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RESEARCH ARTICLE

Surgical Therapies of the COPD

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Abstract

The chronic obstructive pulmonary disease (COPD) includes specific details with chronic bronchitis and emphysematous pneumonic pathology. There are also asthma characteristic lesions that produce "chronic asthmatic bronchitis". The main reason for this case, is smoking. The pathoanatomical abnormalities in COPD lead to disturbances in the ventilation/perfusion (v/q) ratio, leading to respiratory failure and hypoxemia. Furthermore, as the lungs over expand, respiratory remodeling leads to hypoventilation and respiratory failure II and hypercapnia. The treatment consists of medicines that are inhaled or taken from the body. In severe COPD cases where conventional therapeutic interventions have failed, satisfactory results are often achieved using novel intervention techniques. These are a) Bronchoscopic Thurmol Vapor Ablation (BTBA), b) Lung Volume Reduction Surgery (LVRS), c) Targeted Lung Conservation (TLD), d) Stem Cell Therapy, e) Lung Transplantation.

1. Introduction

The chronic obstructive pulmonary disease (COPD) is a heterogeneous group of diseases, which share the common feature of persistent airflow reduction. It is caused by the action of various causes, the most important being smoking, which damages the lungs through many but also well-defined mechanisms.

At this point it should be mentioned that the role of free radicals produced by smoking is very important. The COPD is characterized by narrowing of the airways (bronchus,bronchioles) due to bronchitis and damage to the lung parenchyma by emphysema. The coexistence of chronic bronchitis and emphysema lesions is the disease classification unit of COPD. These lesions disrupt the V/Q ventilation/perfusion relationship, leading to hypoxemia and lung dilatation, and in advanced stages hypercapnia and respiratory acidosis. The classic classification of COPD is Mild, Moderate and Severe - it is done based on the value of FEV-1, the volume of air exhaled in the first second of a deep and vigorous exhalation. COPD is mild if FEV-1 is 60-79% of expected. If it is 40-59% of the expected COPD, it is classified as moderate, and if the FEV-1 is less than 40% of the expected COPD, it is classified as severe. Of course, there are other, more complex situations. However, what is described is satisfactory. Treatment is adjusted according to the severity of COPD. When mechanisms of "bronchial asthma" co-exist in COPD, this fact must be considered both in relation to disease severity and treatment. What does COPD treatment involve?

1. Stop smoking. This is the most interesting intervention
2. Inhaled medications and tablets to support respiratory function
3. Pulmonary resuscitation, improving respiratory function and respiratory muscles

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4. Appropriate diet
5. Surgical treatment

2. Smoking Cessation

It is the most important factor to prevent the occurrence and development of diseases. If interruption occurs early, the disease course is interrupted before airway inflammation develops (1). If disruption occurs later, the outcome is less favorable than if inflammation persists (2, 3). However, it must be emphasized that smoking cessation at any age reduces mortality from the disease (4). Guidance on smoking cessation (5) includes consultation with a pulmonologist and medication support at a 'smoking cessation clinic'. Pharmacological support includes nicotine patches or "nicotine gum". Administration of bupropion, nortriptyline and clonidine (5) was also the last intervention. Likewise, in addition to smoking, other attractive factors should be avoided, such as: B. Exposure to toxic dusts, particles and gases that are characteristic of environmental or occupational pollution (6). Influenza and pneumococcal vaccinations reduce mortality (7,8)

3. Inhalation or other Drugs

Many COPD patients experience improvements in dyspnea and fatigue tolerance with bronchodilators (9). Bronchodilators are long-acting and double-acting drugs. The same applies to anticholinergic drugs, which are also short- or long-acting (10, 11, 12, 13, 14). Bronchodilators are administered through a special device (inhaler) (15). These drugs are received every 6 hours, or every 12 hours, or every 24 hours, whichever comes later.

3.1 Methyloxanthines

Theoyline is the only one used in COPD. It has a moderate bronchodilation effect (16). However, it has anti-inflammatory effects as well as cardiotonic and diuretic effects (17, 18). We often use bronchodilators in combination (β2-agonists + anticholinergics) (19).

3.2 Corticosteroids

Administered in inhaled or tablet form or by intravenous infusion. Corticosteroid use appears to help in 10-15% of patients with COPD (20-23). Some formulations contain an inhaled bronchodilator and an inhaled corticosteroid in inhaled form (24).

3.3 Mucolytics

The COPD causes hypersecretion of bronchial secretions, exceeding 100 mL/day. In these cases, irritating substances (cigarettes or other toxic substances) should not be inhaled. Acetylo cysteine is commonly used as an expectorant in Europe (25). But it also has antioxidant properties. Expectorants: Administration of beta2 agonists and theophylline improves mucociliary clearance and aids expectoration (26).

3.4 Mucus Production Inhibitors

Growth factor receptor inhibitors seem to decrease mucus production. Drainage physiotherapy: If the secretion exceeds 30ml/day, it should be drained at an appropriate drainage point. Inhaled beta2-stimulants should be given before (20-30 minutes) intervention by the physiotherapist (27, 28, 29).

3.5 Continuous Oxygen Therapy

Continuous oxygen therapy must be administered to patients in whom hypoxemia is observed due to V/Q disturbances. The daily duration is 12 or 17 hours/day. In severe cases, 24-hour administration is preferred. If hypoxemia occurs only during sleep, give O2 during sleep. For hypoxemia during exhaustion, administer O2 during daily activities using portable O2 concentrators (30, 31, 32, 33).

4. Pulmonary Resuscitation

Trying to get the best out of the patient. That's why it's considered an important help for patients with severe COPD. Benefits to patients are improved quality of life, shorter hospital stays, and improved physical function (34). However, FEV-1 usually does not improve. Interestingly, despite no improvement in airflow, resuscitation had a much greater health impact than medical therapy (35).

The patient trains the muscles in general, but also trains the respiratory muscles in particular. As with all training programs, results are lost at the end of the program. Continuing with the program is the main reason for maintaining results.

Patients whose arterial O2 partial pressure drops during exercise should be given O2. Hb saturation below 88% during exercise indicates oxygen therapy (36). Administration of bronchodilators appears to improve exercise capacity.

Loosing weight also seems to help (37). At home, it makes sense to train the respiratory muscles using equipment that increases the required inspiratory and expiratory pressures at exercise. Ideally, the duration should be 30 minutes/day.

This improves respiratory muscle function and reduces long-distance shortness of breath in asthma (38, 39).

Importantly, 50% of patients do not complete the rehabilitation program. Even among those patients who completed the program, the results disappeared within a few months of stopping exercise. It is fun to practice having the patient open their lips and exhale. Gains include reduced respiratory rate, increased tidal volume (Tv), and reduced alveolar air trapping. On exhalation (40, 41, 42). PO2 is also sometimes elevated (43). Practicing diaphragmatic breathing appears to help (44).

4.1 Appropriate Diet

Some patients with severe COPD with predominantly emphysematous lesions lost significant weight, and some exhibited cachexia (45). These patients exhibit decreased muscle mass.

These patients exhibit decreased muscle mass. The reasons for this are manifold (46, 47). 15-20% increased energy requirement while stationary (48, 49). The main effect of weight loss is to weaken the inspiratory and expiratory muscles (50).

This fact affects the prognosis of the disease and its behavior. Improved nutrition can improve the condition of the respiratory muscles, as well as other muscles. This improvement is manifested in weight gain (51, 52).

Unfortunately, gaining weight is difficult and requires serious effort. Use of anabolic androgens improves muscle strength and increases body weight (53, 54). In contrast, there are insufficient data to support the routine administration of these agents.

4.2 Antibiotics

Less than 50% of the COPD are caused by bacterial infection with pyogenic organisms that normally colonize the bronchial tree. bacteria as Streptococcus pneumoniae and Moraxella catarrhalis (56). During an attack, the number of microorganisms in patients' bronchial secretions is higher compared to the number of microorganisms during the interval between attacks (57).

Cultures of bronchial secretions provide information on the type of microorganisms, but not on the number of these microorganisms (58). If the patient develops shortness of breath, cough, and purulent sputum, this is an indication for antibiotics (59, 60).

Typically, 7–10 days of trimethoprim/sulfamethoxasol, ampicillin, and tetracycline are effective. If this empiric treatment fails, bronchoscopy is performed, during which, under abstinent conditions, bronchial secretions are collected, cultures and antibiotic profiles are performed to isolate responsible microorganisms and determine their precise susceptibility to antibiotics.

5. Recent Treatment of COPD

In some cases, especially in severe COPD, conventional treatment does not lead to satisfactory results and does not ensure a satisfactory quality of life for the patient. In these cases, invasive treatments are available such as:

1) Bronchoscopic Thermal Vapor Ablation (BTVA), which involves blocking the bronchi with "boiled" sterile water. Using this method, endoscopic lung volume reduction (ELVR), or lung volume reduction, is performed. Endoscopic steam delivery induces an inflammatory response in the irregular bronchi leading to their obstruction. This reduces the volume of the lung, as the proper lung parenchyma is selected, while the healthy lung is overstretched. This method is suitable for patients with emphysema mainly located in the upper lobe, or FEV-1 between 20-45%, and residual volume (RV) >_20% expected value. Preoperatively, it is necessary to accurately determine that the bronchi of the corresponding lung segment must be closed. The surgery is performed under general anesthesia or hypnosis. After surgery, the patient must be monitored because the inflammatory response induced by the superheated steam initially aggravates the patient's symptoms and general condition (61, 62, 63, 64, 65, 66, 67, 68, 69, 70). The equipment needed are: a bronchoscope, a steam generator, and a balloon-terminated catheter with which we close the segmental bronchi that deliver the steam. Balloons should be inflated for at least 8 minutes. This process can then be repeated for the next segment of the cycle.

These patients were treated with corticosteroids and broad-spectrum antibiotics over 14 days to avoid bacterial infections that could complicate the patient's condition. Possible complications are: a) exacerbation of COPD, b) pneumonia, (66), c) hemoptysis (63, 66), d) bronchopneumonia, and e) pneumothorax (66).

6. Surgery to Reduce Lung Volume Lung Volume Reduction Surgery (Lvrs)

This is achieved through surgical techniques that remove large amounts of emphysematous tissue. It appears that this surgical technique helps improve respiratory capacity, vital capacity, and overall quality of life in selected patients (71, 72).

The procedure reduces the size of an overextended emphysematous lung, thus enlarging the remaining healthy lung parenchyma. The LVRS surgical technique is used in patients with severe emphysema, severe dyspnea, and signs of severe air trapping in the alveoli (73). The effectiveness of surgery depends on the location and extent of the emphysematous lesion, as well as on the patient's ability to recover. And his ability to cope with the inconvenience of surgery. According to the National Emphysema Treatment Trial (NETT), 4 patient groups with different risks and benefits of LVRS have been defined.

Group 1: Predominantly upper lobe emphysema, barely beyond surgery.

Group 2: Also, this group showed upper lobe emphysematous lesions but had a high fatigue capacity. This group appeared to respond better to surgery than to drugs.

Group 3: Somatic injury and low recovery characterized by diffuse emphysema. This group had similar expected survival rates regardless of whether they were undergoing surgery or taking medications.

Group 4: Characterized by diffuse lesions and high exercise capacity. This group had a shorter survival time after surgery compared with medical treatment (73).

In LVRS surgery, 30% of the lung parenchyma is resected from each lung. This makes the lungs smaller and work better. The ventilation/perfusion V/Q ratio is also improved. LVRS is performed after sternotomy or thoracoscopically.

In sternotomy, tissue from both lungs is removed simultaneously during thoracoscopic examination, and 3-5 holes are made in the intercostal space and in both ribcages. A thoracoscope was inserted and diffuse lesions were removed from both lungs (73).

Before surgery, patients should undergo a detailed examination including: chest radiograph, spirometry, plethysmography, diffusion capacity measurement (DLCO), blood gas measurements (PaO2 and PaCO2), electrocardiogram (ECG), six minutes walking test (6MWT), and cardiorespiratory fatigue.

The risks of surgery are pneumothorax, pneumonia, heart attack, bleeding and death. Lung volume reduction (LVR) is also carried out through bronchoscopy, and a special valve is placed in the pre-selected bronchi to block, so that the emphysema area can be satisfactorily expanded, and the healthy area can be expanded.

This improves ventilation perfusion, V/Q ratio, and arterial blood gases (74, 75, 76). Therefore, electrodes are used to disrupt the branches of the vagus nerve. The vagus nerve is known to cause contraction of the respiratory muscles and narrowing of the airways, but also increases mucus secretion, which exacerbates narrowing and obstruction of the airways. In COPD patients, the vagus nerve is often overactive, leading to bronchospasm and excess mucus production, causing symptoms such as coughing, shortness of breath, wheezing, and lung heaviness.

By using the methods described above, patients' symptoms and quality of life appear to improve. The beneficial effects are also believed to reduce the need for long-term use of anticholinergic drugs, and the procedure is simple and painless for the patient, taking about an hour.

The bronchoscope is inserted into the bronchi corresponding to the branch of the vagus nerve that we want to destroy. After the bronchoscope is in the correct position, an electrode is inserted through which a current is passed, causing heating to disrupt the adjacent space, which must be 10-12 mm away from the electrode.

7. Stem Cell Therapy (SCT)

Stem cells have the unique ability to develop into any cell in the body through the process of differentiation. They are given intravenously and "find" damaged tissue in various organs. When given to patients with COPD, the stem cells can repair damaged lungs. In addition, stem cells display anti-inflammatory properties, thus "cleaning" the airways and suppressing inflammation.

According to a study by the American Lung Institute. It appears that 82% of treated patients experienced significant improvements in quality of life, breathing capacity, and walking ability (73). It appears that this approach works better with patients who need ventilators or lung transplants.

The treatment appeared to be safe, with no toxic effects or deaths occurring. Stem cell administration, even without HLA compatibility, appears to be effective. Treatment costs $25,000 and is not covered by insurance (78, 79, 80).

8. Lung Transplantation

For some people with severe COPD, lung transplantation may help when drugs and other treatments have not worked. Surgery has risks, such

as graft rejection and long recovery times from surgery (81). The University of California and the University of San Francisco propose the following criteria for selecting patients for lung transplantation.

i. The age of bilateral transplantation is under 60 years old, and the age of unilateral transplantation is under 65 years old

ii. The estimated survival time is at least 18-24 months.

iii. No other serious diseases.

iv. History upon specific drug tolerance.

v. Emotional stabilization and perception of quality of life after lung transplantation (82). The risks of transplantation are: 1) Bleeding 2) Airway obstruction 3) infection 4) pulmonary vein obstruction 5) Pulmonary edema

vi. Pulmonary embolism

vii. Transplant rejection (83)

After the transplantion, immunosuppressive drugs are given. The patient was transferred to the ER, several hours a day. Pain medication is also given. After leaving the ER, perform pulmonary resuscitation procedures. Attempt to mobilize immediately to prevent pulmonary embolism. After discharge, frequent visits to the post-transplant clinic were followed by a 2-day hospital stay for complete respiratory control (54). If all goes well, survival can range from 5 to 6 years (84).

9. Conclusion

1. COPD is a multifactorial disease
2. Drugs adapted to the severity of the disease usually yield satisfactory results.
3. When drugs are ineffective, invasive treatment can be used for special populations, mainly critically ill patients.
4. Smoking cessation is the mainstay of treatment.

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