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Safe Anaesthesia Management in a patient with ventricular fibrillation in huge mediastinum tumor resection

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Abstract: Mediastinum tumor is a common disease in thoracic disease; surgical resection is the mainstay of treatment. Many cases have been reported of hemodynamic and airway collapse induced by general anesthesia in patients with an anterior mediastinal mass, and it is a challenge for the anesthesiologists. Preoperative evaluation should be comprehensive, and a good response could be taken in the event of threatening situation. Ventricular fibrillation occurred in the process of particle implantation in this case. After defibrillation, injecting adrenaline, changing position and so on, cardiopulmonary resuscitation (CPR) was successful.

Keywords: Mediastinum tumor, Ventricular fibrillation, anesthesia

Introduction

Mediastinum tumor is a common disease in thoracic disease; surgical resection is the mainstay of treatment. Mediastinal mass syndrome remains an anesthetic challenge that cannot be underestimated. This paper reports a case of ventricular fibrillation occurred in mediastinal tumor resection, this experience could be valuable for the management of patients with such masses.

Case Presentation

A 21-year-old male patient was admitted to our cardiothoracic ward because of persistent cough, continuing for about three months, and mild chest congestion, tachypnea and fever. Physical examination revealed centered trachea, thoracic symmetry without any deformity but with decreased breath sounds on the left side. Auscultation of the lungs revealed no coarse rhonchi and crackles in both inspiration and expiration. Auscultation of the heart showed no arrhythmia and level 2-3 systolic murmurs on sternum right edge. The electrocardiogram (ECG) showed sinus tachycardia, sinus arrhythmia and occasional ventricular premature beat. Chest cardiac ultrasound showed enlarged right atrium, increased blood flow velocity of the right ventricular outflow tract and pulmonary valve, left ventricular false tend. The fiber electronic bronchoscope showed atresia of left main bronchus. On chest computed tomography (CT), the mass arises in the anterior mediastinum with soft tissue density, filled by inhomogeneous material and unclear border, uneven lesions of reinforcement, the largest cross section is 12cm in diameter (figure 1). Contrast enhanced CT scan shows inhomogeneous enhancement pattern. The differential diagnosis includes the left anterior mediastinal tumor, probably thymic tumor or

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Lymphoma. Biopsy of mediastinal tumor was scheduled.

After taken to the operating room, the patient was monitored with ECG, IBP and pulse oximeter. Vital signs showed BP was about 120/70 mmHg, the heart rate between 90 and 100 beat. min^{-1}, Oxygenation remained with a SpO2 of 94–96%, R 26 times/min. An intubation was done with topical anesthesia of the oropharynx with a spontaneous breath. A size 7.5 tracheal tube was inserted easily. Initial manual ventilation showed no increase in peak airway pressures and hemodynamic status remained stable. Muscle relaxants were then administered, anesthesia was maintained with sevoflurane and surgery commenced. The mediastinum tumor biopsy specimens were obtained and frozen biopsy results suggest for invasive thymoma. Then partial resection of tumor was decided temporarily. Most of mediastinal tumor tissue was resected without affecting the heart and great vessels. And seed implantation was scheduled. The blood pressure fluctuated in the process of removal of the tumor, and the lowest blood pressure was 85/50 mmHg. We maintained blood pressure with dopamine (4 to 8μg $kg^{-1}.min^{-1}$). The blood pressure decreased significantly to 70/40 mmHg in the process of the seed implantation, and returned to normal after intravenous injection of ephedrine 6 mg. Seed implantation went on, and then blood pressure dropped again, and only some bleeding was encountered during the procedure, the minimum was 40/20 mmHg, ventricular fibrillation happened suddenly. We immediately carried out within the chest heart pressure, electrical shock three times, and intravenous epinephrine 300μg. And the heart restored sinus rhythm soon. We maintained the hemodynamic status with adrenaline (0.05 to 0.15μg $kg^{-1}.min^{-1}$). Blood pressure and heart rate decreased significantly in the process of closing the chest after place of mediastinal drainage tube, and returned to normal after intravenous injection of epinephrine 100μg. But the blood pressure again had a downward trend after chest being closed, circulation gradually tend to be stable by giving phenylephrine 150μg, raising the cephalothorax to 30° from a supine position, and increasing adrenaline (0.2 to 0.55μg $kg^{-1}.min^{-1}$).

The patient was taken to the intensive care unit after surgery, and was extubated after a comfortable awakening. The patient remained stable after 24 hours of observation in the intensive care unit, and he was transferred to the cardiothoracic ward on the second day.

Discussion

Mediastinal tumor resection is very common. Many cases have been reported of hemodynamic and airway collapse induced by general anesthesia in patients with an anterior mediastinal mass [1-2]. We pay more attention on its influence on airway before surgery because of its special anatomic location. CT and bronchial endoscopy revealed the left main bronchus was almost completely closed (figure 1). Preoperative assessment of the patient, we chose to keep spontaneous breathing intubation, after considering the use of anesthetic drugs and mechanical positive pressure ventilation may cause further obstruction of the airway. We throughout have no difficulty of airway management. Intraoperative blood gas results showed that the oxygen partial pressure, CO2 partial pressure and electrolyte were in the normal range. Electrocardiogram, Chest cardiac ultrasound and CT examination results showed that the obvious compression on heart and great vessels (including the left pulmonary artery, left pulmonary vein, aorta and left and right ventricle) (figure 2). We should consider mediastinum tumor may cause great influence to the circulatory system in the process of surgery and anesthesia in the preoperative evaluation.

The blood pressure had small amplitude fluctuation, and the heart rate change was not obvious in the process of tumor resection before seed implantation. In the process of residual tumor in embedded particles ventricular fibrillation

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occurred. The main reasons considered as follows: (1) the compression of heart and large blood vessels should be alleviated after the tumor was nearly entirely removed. But the tumor tissue in the pulmonary trunk areas cannot be removed completely. Then due to the compression of tumor remnants, lose heart side support, coupled with the reason of the position, the stub under the action of gravity may further intensified compression of mediastinal area on blood vessels. (2) Any to oppression of heart and vascular operation action could make with the biggest impacts on the hemodynamic status [3]. When the particles implanted, we needed a hand to fix particle spear head end on the residual tumor, one hand to pull the trigger, and put the particles into the corresponding location [4]. Pulmonary artery, left pulmonary artery and pulmonary vein in tumor remnants of the original oppression, continued to be pressed, deformation and which cause a decrease in the preload and an increase in the afterload, even leaded to a temporary blood flow interruption, eventually leaded to ventricular fibrillation [5]. (3) The large hole was left in the left chest after most of the tumor tissue was resected. After the chest was closed, the significantly changed pressure of chest cavity resulted in mediastinal shift or swing, which further increased the afterload of the heart, and even leaded the mechanical outflow obstruction, and caused severe changes in hemodynamic status [3].

Immediately after ventricular fibrillation, we treated the patient with the intrathoracic pressure, heart electric defibrillation, and intravenous injection of epinephrine. And soon it returned to sinus rhythm. The heart rate turned slowly and blood pressure went down when after closing chest. To increase the dose of adrenaline injection (0.2 to 0.25μg $kg^{-1}.min^{-1}$); changed the position to the Fowler's position [6]; position is very important for this kind of patients although with no position related symptoms. We moved the two drainage tubes from the superior mediastinum area to the bottom of the pericardium. The circulation gradually stabilized through a series of processing.

Conclusion

Complications are associated mainly with hemodynamic changes and airway obstruction, and they may occur at the time of induction, during extubation, or even days after the procedure [7]. However, it occurred during the procedure with a serious hemodynamic complication. Preoperative appropriate evaluation must be comprehensive for such patients to determine the operation method and way of anesthesia. When the CT examination can't clear about the influence of tumor on the great vessels, further examination of three-dimensional reconstruction and MRI are needed [8]. Sometimes Transesophageal echocardiography should be considered [9-10]. It's a pity that we didn't implement the related monitoring in the case, or we can clear the blood volume, cardiac function and left ventricular outflow, can further clarify the cause of ventricular fibrillation. Surgeons should formulate detailed operation plan in preoperative, should not change the plan temporarily [10]. If we don't change the surgical method, ventricular fibrillation may not happen. We need to analyze the reasons and take positive countermeasures when the circulatory system is unstable. Ventricular fibrillation is one of the serious complications during general anesthesia, if not handled in time, life will be threatened.

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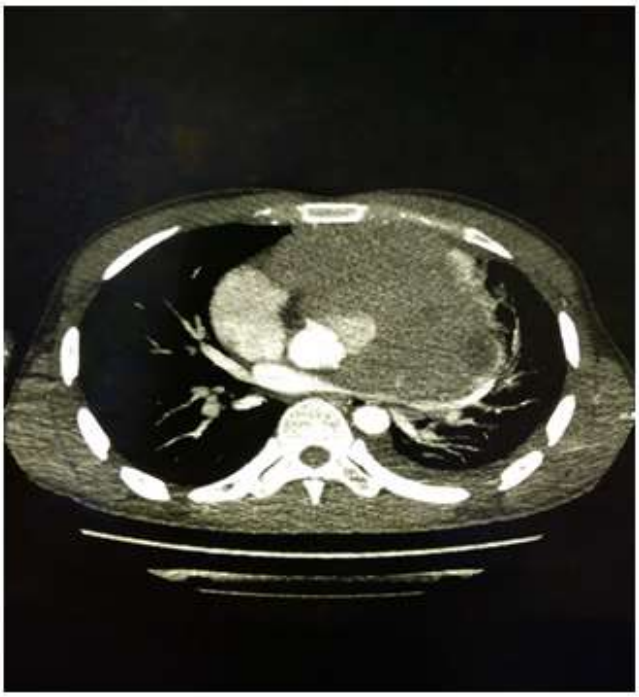
Fig1 On chest computed tomography (CT) the mass arises in the anterior mediastinum with soft tissue density, the largest cross section is 12cm in diameter. Computed tomography scan revealed the left main bronchus was almost completely closed.



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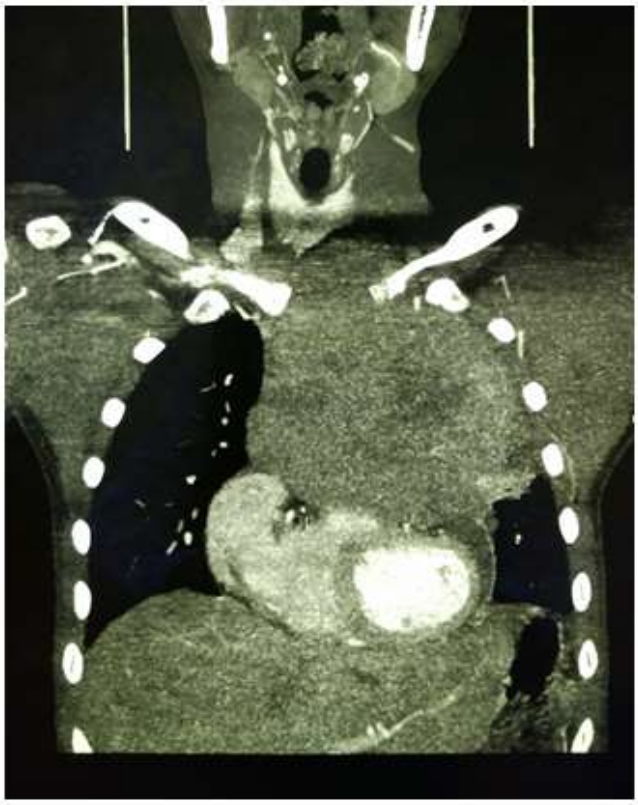

Fig2. Computed tomography scan showed that the obvious oppression on heart and great vessels (including the left pulmonary artery, left pulmonary vein, aorta and left and right ventricle)

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