Procedural sedation for a child with a mediastinal mass and superior vena caval syndrome

Sir,

Anesthetic management of patients with mediastinal masses, especially in the pediatric age group poses a considerable challenge to all anesthesiologists. We describe the anaesthetic management of a 7-year-old child with a mediastinal mass and superior vena cava syndrome (SVCS) for diagnostic computed tomography (CT) and tissue biopsy under CT guidance. Our scenario is unique because a preprocedure CT scan which would probably help us to understand the extent of airway and hemodynamic compromise caused by the lesion

was unavailable and we had to rely on clinical examination for formulating the anesthetic technique.

A 7-year-old, boy with body mass index 16.5 kg/m^2 (weight 15 kg) presented with a history of breathing difficulty and puffiness of the face for 3 days. Child preferred the sitting position which decreased his dyspnea with no preference of lateral position. Although he could lie supine, without cough; he was dyspneic in the supine position. There was no history of fever, cough, hemoptysis, hoarseness of voice or stridor. Anesthesia team was involved for procedural sedation for undertaking CT of the thorax and obtaining tissue biopsy from the lesion. He was admitted to pediatric ICU (PICU) for monitoring and started on high flow oxygen. On examination, the child was in propped up position, alert, tachypneic (respiratory rate [RR] = 55 breaths/min), using accessory muscles of respiration, heart rate (HR) was104/min, blood pressure (BP) 108/64 mmHg, oxygen saturation of 98% on oxygen. He had facial puffiness and plethora, with distended neck veins suggestive of superior vena caval syndrome. The child received preprocedure dose of dexamethasone (30 mg) in PICU, 6 h prior to the procedure.

High-risk consent was obtained due to the presence of SVCS and respiratory symptoms in our patient [Figure 1]. We decided to proceed with the planned procedure under sedation; with adequate preparation for dealing with airway compromise and cardiovascular collapse; if these occurred. The difficult airway cart was checked, and a rigid bronchoscope was made available in the CT suite. The cardiac perfusion team was alerted in the OR in case emergency cardiopulmonary bypass (CPB) was to be instituted.

The child's father was present with him in the CT suite throughout the procedure. Standard ASA monitors were placed including ECG, SpO_2, $ETCO_2$ measured through a nasal cannula, and noninvasive BP. The saturation on oxygen was 98%, HR 132/min, BP 108/58 mmHg and RR was 40 breaths/min. The patient was given oxygen via nasal prongs and premedicated with glycopyrrolate 0.1 mg and ondansetron 2 mg through an intravenous cannula on the right upper limb. He could lie supine, with dyspnea and was sedated using 1 μg/kg dexmedetomidine injected slowly over ten minutes. The HR was 120/min and BP was 100/52 mmHg at this time. An additional intravenous access was obtained on the lower limb. The CT scan was performed, and the biopsy site was marked by the interventional radiologist. A bolus of 1 mg/kg of ketamine was given at this point, and the dexmedetomidine infusion rate decreased to 0.5 μg/kg/h. The biopsy site skin was infiltrated with 2% lignocaine (2 ml), and an additional dose of ketamine 0.5 mg/kg was given prior to the siting of the biopsy needle. The child did not move in response to the injection of a local anesthetic. Tissue biopsy was obtained from three sites under all sterile precautions, and the entire procedure lasted thirty minutes. The total dose of ketamine administered was 30 mg. The child was awake seven minutes after the discontinuation of dexmedetomidine infusion and was transferred to the PICU in the propped up position.

The CT scan [Figure 2] reported a large minimally enhancing homogeneous mass in the anterior and middle mediastinum. The biopsy from mediastinal mass was consistent with T-lymphoblastic lymphoma. The child was given a course of steroids and was discharged from the hospital following dramatic improvement in his condition. He is currently undergoing chemotherapy at our institution.

We report the use of dexmedetomidine and ketamine combination for procedural sedation in a child with mediastinal mass as there are limited reports on the use of this drug combination for sedation in pediatric[1,2] and adult patients[3] with mediastinal masses.

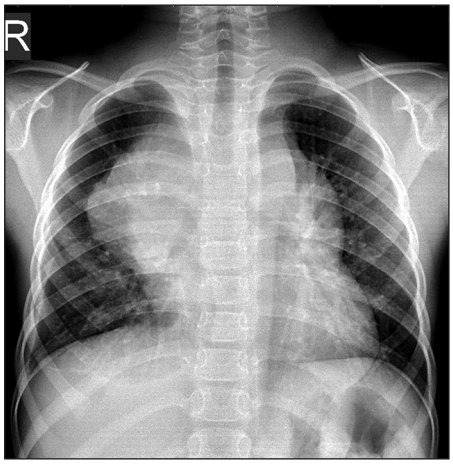

Figure 1: Preprocedure chest radiograph depicting mediastinal mass

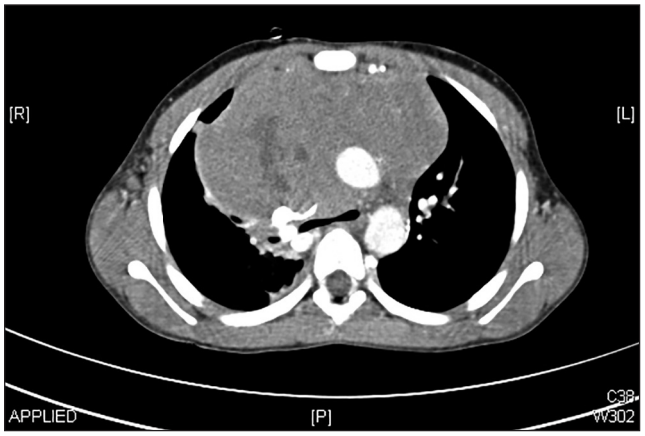

Figure 2: Computed tomography scan (thorax) depicting area of maximal compression of the trachea by the mediastinal mass

Our patient presented with a rapidly growing mediastinal mass involving both, the middle and anterior mediastinum. Tumors found in the anterior mediastinum of children are referred to by the four Ts: Thymoma, teratoma, thyroid/other and terrible lymphoma; lymphomas being the most common. The lymphoblastic T-cell tumors have a doubling time of as little as 12 h and may have a dramatic clinical presentation (as in our patient) in a previously healthy child. Superior vena caval syndrome rarely occurs in children with most cases being iatrogenic, secondary to either congenital heart surgery or total parenteral nutrition.[4] Mediastinal tumors represent the primary natural cause of SVCS in childhood and adolescence.[4] The signs and symptoms of SVCS are due to impaired venous drainage of blood from the head and neck and increase in the supine position and when sitting but leaning forward. The concerns in our patient included the need to provide effective sedation and analgesia for obtaining tissue for diagnosis in a remote location; while minimizing the need for positive pressure ventilation, potential for apnea and hemodynamic compromise, with preexisting SVCS and baseline respiratory dysfunction. We decided to proceed with procedural sedation using dexmedetomidine as maintaining spontaneous ventilation was vital in our patient. The child received preprocedure dose of dexamethasone which provides symptomatic relief and decreases cardiorespiratory compromise.[5]

Dexmedetomidine is a selective α_2 agonist with sedative, analgesic, amnesic, and antisialagogue properties that maintain spontaneous respiration with minimum respiratory depression, making it suitable for cases where spontaneous ventilation is preferred. The advantage of dexmedetomidine over other sedative medications is that it maintains ventilation and airway patency in the presence of increasing sedation,[6,7] and has a short half-life (1.5-3 h) after intravenous dosing; which translates into easy titration of dose and faster recovery.[8]

Dexmedetomidine may not be an ideal sole agent for procedural sedation during painful procedures.[9,10] In such cases, the addition of ketamine to dexmedetomidine can provide optimal sedation and analgesia.[11,12] The analgesic effects of dexmedetomidine and ketamine are due to different mechanisms of action at unique sites. The antinociceptive effects of dexmedetomidine are due to its stimulation of the α_2 adrenoceptors in the locus coeruleus and the spinal cord, inhibiting the firing of nociceptive neurons.[13] Ketamine, an N-methyl-D-aspartate antagonist, provides analgesia by preventing the induction of central sensitization to painful stimuli.[14]

When used together, dexmedetomidine may prevent the tachycardia, hypertension, salivation, and emergence phenomena from ketamine,[15] whereas ketamine may prevent bradycardia and hypotension reported with dexmedetomidine.[11] Addition of ketamine to dexmedetomidine sedation regimen also speeds up the onset of sedation.[11] The combination of dexmedetomidine with ketamine has been used successfully for procedural sedation in infants and children undergoing cardiac catheterization[12] and lumbar puncture also.[16]

Anterior mediastinal masses in children should be approached with caution, with multi-disciplinary involvement, the least invasive diagnostic techniques, careful preoperative evaluation, and avoidance of general anesthesia for diagnostic procedures.[5] Children at high risk for cardiorespiratory collapse may benefit from preoperative treatment of the tumor to shrink it and restore cardiorespiratory stability. Personnel and equipment for emergency airway management including rigid bronchoscopy, difficult airway cart equipment and tracheostomy should be available. In patients at high risk of cardiorespiratory instability, preparations for extracorporeal membrane oxygenation (ECMO) or CPB should be made preoperatively. In the presence of severe distal tracheal and/or bilateral main stem bronchial compression, cannulation for CPB should occur before the induction of anesthesia.[5] Our rescue plan in case of a respiratory event was to insert the rigid bronchoscope to aid ventilation and shift the child to the operation room for further management. Fortunately, our patient tolerated the supine position and sedation well; but as a more precautious approach we should have performed femoral vessel cannulation in case we required CPB, as ECMO is currently unavailable in our institute.

Children with mediastinal masses require a carefully tailored, individualized anesthetic approach. Minor diagnostic procedures in such children can be accomplished under sedation with a combination of dexmedetomidine and ketamine; but personnel and equipment to manage cardiorespiratory collapse should be readily available during procedural sedation.

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References

1. Mahmoud M, Tyler T, Sadhasivam S. Dexmedetomidine and ketamine for large anterior mediastinal mass biopsy. Paediatr Anaesth 2008;18:1011-3.
2. Corridore M1, Phillips A, Rabe AJ, Tobias JD. Dexmedetomidine-ketamine sedation in a child with a mediastinal mass. World J Pediatr Congenit Heart Surg 2012;3:142-6.
3. Abdelmalak B, Marcanthony N, Abdelmalak J, Machuzak MS, Gildea TR, Doyle DJ. Dexmedetomidine for anesthetic management of anterior mediastinal mass. J Anesth 2010;24:607-10.

4. Lerman J. Anterior mediastinal masses in children. Semin Anesth Perioper Med Pain 2007;26:133-40.
5. Blank RS, de Souza DG. Anesthetic management of patients with an anterior mediastinal mass: Continuing professional development. Can J Anaesth 2011;58:853-9, 60.
6. Mason KP, Lerman J. Review article: Dexmedetomidine in children: Current knowledge and future applications. Anesth Analg 2011;113:1129-42.
7. Mahmoud M, Radhakrishman R, Gunter J, Sadhasivam S, Schapiro A, McAuliffe J, *et al.* Effect of increasing depth of dexmedetomidine anesthesia on upper airway morphology in children. Paediatr Anaesth 2010;20:506-15.
8. Dyck JB, Maze M, Haack C, Vuorilehto L, Shafer SL. The pharmacokinetics and hemodynamic effects of intravenous and intramuscular dexmedetomidine hydrochloride in adult human volunteers. Anesthesiology 1993;78:813-20.
9. Tobias JD, Berkenbosch JW. Initial experience with dexmedetomidine in paediatric-aged patients. Paediatr Anaesth 2002;12:171-5.
10. Jalowiecki P, Rudner R, Gonciarz M, Kawecki P, Petelenz M, Dziurdzik P. Sole use of dexmedetomidine has limited utility for conscious sedation during outpatient colonoscopy. Anesthesiology 2005;103:269-73.
11. Tobias JD. Dexmedetomidine and ketamine: An effective alternative for procedural sedation? Pediatr Crit Care Med 2012;13:423-7.
12. Goyal R, Singh S, Bangi A, Singh SK. Case series: Dexmedetomidine and ketamine for anesthesia in patients with uncorrected congenital cyanotic heart disease presenting for non-cardiac surgery. J Anaesthesiol Clin Pharmacol 2013;29:543-6.
13. Gertler R, Brown HC, Mitchell DH, Silvius EN. Dexmedetomidine: A novel sedative-analgesic agent. Proc (Bayl Univ Med Cent) 2001;14:13-21.
14. Pai A, Heining M. Ketamine. Contin Educ Anaesth Crit Care Pain 2007;7:59-63.
15. Levänen J, Mäkelä ML, Scheinin H. Dexmedetomidine premedication attenuates ketamine-induced cardiostimulatory effects and postanesthetic delirium. Anesthesiology 1995;82:1117-25.
16. McVey JD, Tobias JD. Dexmedetomidine and ketamine for sedation during spinal anesthesia in children. J Clin Anesth 2010;22:538-45.

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