Superior mediastinal masses in children – two cases of lymphoma

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The exact incidence of superior mediastinal masses in children is largely unknown. They present as a spectrum of disease ranging from an incidental finding on a chest X-ray to being markedly symptomatic with superior vena caval syndrome or obstruction of the upper airways. Lymphomas are the most common causes of superior mediastinal masses in children. We present two cases of confirmed T-cell lymphoma

in children with superior mediastinal masses. In doing so, we explore a diagnostic approach and visit the complications the physician needs to be aware of when confronted with a child with a superior mediastinal mass.

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Case 1

The first patient is a 4-year-old HIV-negative male who presented to Steve Biko Academic Hospital with a 1-week history of cough and shortness of breath. This was the first time this child had been ill. There was no other significant history and there were no tuberculosis (TB) contacts.

Clinically this child was in moderate respiratory distress and was oxygen dependent. There was shift of the mediastinum to the right and stony dullness to percussion on the left, indicative of a left-sided pleural effusion. There were no significant peripheral nodes that could be biopsied and there was no hepatosplenomegaly.

A frontal chest X-ray (CXR) of this child confirmed a left-sided pleural effusion and a widened superior mediastinum as evidenced by Fig. 1. The widened superior mediastinum became more apparent on drainage of the effusion. The computed tomography (CT) confirmed the presence of a large superior mediastinal mass as in Fig. 2. The effusion was exudative in nature with a very high adenosine deaminase level of 184 U/L. Cytology of the effusion revealed atypical lymphocytes suggestive of a malignancy. The child's white cell count was normal with no atypical lymphocytes on smear. Tumour markers including serum lactate dehydrogenase (LDH) were not elevated.

The superior medistinal mass was biopsied by the cardiothoracics surgery team and a bone marrow aspirate and trephine (BMAT) was performed concurrently. The anaesthetic for the entire process was conducted in an extremely cautious fashion with a gas induction and with spontaneous respiration via endotracheal tube during the procedure. The BMAT was not suggestive of malignancy. Histology of the mass itself revealed a T-cell lymphoblastic lymphoma as depicted in Fig. 3.

Case 2

The second case was a 2-year-old HIV-negative male who presented with an acute history of cough and shortness of breath following a choking episode. Considering the history, a foreign body was the initial concern. This was a clinically well child with no respiratory symptomatology. The frontal CXR revealed an incidental finding of a widened superior mediastinum as depicted in Fig. 4. A contrasted CT scan of the chest confirmed a homogenous superior mediastinal mass in the anterior compartment, as shown in Figs. 5. There were no calcifications or cystic changes that would suggest a teratoma. The CT did reveal evidence of compression of the trachea although the child was clinically asymptomatic. In this case as well, there were no peripheral lymph nodes to biopsy and haematological workup including tumour markers was non-contributory. On awaiting theatre for a histological specimen of the mass, the patient had an unexpected cardio-respiratory arrest and unfortunately died.

A postmortem examination revealed no evidence of a foreign body aspiration as suggested by the history. Histology of the mass revealed a T-cell lymphoma. The cause of death was most likely upper airway obstruction from a very large tumour.

Neither patient received corticosteroids while awaiting theatre.

Discussion

Depending on the compartment of the mediastinum involved, there are a number of causes of a widened mediastinum, as shown in Table 1.[1-3] This is imperative in trying to define the aetiology. The majority of mediastinal masses in children are malignant.[2]

Lymphomas are the most common cause of mediastinal masses in the paediatric population.[1,4] Between 50 and 70% of patients with lymphoblastic lymphomas present with an anterior mediastinal or intrathoracic mass.[1] In the paediatric population, two-thirds of lymphomas occurring in the mediastinum are non-Hodgkin's lymphoma, and the remainder are Hodgkin's lymphoma. The second most common cause of mediastinal masses in the anterior mediastinum are germ cell tumours including benign teratomas in addition to malignant seminomas and yolk sac tumours. Germ cell tumours peak in incidence at 3 years of age and at adolescence. The mediastinum is the fourth most common site for teratomas. Neurogenic tumours including neuroblastoma are the most common causes of posterior mediastinal masses.

The diagnostic evaluation begins with a frontal and lateral chest X-ray in which 90% of mediastinal masses can be seen.[2] A CT scan of the chest is necessary to anatomically define the extent and nature of the mass, define the compartment of the mediastinum in which the mass occurs and to determine the degree of airway compression.[2] There are certain clues that could point to a specific diagnosis with fat, fluid and calcified components being more common in germ

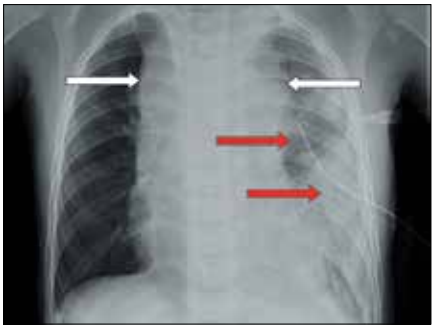

Fig 1. Frontal chest X-ray of patient 1 revealing a widened superior mediastinum (white arrows) and an intercostal drain on the left (red arrows).

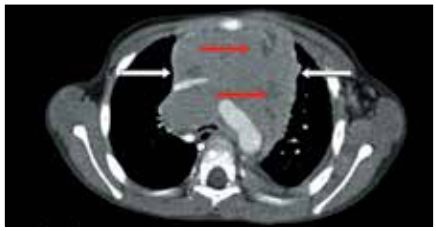

Fig. 2. Axial contrasted CT)at the level of the carina demonstrating the large superior mediastinal mass (white arrows) with areas of necrosis and cystic change (red arrows).

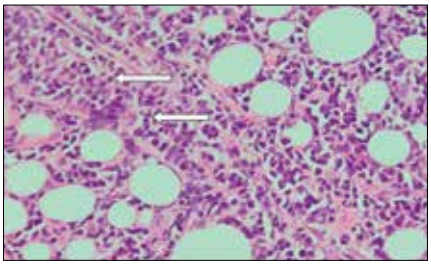

Fig. 3. H&E section of the mass seen in figures revealing extensive lymphocyte proliferation (courtesy of Dr J Dinkel, Department of Anatomical Pathology, Tshwane Academic Division, NHLS).

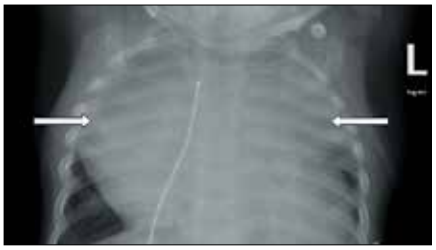

Fig. 4. Frontal chest X-ray of patient 2 demonstrating large superior mediastinal mass (arrows).

Table 1. Mediastinal masses by location

Anterior	Middle	Posterior
Non-Hodgkin's lymphoma	Vascular malformations	Neuroblastoma
Hodgkin's lymphoma	Double aortic arch	Ganglioneuroblastoma
Germ cell tumour	Pulmonary artery sling	Ganglioneuroma
Hyperplastic/ectopic thymus	Aneurysms	Nerve sheath tumours
Thymoma	Bronchogenic/foregut cysts	
	Mediastinal lymph nodes	

cell tumours.[3,5] The involved compartment will guide the differential diagnosis.[5]

Haematological markers that are useful include a full blood count with differential and (looking for atypical lymphocytes or blasts, or cytopenias indicating possible bone marrow infiltration) tumour markers (alpha fetoprotein, beta human chorionic gonadotrophin (HCG)) in the case of germ cell tumours. A BMAT is necessary in the case of a suspected haematological malignancy, as one-third of patients will have bone marrow involvement.[2] A biopsy of the mass itself is mandatory in those cases where a diagnosis cannot be made with peripheral specimens (biopsy of peripheral lymph nodes or other blood investigations). Biopsy of the mass itself can be obtained by a CT-guided procedure or via sternotomy. Certain tumour markers may assist with a diagnosis: for instance, elevated alpha foetoprotein and beta HCG would suggest a germ cell tumour.[5] A peripheral flow cytometry conducted on a patient with a very high white cell count would suggest a lymphoma/leukaemia. Elevated urinary levels of the catecholamine vanillylmandelic acid (VMA) and homovanillic acid (HVA) in a patient with a posterior mediastinal mass is suggestive of a neuroblastoma.[6]

When planning a biopsy, the clinician needs to be aware that there is a significant anaesthetic risk with any form of sedation and induction of anaesthesia leading to possible acute airway obstruction, sudden cardiac arrest and death.[4,7-9] The risk is present even in the case of an asymptomatic lesion.[4] Children with superior mediastinal masses are at higher risk of an anaesthetic death than their adult counterparts.[9] Conscious sedation with spontaneous breathing during the procedure is the recommended method of anaesthesia in these patients and neuromuscular blockade is not advised.[4,8,9]

The role of preoperative steroids needs to be clearly defined, the advantage of which will decrease the risk of airway obstruction by shrinking the tumour and improving the anaesthetic outcome.[10] However, this runs the risk of an inadequate biopsy specimen and could potentially interfere with a histological diagnosis.[7] In one series of 18 patients, preoperative steroids were used in patients with features of airway compromise and despite this a good histological sample was obtained in 95% of cases; prolonged use of steroids (>5 days) impaired histological diagnosis in 5% of cases.[7] Another series also concluded minimal interference with pathological diagnosis with the use of pre-operative steroids in high-risk patients.[10] This is definitely an area that needs further research and exploration.

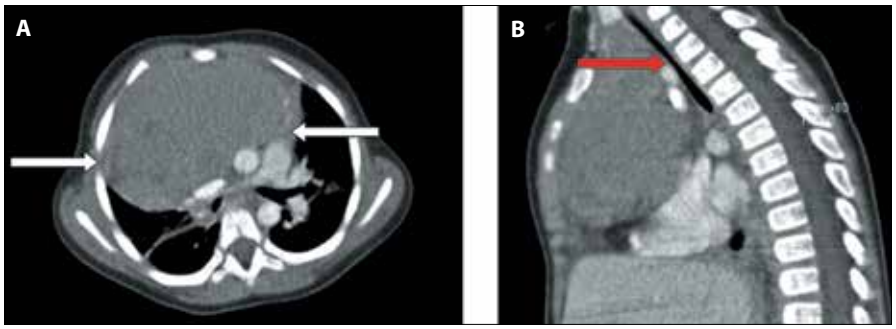

Fig. 5A and B. Axial (A) and sagittal (B) CT views of patient 2 revealing a large homogenous superior mediastinal mass (white arrows). Tracheal compression is noted in sagittal view (red arrow).

In case 2, starting preoperative steroids would have possibly resulted in tumour shrinkage and avoided an unfortunate demise. This is definitely a learning point in the case.

Conclusion

Lymphomas are one of the most common causes of superior mediastinal masses in the paediatric population. A mass in the superior mediastinum usually requires a histological diagnosis. These patients, despite appearing clinically stable, can be challenging to manage and caution should be employed during the time of biopsy when anaesthetic is administered. The physician should consider the use of preoperative steroids in symptomatic individuals or asymptomatic individuals with evidence of airway compression on imaging in order to improve the anaesthetic outcome.

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