9% (2/22) in the malignant group and non-malignant group respectively. Extrathoracic LN (cervical or inguinal) biopsy was done in 40% (27/68) of our patients which helped in establishing the diagnosis. This offered less risk because of minimal sedation and prevention of respiratory compromise. Patients who presented with either leukocytosis or bicytopenia were confirmed to have T-cell ALL through bone marrow evaluation and immunophenotyping. No deaths were reported following sedation and anesthesia for all procedures.

Corticosteroids were used as emergency treatment for patients presenting with life-threatening symptoms. It should be considered that steroid use can compromise the quality of diagnostic material sampled on subsequent biopsies (9). It is also important to note that it imposes a significant risk for tumor lysis syndrome (11). Almost 40% (27/68) of our subjects needed steroid pretreatment at the onset, reflecting the number of patients requiring immediate intervention at presentation. These patients presented with either signs and symptoms of respiratory compromise, bulky disease, or the presence of massive pleural effusions.

Thirty-nine (39) of the 68 patients in this study died with a mortality rate of 57.4% for all cases of intra-thoracic tumors. Different studies reported a mortality rate of 16.4% to 45% in patients presenting with intrathoracic masses (2,3,10,15). Mortality is more than 50% across all etiology, with non-hematologic malignancies having the highest rate. The prognosis of these patients was found to be significantly associated (p value=0.004) with a diagnosis of intrathoracic mass. Based on our observations, the likelihood of death is twice as high in those with malignant lesions.

About 40% (27/68) of patients presented with the advanced stage of the disease as manifested by serious life-threatening symptoms. Kashif et al in 2019 were able to associate the prognosis of these patients with the underlying diagnosis, the delayed presentation to the healthcare facility, and the education status of the head of the patient's family. One study from Japan showed that the median time of symptoms onset to diagnosis was 8.5 days and warning signs leading to admission were noted on average only two days prior to admission (16). Reviews of other available studies do not include specific details on the time frame of symptomatology to specific treatment interventions. This study was not able to show an association between the duration of symptoms to diagnosis, treatment, and outcome. This may be due to the small sample size and the large variability of days across patients. The timeline for all patients, both who died and are still alive, are similar. Our study was only able to give an overview of the average timeline of management in this subset of patients.

Conclusion

Aside from the demographic characteristics of pediatric patients with intrathoracic mass as well as the high mortality rate, this study also highlighted the non-uniformity of diagnostic and treatment approaches in this subset of the population. This may or may not affect the protracted timeline of events from health-seeking behavior to the onset of directed therapy.

From our limited data, we observed that most patients with thoracic masses are in the school-age group, males, with some form of malnutrition. Majority of the patients presented with respiratory symptoms like cough, dyspnea, and chest pain. Most of the masses were located at the anterior mediastinum and are malignant in nature, mainly NHL and Tcell ALL. Steroid pretreatment was given in 40% of the cases indicating the number of cases who were initially seen with severe and life-threatening symptoms. Only a small percentage of these patients underwent directed treatment (<20%) as some expired prior to establishing the diagnosis. Mortality rate is high at 57% and those with malignant lesions were twice more likely to die.

This study had several limitations but it was able to raise awareness regarding the current practice surrounding this kind of case. Diagnostic tests were not obtained uniformly in all subjects. Creating institutional protocols for managing this rare and life-threatening condition may help provide similar and/or comparable data that can eventually translate to better figures for researches in diagnosing and treating these patients. Algorithms for management, or diagnostic and treatment protocols with definite time frames can improve efforts to establish the diagnosis and start directed therapy in the shortest possible time with hopes to augment the high mortality in this subset of patients.

Retrospective studies are usually influenced by recall, reporting, and information bias. It is important to validate the findings of this study with prospective studies. Future prospective studies may include social and economic status in factors that may impact the outcome of the patients. Further studies with larger number of patients, through collaboration among multiple centers, will improve applicability of these results.

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