ATAR Human Biology

Task 3: Lung Diseases and Treatments

Diseases: Cystic Fibrosis & Pneumonia

Cystic Fibrosis:

Cystic fibrosis (CF) is a progressive inherited disorder that damages the lungs and digestive system. CF affects the cells involved in producing mucus, a substances which is essential for bodily functions, as it acts as a layer of protection and moister in keeping the vital organs from drying out. Mucus should normally be thin and slippery, however those with the disorder show to have their consistency to be thick and sticky. Resulting in blockage of the tubes and passageways throughout their body, especially within the lungs and pancreas. Over time the patient's airways build up with the thick and sticky mucus making it harder for them to breath, leading to infections as the germs are trapped within the mucus.

Cystic Fibrosis Causes:

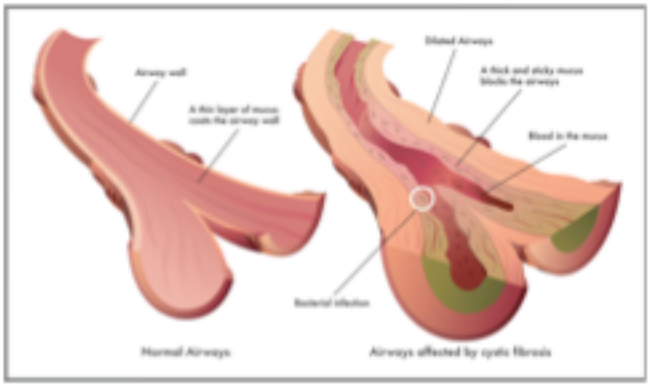
Cystic fibrosis is caused by a mutation in the cystic fibrosis transmembrane conductance regulator (CFTR) gene. With the mutations in the CFTR gene causing the CFTR protein to not function properly, as it changes the protein that controls the flow of the salt in and out of the cells. Resulting in a thick and sticky mucus (as mentioned above) in the respiratory, digestive and reproductive systems, as well as an increase of salt in sweat.

For an individual to have cystic fibrosis they must inherit one copy of the gene from each parent, as it is classified as an inherited disorder. However, if an individual only inherits one copy they will not develop cystic fibrosis. Instead they will be classified as a carrier of the disorder, with the possibility of passing it down onto their own children.

Cystic Fibrosis Diagnosis:

To diagnose cystic fibrosis it requires symptoms linked with the disorder which is prevalent in at least one organ system, and evidence of CFTR mutation in the CFTR. Additionally, other diagnostic tests that can be conducted include: immunoreactive trypsinogen (IRT), sweat chloride test, sputum test, chest x-ray, CT scan and pulmonary function tests (PFTs).

Cystic Fibrosis Symptoms:



- trouble with bowel movements
- foul smelling, greasy stools
- wheezing and trouble breathing
- persistent cough - produces thick mucus (sputum)
- frequent lung infections
- exercise intolerance
- inflamed nasal passages
- recurrent sinusitis
- infertility (high in men)
- poor weight gain and growth
- intestinal blockage, particularly in newborns (meconium ileum)
- chronic or severe constipation

Cystic Fibrosis Treatments:

Although there is no cure of cystic fibrosis, advances in treatment and medications help ease symptoms, decrease complications and overall improve the quality of life for those who have been diagnosed. Commonly the treatments focus on the clearance of the airway, while the medication targets in improving the function of the faulty CFTR protein and preventing complications. Additionally, surgery is also an option for those who require.

Treatment - Physical Therapy:

- **Autogenic Drainage:** Patient breaths out hard, similar to a huff, moving the mucus from the smaller airways towards the central airways, making it easier for the patient to cough out the mucus.
- **Active Cycle of Breathing**: Patient breaths in deeply, holding it in and then releasing by huffing for various lengths of time. This allows the patient to clear their mucus and decrease airway blockages as the technique controls their breathing and relaxes their shoulders and upper chest.

Treatment - Surgical Procedures:

- **Bowel Surgery:** May be performed to relieve blockage in the bowels and involves the extraction of a section of the bowel.
- **Feeding Tube:** CF can interfere with digestion and absorption of food nutrients. In a result a feeding tube is passed through the nose or stomach (surgically inserted) to supply nutrients and help improve the interference caused by the disease.
- **Double-Lung Transplant:** A procedure which can improve the overall length and quality of a patient's life, if typical treatment alone can not maintain physical function and the health of the lung.

Treatment - Medication:

- **Antibiotics:** May receive in pills, inhaler or a shot to prevent or treat infections at the lungs.
- **Anti-inflammatory Medicines:** Ibuprofen and corticosteroids.
- **Bronchodilators:** In the form of an inhaler to relax the muscles in the lungs and widen the airways (bronchi).
- **Mucus thinner (e.g. Guaifenesin):** Thins out the mucus in the airways, allowing for the patient to cough it out of the lungs.
- **CFTR Modulators:** Drugs that target the underlying defect in the CFTR protein.
- **Combination Therapy:** Combines three CFTR modulators to target the CFTR protein allowing it to function efficiently.

Treatment - Airway Clearance Techniques:

- **Chest Therapy or Persuasion:** Clears the mucus from a patients lungs by having someone with cupped hands clap on the patient's front and back of the chest.
- **Oscillating Devices**: A patients breaths through a device that oscillates or vibrates their airways, loosening the mucus and making it easier for the patient to cough it up.

Cystic Fibrosis Preventions:

Cystic fibrosis can not be prevented as it is caused by faulty genes, simply meaning there is nothing that can be done to prevent it. However, it is highly recommended that genetic testings should be performed for those who have cystic fibrosis or are carries of the disease from relatives. The genetic testings can determine a the patient's child's risk level for CF, as with the proper treatments, as stated above, from early childhood can help ease the systems, decrease complications and improve quality of life for the child.

Pneumonia Causes:

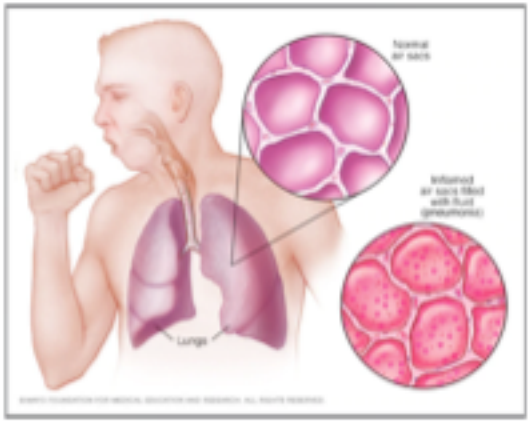
There are various types of infectious agents which can cause pneumonia, such as viruses, bacteria and fungi. Bacterial pneumonia can be caused by mycoplasma pneumonia, haemophilia influenza and legionella pneumophila with the most common cause being streptococcus pneumonia. While for viral pneumonia, respiratory viruses are commonly the main cause with examples being influenza (flu), respiratory syncytial virus (RSV) and rhinoviruses (common cold). Additionally, fungal pneumonia can be caused by fungi from soil or bird droppings as it is mostly common with people who are found to have a weakened immune system. Examples of fungi that cause fungal pneumonia include pneumocystis jirovecii, cryptococcus neoformans and histoplasmosis species.

Pneumonia Diagnosis:

A doctor will begin by questioning the individual's medical history and conducting a physical exam, using a stethoscope. The purpose is to listen to the lungs and check for pneumonia symptoms, such as abnormal bubbling or crackling sounds. If pneumonia is suspected, the doctor may recommend the following tests: blood tests, chest x-rays, pulse oximetry, sputum test, CT scan and pleural fluid culture.

Pneumonia Symptoms:

- coughing, may produce greenish, yellow phlegm or even bloody mucus
- fever, sweating and shaking chills
- shortness of breath
- rapid, shallow breathing
- sharp or stabbing chest pains, worsen when breathing deeply or when coughing
- loss of appetite, low energy and fatigue
- nausea and vomiting, prevalent in small children
- confusion, common in older individuals
- headaches



Pneumonia Treatment:

Treatments can vary depending on the type of pneumonia an individual has, the severity level and the general health of the individual. Prescription medications may be prescribed from a doctor to help treat the infection, with oral antibiotics treating most cases of bacterial pneumonia. While most cases of viral pneumonia can be treated on their own with at home care, such as over the counter (OTC) medication to help relieve pain and fever. These may include aspirin, ibuprofen (Advil, Motrin) and acetaminophen (Tylenol). However, a doctor may still prescribe antiviral, as antibiotic medications do not work on viruses. Additionally, anti fungal medications are used to help treat fungal pneumonia. Although for this to take in effect the individual must take the medication for several weeks to clear the infection.

Pneumonia Prevention:

- receive flu vaccine yearly
- receive PCV13 (Prevnar 13) if you are:
  - people aged 65 or older
  - children aged 5 and under
- receive PPSV23 (Pneumovax) if you are:
  - people aged 65 or older
  - children older than 2 who are in high risk of bacterial pneumonia
  - people between 19 - 64 who smoke or have asthma
- practice good hygiene
- exercise
- do not smoke

- eat a balanced diet
- exercise regularly
- wash hands thoroughly and regularly
- receive enough sleep
- quit smoking

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