Case report

Anaesthetic management of a child with mediastinal tumour, superior vena caval obstruction and thrombocytopenia

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Abstract

A 4 year old girl presented with swelling of left half of face, fever, hurried breathing and a mass over the left forearm. A computerised tomography (CT) scan revealed a large mediastinal mass compressing the superior vena cava, encasing trachea, both main bronchi and pulmonary trunk with infiltration into left upper lobe of lung. Haematological investigations revealed anaemia and thrombocytopenia. As part of clinical evaluation, she was posted for left ulnar mass biopsy. The case was successfully managed with an ultrasound guided brachial plexus block without any respiratory or haemodynamic compromise.

Keywords: Mediastinal tumour, superior vena caval obstruction, thrombocytopaenia

Introduction

Mediastinal tumours, particularly those in the anterior mediastinum pose a great challenge to anaesthesiologists due to their wide spectrum of complications. The mortality and morbidity related to surgery and anaesthesia in patients with mediastinal mass would depend on their size and extent. They can be very difficult to manage in the perioperative period, and there have been cases of cardiorespiratory disasters and even death.[1] The unique problems associated with mediastinal mass consequences of compression of vital structures inside the mediastinum such as the trachea causing airway obstruction, superior vena cava causing obstruction to venous return or the heart itself causing obstruction to cardiac outflow. Here we report the anaesthetic management of a child who presented with a mediastinal mass with superior mediastinal syndrome in sepsis and proximal ulnar mass scheduled for biopsy of the ulnar mass.

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Case report

A four year old child, weighing 14.6 kg, presented with sudden onset of swelling of the left half of the face, fever and hurried breathing. A chest x-ray done at a local hospital showed bilateral paracardiac haziness *(Figure 1)*. The child was prescribed oral cefixime and ciprofloxacin by a local doctor for fever and was referred to our hospital for further management in view of suspected superior mediastinal syndrome. The child did not have any other significant past history.

On examination, the child was found to have generalised lymphadenopathy, tachycardia, tachypnoea, decreased air entry over the left lung fields and massive hepatosplenomegaly. Haematological investigations revealed anaemia, thrombocytopenia, hypoalbuminemia, elevated erythrocyte sedimentation rate (ESR) with bandemia in peripheral smear.

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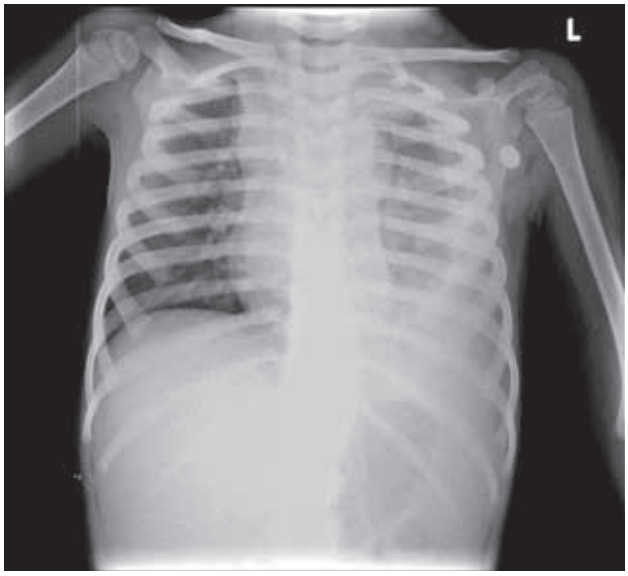

Figure 1: Chest x-ray showing paracardiac haziness, hilar widening and left sided pleural effusion

A computerised tomography (CT) scan of the chest showed a large heterogeneously enhancing lesion with a few non-enhancing necrotic areas in anterior mediastinum, compressing superior vena cava just above its entry into right atrium *(Figures 2 and 3)*. The lesion was found to be encasing the lower trachea at the carinal level, both main bronchi, pulmonary trunk and both main pulmonary arteries. On the left side, the lesion was also infiltrating into the upper lobe of lung with gross left sided pleural effusion and near complete collapse of left lung. Right lung parenchyma and cardia were normal.

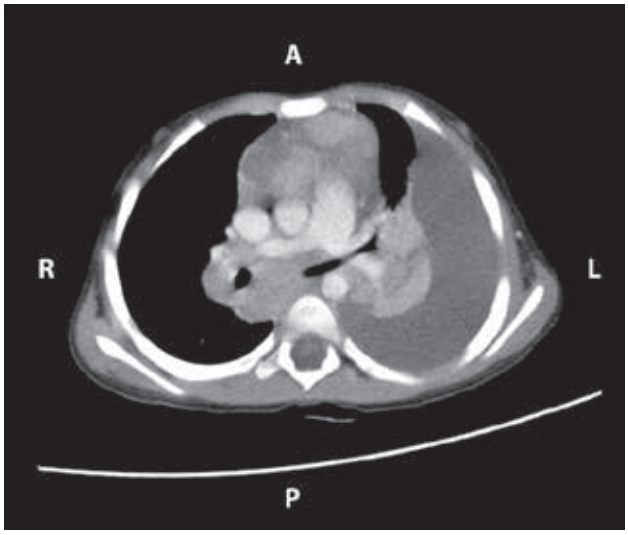

Figure 2: Scan showing encasement of mediastinal structures, collapse of left lung with left gross pleural effusion (cross section).

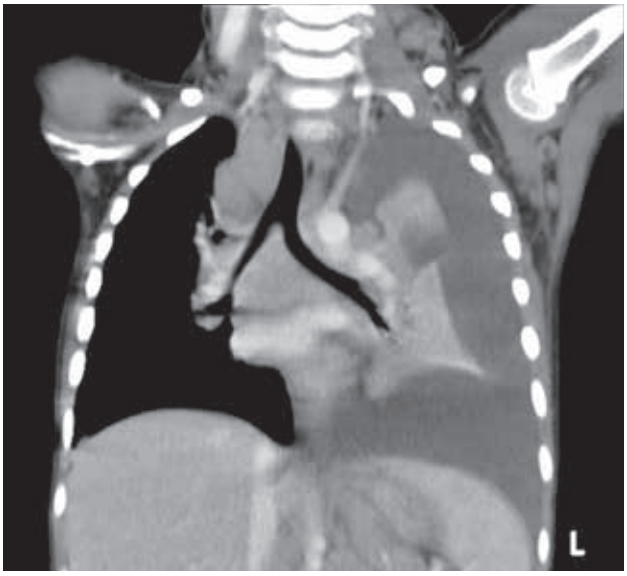

Figure 3: Scan showing encasement of mediastinal structures, collapse of left lung with left gross pleural effusion (anteroposterior view).

Echocardiography revealed mild pericardial effusion all around the heart with normal cardiac function. Ultrasound of the left elbow revealed proximal ulnar osteolysis with enlarged epitrochlear lymph nodes. Further evaluations including pleural fluid tap, bone marrow aspiration and biopsy were done in order to reach a diagnosis. While pleural fluid cytology showed degenerated cells, bone marrow biopsy revealed reactive marrow with dyspoiesis. A fine needle aspiration cytology (FNAC) of the enlarged right posterior cervical lymph node was done but the reports were inconclusive. Hence, the orthopaedic surgeon decided to schedule the child for a biopsy of the ulnar mass so as to obtain a diagnostic clue and facilitate definitive treatment.

Preoperative evaluation revealed a pulse rate 150 beats/min, blood pressure 96/60 mm Hg, respiratory rate 28/min and oxygen saturation (SpO_2) 99% on room air. The child was febrile with a body temperature of 38 °C. Respiratory system examination showed decreased air entry over left lung fields but without any signs of respiratory distress. Apart from hepatosplenomegaly, rest of the systemic examination was unremarkable. Investigations showed a haemoglobin level of 8.2 g/dL, platelet count of 33,000/mm^3 and a total leucocyte count of 12,000/mm^3.

In view of the multitude of problems with significant anaesthetic implications, it was decided to perform the biopsy under an ultrasound guided supraclavicular brachial plexus block.

Standard monitoring as per American Society of Anaesthesiologists (ASA) was followed which included a 5 lead electrocardiogram, noninvasive blood pressure measurement and pulse oximtery (SpO_2). In addition, an axillary temperature probe was also placed revealing a temperature of 38 degree Celsius. A 22 gauge intravenous (IV) cannula was inserted in right upper limb. Child was sedated with IV ketamine 7 mg and IV midazolam 0.5 mg while breathing oxygen at 4 L/min through anaesthetic face mask. IV paracetamol was given since the child was febrile. A supraclavicular brachial plexus block was then given under ultrasound guidance using a 22 gauge IV cannula needle with 2 ml 2% lignocaine with 1:2,00,000 adrenaline and 8 ml of 0.25% bupivacaine under aseptic precautions. The surgery was allowed to commence after 15 min. Another dose of IV ketamine 7 mg was repeated in the intraoperative period. No other anaesthetic agents were used. The procedure was uneventful. Haemodynamic parameters were stable throughout the procedure with a heart rate of 120-130 bpm, blood pressure of 100/60 to 90/52 mm Hg and SpO_2 of 98-100%. At the end of procedure, child was shifted to the postoperative care unit once fully awake and breathing regularly with oxygen supplementation using facemask. Child was comfortable in the postoperative period and recovered from the block uneventfully.

The fine needle aspiration cytology was suggestive of small round cell tumour and bone (ulna) biopsy showed features of germ cell tumour. The poor prognosis and the need for chemotherapy were explained to the parents. They decided to take the child home against medical advice as they could not afford the treatment.

Discussion

Providing anaesthesia for patients with a large anterior mediastinal mass has always been challenging for anaesthesiologists. This is primarily owing to the high incidence of airway and haemodynamic collapse on induction of anaesthesia.[2] This is a recognised fact since 1970s, but development of modern monitoring equipment as well as regional techniques has come a long way in helping anaesthesiologists face this challenge more efficiently.

Mediastinal tumours, benign or malignant, may present with a wide spectrum of symptoms. The main features which differentiate adult and paediatric mediastinal tumours are tumour histology, location and symptoms.[3]

Paediatric patients need at least sedation if not general anaesthesia for even small procedures. In this case, it was open biopsy and would necessitate analgesia apart from sedation. Administration of general anaesthesia is fraught with dangers. Induction of general anaesthesia causes relaxation of airway muscles which can increase the compressibility of airways and possibly exacerbate the airway obstruction by extrinsic mass.[4] Loss of tone of chest muscles can also cause abnormal pattern of breathing causing partial obstruction which can further increase the extrinsic obstruction.[5] The incidence is higher in patients who are symptomatic preoperatively.

Perioperative airway management in such cases usually requires meticulous preoperative evaluation and planning. Various options include induction in sitting position, maintaining spontaneous respiration (awake fibre optic intubation or inhalational induction or induction with ketamine), airway stenting (using long endotracheal tube, double-lumen endobronchial tube, rigid bronchoscope or insertion of tracheobronchial stents) and cardiopulmonary bypass.[5] The selection of method of airway management is individualised based on patient characteristics. The most important risk factors suggestive of airway compromise are: airway narrowing or displacement in imaging, anterior location of tumour, histological diagnosis of lymphoma, signs and symptoms of superior vena caval obstruction, radiologic evidence of vessel compression, pericardial effusion and pleural effusion.[6] This increases the morbidity and mortality associated with general anaesthesia especially in

the paediatric population due the smaller airway diameter.[7] Therefore the primary aim should be to maintain spontaneous ventilation.

In this case, since child did not have evidence of significant airway obstruction preoperatively, we have used intravenous ketamine and midazolam for sedation while maintaining spontaneous breathing.[6]

Mediastinal masses may compress the superior vena cava or pulmonary arteries or pericardium and heart. Superior vena caval obstruction as was present in this case can cause airway oedema and decreased preload. Induction of anaesthesia and positive pressure ventilation can further decrease the venous return and result in sudden cardiovascular collapse.[7] Pulmonary trunk or pulmonary artery compression can cause a decrease in the right ventricular outflow thus leading to hypoxaemia, hypotension and even cardiac arrest, especially in supine position.[8] Infiltration of pericardium or myocardium by tumour mass may severely compromise the cardiac function. Hence preoperative echocardiography becomes essential to rule out a cardiac tamponade or a compromised ventricular function. Presence of pericardial tamponade requires a preoperative pericardiocentesis to decrease the perioperative morbidity.[9]

Regional anaesthesia was favoured in this case as there was evidence of superior venacaval obstruction and pulmonary trunk encasement. The pericardial effusion was minimal, with no tamponade and there was good biventricular function ensuring stable haemodynamics during sedation.

Ketamine at low doses (0.2-0.8mg/kg IV) has been found to have minimal effects on the respiratory drive and keeps the airway reflexes relatively intact. However, in paediatric patients and when combined with other sedatives, it may cause respiratory depression. Also it increases airway secretions and can possibly cause laryngospasm. Its effect on cardiovascular system is predominantly stimulating. Irrespective of dose, ketamine increases blood pressure, heart rate and cardiac output.[10]

Midazolam, at sedative doses of 0.5-1mg IV (titrated as per desired level of sedation), is known to produce respiratory depression depending on the rate of administration and patient characteristics. In our case a combination of ketamine and midazolam was used which helped in maintaining stable haemodynamics. Respiratory depression was avoided by titrated drug administration by slow intravenous route while supplementing oxygen through anaesthetic face mask.

Another option which can be considered in patients with mediastinal mass posted for extra-thoracic surgeries are regional anaesthetic techniques. This ensures haemodynamic stability as well as avoids airway manipulation. Ultrasound guided brachial plexus block is a safer alternative to general anaesthesia for upper limb procedures as in this case. While these techniques carry their own set of complications (risk of vascular puncture and pneumothorax), the use of ultrasound has made it a safer option. This is probably the reason why peripheral nerve blocks are gaining popularity in paediatric patients as well. Bleeding disorders are considered as a relative contraindication as it increases the risk of local haematoma formation and ischaemic nerve damage.[11] Weighing the risk-benefit ratio, it was decided to perform the procedure under ultrasound guided nerve block.

Conclusion

Regional anaesthesia is a safer alternative to general anaesthesia in patients with mediastinal mass posted for extrathoracic surgeries. Even though coagulopathy is considered a relative contraindication for nerve blocks, the presence of ultrasound guidance has made it much safer. Paediatric nerve blocks in experienced hands can be a safer alternative in children with mediastinal mass. Weighing the risk benefit ratio in an individualised manner helps to decide the best mode of anaesthesia.

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