Study on Lung Protection during General Thoracic Surgery

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Abstract: Lung protection has two concepts, broad and narrow. Narrow lung protection refers to the protection of donor lungs during lung transplantation or cardiopulmonary transplantation, so that it can still exert normal lung function after transplantation in the recipient. Generalized lung protection is the active prevention and treatment of lung injury caused by various reasons and impending, in order to maintain the patient's lung function and promote early recovery. Perioperative lung protection during surgery belongs to the category of broad lung protection. The lung is the only organ in the body that receives all cardiac output, and it is also a giant filter that the whole body venous blood must pass through. At the same time, the lung is also an open organ. This makes the lungs susceptible to damage from endogenous and exogenous harmful factors. Preoperative risk factors, surgery, anesthesia, blood transfusion, cardiopulmonary bypass, and other medical measures can cause certain damage to the lungs during the perioperative period. Various comorbidities of the lungs during the perioperative period occur. Threatening the safety of patients' lives. Therefore, perioperative lung protection measures are very important to prevent and treat perioperative pulmonary complications, which is a powerful guarantee for rapid recovery of surgical patients.

1. Introduction

"Quick rehabilitation surgery" refers to the application of various proven effective methods before, during and after surgery to reduce surgical stress and complications and accelerate the postoperative recovery of patients. It is a combination of a series of effective measures Collaborative results. Rapid rehabilitation surgery must be a multi-disciplinary collaborative process, including not only surgeons, anesthesiologists, rehabilitation therapists, nurses, but also the active participation of patients and their families. More importantly, rapid rehabilitation surgery relies on the synthesis and good integration of important perioperative treatment methods. For thoracic surgery, perioperative lung protection is the key to reducing postoperative pulmonary complications. In recent years, the Chinese Medical Association Thoracic and Cardiovascular Surgery Branch and the Chinese Medical Doctors Association Thoracic Surgeon Branch have organized perioperative management and rapid rehabilitation surgery academic exchanges. The following consensus is for your reference.

2. Common Pulmonary Complications and Related Risk Factors during Surgery

Postoperative pulmonary complications are an important part of the risk of thoracic surgery. During the perioperative period, the common pulmonary complications of patients include atelectasis, pulmonary edema, pneumonia, bronchitis, bronchospasm, respiratory failure and even ARDS, and aggravation of basic chronic lung disease. Studies have shown that the incidence of pulmonary complications after epigastric surgery is as high as 35%, of which pneumonia accounts for 16.6%, bronchitis accounts for 15%, atelectasis and pulmonary embolism each account for 1.7%. Postoperative pneumonia is usually hospital-acquired pneumonia, with a case fatality rate as high as 10% to 30%. Postoperative pulmonary complications lead to an average length of hospital stay of 1 to 2 weeks. When accompanied by respiratory diseases such as chronic obstructive pulmonary disease (COPD), the incidence of bronchospasm increases during the perioperative period. The incidence of bronchospasm in patients with a history of asthma is about 10%. The incidence of

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bronchospasm in patients undergoing chest and abdominal surgery is higher than that in other operations.

The main risk factors for pulmonary complications in patients during perioperative period include two aspects: patients' basic condition-related factors and surgery-related risk factors. Smoking: Smoking can cause disturbance of respiratory cilia swinging function and increased secretions. The test confirmed that the relative risk of lung complications of smokers was 1.4 to 4.3 times that of non-smokers. Even in patients without chronic lung disease, smoking can increase the risk of pulmonary complications. Quitting smoking for more than 8 weeks before surgery can reduce the incidence of postoperative complications. Poor overall health status: The American Society of Anesthesiologists' estimated condition classification (ASA classification) is an important predictor of postoperative pulmonary complications. The higher the ASA grade, the greater the risk of postoperative pulmonary complications. Preoperative malnutrition and low plasma protein lead to increased lung water, the probability of pulmonary comorbidities increased significantly. Basic lung disease: COPD is not an absolute contraindication to any thoracic surgery, but research has confirmed that COPD patients have an increased risk of postoperative pulmonary complications. Pulmonary function tests are the gold standard for the diagnosis of COPD. For patients with COPD who have not effectively improved symptoms and airflow limitation and exercise tolerance, they should be given active treatment before surgery; for patients undergoing elective surgery, if COPD is exacerbated, it should be Postponed surgery. Early studies have shown that the overall incidence of postoperative complications in asthma patients is higher than that in patients without asthma. Age: With the increase of age, the lung parenchyma changes, the fibrous connective tissue increases, the lung elasticity weakens, and the alveolar collapses, resulting in decreased lung compliance and increased respiratory resistance, which leads to decreased lung ventilation and ventilation function. Obesity: Obese patients have significantly reduced lung compliance and dysfunction of ventilation / blood flow in the supine position. At the same time, obese patients have thoracic kyphosis, lumbar lordosis, excessive intra-abdominal fat, and diaphragmatic elevation resulting in decreased thoracic cage and mobility Therefore, hypoxemia and hypercapnia are often present, and typical cases can be seen in patients with sleep apnea syndrome. Although obesity is often considered to increase the risk of pulmonary complications, most studies have not found an internal link between the two.

Risk factors related to surgery. Surgical site: Thoracic and upper abdominal surgery are the most important surgical-related risk factors. Studies have shown that the degree of impact of the surgical site on lung infection is: head> chest> upper abdomen> lower abdomen> other. Anesthesia: The type of anesthesia, the choice of drugs, and the method of operation are all risk factors associated with the operation. Under general anesthesia, endotracheal intubation can destroy the respiratory barrier and can even induce bronchospasm; the diaphragm lifts up, and the functional residual volume (FRC) decreases, which can lead to atelectasis; mechanical positive pressure ventilation can cause the negative pressure in the chest cavity to disappear, the physiological invalid cavity and Increased shunt, improper mechanical ventilation can cause pulmonary barotrauma, which is more common in mechanical ventilation with high tidal volume and high airway pressure; long-term inhalation of high concentrations of oxygen can cause lung insufficiency; inhalation of anesthetic drugs can weaken pulmonary hypoxic pulmonary vasoconstriction Response, change the ratio of ventilation / blood flow, reduce the alveolar surfactant, seriously affect the patient ’s intraoperative lung function, increase the incidence of postoperative pulmonary comorbidities; opioid analgesics (such as fentanyl, (Petidine hydrochloride, morphine hydrochloride, etc.) have an inhibitory effect on the respiratory center, especially in patients with D, JL; the residual effect of muscle relaxants can lead to reduced ventilation, affecting respiratory function; intravenous anesthetics on circulation and respiration The system has a certain inhibitory effect. Surgical operation: After the thoracotomy, the chest cavity was opened on the side, and the traction and expansion of the lungs caused by the negative pressure in the chest disappeared, resulting in atrophy of the alveoli, a sharp decrease in the alveolar ventilation area (even a reduction of about 50%), and increased resistance to pulmonary circulation. Injury to the chest wall, bronchus and lung tissue during the operation, resulting in weakened respiratory movement; excessive compression or stretching of lung tissue will damage

healthy lung tissue. Thoracotomy can limit the respiratory movement range due to chest wall softening, phrenic nerve injury, pleural effusion, pain, and excessive dressing, which can affect the patient's ventilation function and induce bronchospasm.

3. Strategies and Measures of Lung Protection during Operation

Before the operation, the medical history should be reviewed in detail, and the process of diagnosis and treatment should be understood. In particular, you should pay attention to the following points: (1) whether you have a long-term cough, the nature of the cough and the changes in day and night. (2) Understand the sputum situation, including sputum volume, sputum color, viscosity level, whether it is easy to cough, whether changing the position is helpful for sputum discharge; whether there is blood in the sputum, if there is hemoptysis, you should know the amount of hemoptysis. Know if there is a history of frequent coughing of yellow pus and odor. (3) The nature of dyspnea (inhalation, exhalation, mixedness), whether there is dyspnea at rest. If so, it indicates poor cardiopulmonary function compensation and poor tolerance to anesthesia and surgery. (4) Smoking history: For smokers, they should know their daily smoking volume, smoking years, and the time to stop smoking before surgery. (5) Disease inducing and relieving factors: such as whether asthma patients have specific allergens. (6) Treatment history: the application of antibiotics, bronchodilators and glucocorticoids, including specific dosage and usage, and the patient's response to drugs.

Detailed medical examination. Body shape and appearance: Patients with obesity and scoliosis are prone to atelectasis and hypoxemia due to decreased lung volume (FRC, total lung volume) and decreased lung compliance; patients with malnutrition and cachexia have respiratory muscle strength Weak, weakened immunity, easy to co-infection. Observe the lips and nail bed for cyanosis. Patients with COPD may have a barrel chest; if the chest wall is asymmetric, there may be pneumothorax, pleural effusion, or lung consolidation. Respiratory condition: Respiratory frequency> 25b ~ / min is the early manifestation of respiratory failure; expiratory effort suggests airway obstruction; as the diaphragm and intercostal muscle load increases, the role of auxiliary respiratory muscles increases; abnormal breathing indicates diaphragmatic paralysis or Severe dysfunction. Chest auscultation: Special emphasis should be placed on the importance of chest auscultation. In patients with obstructive pulmonary disease, the expiratory phase is prolonged, and the breath sounds are low; when the sputum is retained, a rough wet sound can be heard, the position is not fixed, and it can disappear after coughing. If the chirp is fixed, it may be bronchiectasis or lung abscess. Those with small airway spasm can hear wheezing sounds of higher pitch, seen in patients with asthma or chronic asthmatic bronchitis. Lung percussion: those with emphysema showed unvoiced sounds on percussion; those with lung consolidation showed dullness on percussion. Others: Patients with pulmonary hypertension, pulmonary heart disease, and right heart insufficiency may have jugular vein engorgement, liver-neck reflux sign (+), and second heart sound splitting may be heard on heart auscultation.

Preoperative lung function evaluation. Pulmonary function test helps to understand the nature and severity of lung diseases and whether the lesions are reversible, it can predict the efficacy of surgery and the occurrence of postoperative pulmonary complications, and help the choice of chest surgery type and scope of surgery. For patients undergoing thoracotomy and non-thoracotomy patients who are> 60 years old, have lung disease, and have a history of smoking, routine lung function tests are required.

Intraoperative management. Shorten the time of anesthesia and surgery: choose incisions (such as transverse incisions) with a small impact on the strength of the abdominal muscles and light postoperative pain, and simple and practical surgical procedures. Surgical operation promotes minimally invasive: anesthesia intubation should be as noninvasive as possible. Surgery should protect lung tissue as much as possible, avoid excessive pulling, squeezing and twisting of lung tissue, and hemostasis should be stopped during the operation. When lung cancer patients undergo lung resection, they must abide by two principles: removing tumors to the greatest extent and retaining lung tissue to the greatest extent. Thoracic integrity should be ensured, especially when

dealing with severe chest trauma and chest tumors and massive removal of chest wall tissue. To protect the integrity of the recurrent laryngeal nerve and glottis, bilateral recurrent laryngeal nerve injury will cause serious consequences. Protect the integrity of the phrenic nerve and diaphragm; prevent phrenic nerve injury and diaphragmatic hernia. Timely detection and management of tension pneumothorax and related postoperative complications of thoracic surgery (such as hemothorax, chylothorax, pulmonary embolism, etc.). Ensure airway patency and maintain adequate ventilation: to ensure airway patency is the most important part of chest surgery anesthesia, so as to achieve sufficient oxygen supply and good CO: discharge. But PaCO should be avoided: long-term <35lnlnHg, otherwise it may cause cerebral vasospasm and insufficient blood supply. Maintain circulatory stability: avoid excessively high or low blood pressure, prevent arrhythmia, and promptly correct in case of shock. Standardize intraoperative infusion: ensure at least two venous pathways: one pathway can quickly transfuse blood transfusion; one pathway can monitor central venous pressure and give cardiovascular active drugs.

4. Conclusion

This article discusses the new concept and new measures of lung protection during perioperative period, and integrates it more closely with the concept of accelerated rehabilitation. Accelerating rehabilitation requires an organic integration of a series of effective measures. It is a multi-disciplinary collaborative process. In addition to physicians, anesthesiologists, rehabilitation therapists and nursing staff, it also includes the active participation of patients and their families. For thoracic surgery, perioperative lung protection is a key measure to reduce postoperative pulmonary complications.

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