Narrative Review Article: An Overview of The Anatomy and Physiology of Respiration

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ABSTRACT

The respiratory system has two parts, upper and lower, which are responsible for ventilation (air passage from inside to outside and vice versa). The upper airways include the nostrils, sinuses, tonsils and adenoids, the larynx and trachea, and the lower respiratory tract includes the lungs (bronchial branches and alveoli). On each side of the nose are three separate airways called tentacles. These tentacles heat and humidity and filter the incoming air. Mucus secretions are constantly flowing in the nasal cavities, causing it to become moist. These secretions are secreted from goblet cells of the nose and are constantly flowing to the throat by ciliated bodies. The olfactory neurotransmitters are located in the nasal membrane. The sinuses around the nose are four pairs of bony cavities made up of epithelial tissue and mucus-secreting glands that drain their mucus secretions into the nasal cavity. These sinuses are: frontal sinuses (forehead), ethmoidal sinuses (perineum of the eye), sphenoidal sinuses (butterfly), maxillary sinuses (cheek). The throat is divided into three parts: the nasopharynx (nasopharynx), the oropharynx (rural throat) and the laryngopharynx (larynx). The larynx is made up of 9 cartilages: 3 large epiglottis, thyroid, cricoid and 3 small paired cartilages. The most important function of the larynx is to produce sound, and its other role is to pass air through the upper to lower system. It also prevents foreign objects from entering the bottom by creating a cough reflex. Thyroid cartilage is the largest laryngeal cartilage. Arytenoid cartilage, along with thyroid cartilage, is involved in moving the vocal cords. The trachea has a C-shaped or semi-annular cartilage tissue, and the posterior part, which is adjacent to the esophagus, has muscle tissue.

Introduction

The process of gas exchange between the atmosphere and the blood (external respiration) [1-3]and between the blood and the cells of the body [4-6](internal respiration) is generally called respiration. Resistance of the airways and lung capacity during inhalation (negative chest pressure [7-9] and decrease relative to the atmosphere) and as a result air enters the respiratory system and the opposite happens when exhaling [10-12]. Any factor that reduces airway diameter increases airway resistance

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and, as a result, impairs ventilation (such as airway smooth muscle contraction in asthma, thickening of bronchial mucus in chronic bronchitis, airway obstruction by discharge, tumor, or Foreign body and loss of elasticity of the lungs in emphysema) [13-15]. Capacity (comfort) means the degree of comfort in lung expansion and indicates the relationship between lung volume and pressure [16-18]. Diseases such as emphysema, in which the elastic structure of the alveolar wall is damaged, cause the lungs to relax and increase lung compliance [19-21]. Relatively less pressure is required to achieve the same volume of air during inhalation, but passive exhalation is impaired [22-25]. In contrast, diseases that cause fibrosis of the lungs cause the lungs to tighten and the lungs to receive less [26-28]. Tightened lungs require high inspiratory pressure to achieve the specified volume of gas. Alveolar surface pressure also affects lung compliance [29-31]. The secretion of surfactant by alveolar cells reduces surface tension and thus increases compliance [32-35]. The pleura is the serous mucous membrane that covers the visceral layer of the lungs and the gaps between the lobes of the lungs [36-38]. The chest is made up of 12 pairs. The first seven pairs are attached to the sternum by cartilage [39-41]. The next three gears the false gears are connected to each other by rib cartilage. Gears 11 and 12 are not connected to the sternum [42-46]. Nerve delivery to the diaphragm (phrenic nerve) is through the third cervical spine, so spinal injuries at the level of the third cervical vertebra and above impair ventilation. Diffusion is the process by which a gas exchange takes place between oxygen and CO2 [47-49], for which there is a level of air and blood. Pulmonary perfusion is called pulmonary blood flow. Naturally [50-52], about 2% of the blood that is pumped from the right ventricle to the lungs can reach the alveolar capillaries, causing a dark blood shunt to the left ventricle [53-55], which returns to the left heart without oxygenation. This low pressure increases the blood's absorption capacity. When standing, the force of gravity causes the apex of the lungs to have less blood flow [59-61]. Perfusion is also affected by alveolar pressure. Any factor that increases the pressure inside the alveoli can block the capillaries around the alveoli [62-65]. The adequacy of gas exchange depends on the balance of perfusion and ventilation. Ventilation is the entry and exit of air into and out of the lungs [66-68]. There are four conditions regarding the ratio of the lungs:

- ✓ Normal [69];
- ✓ Decrease ratio (shunt) [70];
- ✓ Increase ratio (dead space) [71];
- ✓ Lack of ventilation and blood supply (the unit of shutdown of any factor that obstructs the airways such as atelectasis, tumor, accumulation of secretions) causes shunting, ie blood returns to the left ventricle without oxygenation [72].

Acute respiratory failure

The most common and thoracic and abdominal surgeries are the most common causes of shunting. A shunt of more than 20% causes severe hypoxia [73-75]. Disorders such as pulmonary embolism and pulmonary infarction, which reduce blood flow, cause a dead space. The off unit occurs when there is no ventilation and no blood flow [76-78]. This condition is mainly found in pneumothorax and acute respiratory failure syndrome. Lung function can be measured by measuring lung volumes and capacities [79-81].

Neurological control of respiration

Breathing in the normal state of rest is done as a result of the respiratory muscles stimulating the phrenic nerve [82-85]. The rhythm of respiration is controlled by the respiratory center in the brain, which is located in the medulla and pons [86].

There are two main centers of respiration in Medulla:

A) Abdominal: which holds the tail and open neurons [87].

B) Dorsal: which has only demyelinated neurons [88].

Resting breathing does not require VRG. Messages coming from DRG take about 2 seconds. So the patient's tail lasts 2 seconds, then rests for 3 seconds. Therefore, the patient's exhalation time is 3 seconds. The patient does not need a brain bridge for normal breathing [89-91].

The apnostal center in the lower part of the pons stimulates the respiratory center in the medulla and stimulates a deep, long tail. The pneumotaxic center above the pons also controls the pattern of breathing and allows breathing and speech to occur simultaneously. This center accelerates tail shutdown. Numerous groups of receptors help control the brain's ability to breathe [92-95]. The central chemoreceptors in the medulla respond to chemical changes in the CSF, which is the result of chemical changes in the blood. These chemoreceptors react to increase or decrease CO2 and pH and send messages to the lungs to change the depth and number of breaths. Peripheral chemoreceptors in the aortic and carotid arcs are sensitive to minimal changes in PaCO2, followed by PaCO2 and pH. Muscle and joint receptors also respond to bodily movements (exercise) [96-98]. More ventilation is needed during exercise, so moving the joints within the ROM range can increase the number of breaths. Aortic and carotid body receptors also respond to an increase or decrease in paco2, increasing or decreasing ventilation [99-101]. Increased CO2 is a natural stimulus to increase ventilation. Decreased Pao2 can also stimulate ventilation, but only when it is less than 70 mm Hg. The cough reflex is a neural reflex that is stimulated by a mechanical stimulus. Inhalation of stimuli and mucus rapidly stimulates the traction receptors located in the carina and large bronchi, which eventually causes the gas to flow out with great intensity (coughing).

Oxygen is carried throughout the body in three ways:

- ✓ Combined with water in the form of carbonic acid (70%).
- ✓ Connected to hemoglobin.
- ✓ Dissolved in plasma.

In the lungs, H2CO3 is converted to carbon dioxide by the enzyme carbonic anhydrase. Thus, CO2 is excreted through exhalation, but re-binds in the blood and is converted to H and HCG. Respiratory system changes in old age Gradual changes in respiratory system function begin in middle age [102-104].

History and physical examination

The most important reason for these patients is shortness of breath (shortness and difficulty in breathing). Smoking (the most important factor) and exposure to secondhand smoke, family or genetic history, allergies and environmental pollution, and occupational exposure are among the most important risk factors for respiratory diseases. Sudden shortness of breath in a healthy person may indicate pneumothorax, airway obstruction, and ARDS. In a person after surgery, sudden shortness of breath can be due to a pulmonary embolism. Whistling is mainly caused by narrowing of the bronchi and airways. Shortness of breath with wheezing on exhalation occurs in COPD patients. Whistling in the tail and exhalation usually indicates asthma if there is no possible heart failure. Vocal breathing may be the result of airway obstruction with obstruction of the main bronchi (due to a tumor or foreign body) [105].

In inflammation of the trachea and larynx, a loud cough is heard. Inflammation of the tracheal surfaces causes a rusty cough (single cough). Cough with pleural pain, show pleural abnormalities or chest wall (muscular, skeletal involvement). Coughing at night may be due to

right heart failure called bronchial. Morning cough with sputum production may be a sign of bronchitis. Cough when the patient is lying on his back with sputum in the back of the throat and may have chronic sinusitis. If the cause of the cough is irritation and smoking cessation plans, it may be possible to improve the cough by consuming some warm liquid, as it has been caused by irritation of the throat. Acute cough is a cough that lasts less than three weeks and subacute cough is a cough that lasts 3-8 weeks. According to the American College of Chest, instead of cough relievers (such as cough syrup and cough drops), it is better than first-generation antihistamines to treat acute cough or upper respiratory tract cough syndrome, which is secondary to sinus and nasal diseases (due to Discharge from the back of the throat).

Excessive and purulent sputum (thick, yellow and green or red) or discolored is a sign of a bacterial infection. Sputum is low, mucous, and recurrent due to viral infections (eg in viral bronchitis). A gradual increase in sputum over a long period of time may indicate chronic bronchitis or atelectasis. Pink sputum can be caused by a tumor. Excessive, foamy, pink sputum, which often rises to the throat, can be a sign of pulmonary edema. Bad breath can be a sign of a lung abscess and bronchiectasis or a lung infection. In patients with sputum, they are encouraged to drink plenty of fluids and incense to reduce the amount of sputum that continues to drain. People who have sputum have anorexia due to the smell of sputum or the taste of sputum in the mouth. Therefore, the nurse should encourage them to maintain good oral hygiene. The patient's favorite foods should be provided. Eating a citrus juice before a meal changes the taste of the patient's mouth and makes him want to eat. Chest pain associated with lung disease is sharp, pungent (like stabbing), and intermittent, and may sometimes be referred as pain. For example, if it is felt in the neck, back, or abdomen, a late symptom of lung cancer is pain that may be vague and persistent (due to metastasis to the chest wall) or shooting into the mid-chest area with the spine. Pulmonary diseases do not always cause pain because the lungs and visceral pleura lack the sensory nerve. Therefore, pain is not felt, but the parietal pleura has a sensory nerve and will feel pain if there is inflammation and stretching of the lung membrane. Pleural pain is the penetration of a knife that occurs with each tail. The patient feels comfortable when he is on the affected and painful side, and the pain is reduced if the patient places his hand on the affected area and holds the chest steady. To reduce lung pain, it is better not to use narcotic analgesics, because it affects the respiratory center and cough. Local anesthesia (intercostal block) may be used to relieve severe pain. Whistling has a high tone and musical sound that is heard especially during exhalation and is caused by narrowing of the airways. The blood coming out of the reeds is bright, red and foamy with sputum and may be accompanied by a salty taste in the mouth and itchy throat. In pulmonary hemorrhage, the patient feels a bubble or burning sensation in the chest and sleeps towards the bleeding lung. Blood drawn from the lungs has an alkaline pH. Cyanosis occurs when about 5 mg / dl of hemoglobin in the blood lacks O2. In lung disease, central cyanosis is identified by examining the color of the tongue and lips, and this symptom indicates a decrease in arterial oxygen. Peripheral cyanosis occurs due to reduced blood flow to a specific area of the body, such as narrowing of the arteries due to the cold, and is not necessarily a sign of a central system problem. In clubbing, which is a sign of chronic hypoxia, the angle between the nail plate and the finger is more than 160 degrees. In the initial clubbing this smoke angle is 180 degrees and in the advanced clubbing it is more than 180 degrees. Shamroot method can be used to check the initial clubbing. In this way, the dorsal surface (nails) of the two index fingers are

placed opposite each other. Normally a small hole is made between two fingers. Trans-illumination test is used to examine the ethmoid and axillary sinuses. In a dark room, a pen flashlight is turned on and placed on the patient's ethmoid sinus. The nurse's other hand is placed on the person's eyebrows to prevent light from spreading. If the ethmoid sinuses are healthy, light radiation can be seen in the forehead. A flashlight is placed on the maxillary plateau and the patient is asked to open his mouth. If the maxillary sinus is healthy, the pour should be visible on the roof of the patient's mouth. Naturally, the ratio of posterior anterior diameter to lateral diameter is 12. In the barrel, the anterior diameter of the mood increases, and this condition occurs in emphysema. In the funnel chest, the lower part of the sternum is sunken, which is a place that puts pressure on the large heart and arteries, causing a murmur. Such conditions are seen in the softness of bones and the syndrome of marfan. Pigeon breasts are caused by displacement of the sternum, and congenital defects of the atrial or ventricular wall are the most common cause. Osteoporosis, Marfan syndrome and severe kyphoscoliosis are also seen. In kyphosis scoliosis, the scapula goes up and a problem develops in the spine. This deformity limits the dilation of the lungs. Hyperpnea is an increase in the depth of respiration due to the use of respiratory sub-muscles. In hyperventilation, the depth and number of breaths increases, which is called casmal breathing, which is mainly seen in kidney disorders or diabetes. In this type of breathing, respiratory alkalosis occurs. For this reason, it is recommended that the patient breathe in a plastic bag to re-breathe the CO2 from the exhalation [106].

Depth and number of breaths

Hyoventilation is the reduction of CO2 retention that leads to respiratory acidosis.

Shinstoke breathing is an abnormal breathing for 20 seconds in which apnea occurs and periods of deep breathing occur. In this breathing, the number and depth of the patient's breathing pattern vary. This respiration occurs in heart failure or central respiratory injuries (drug poisoning, tumors, brain injuries). Biot or cluster type breathing has different depth of breathing and variable periods of apnea. This type of breathing is seen with central nervous system disorders. Increased number and depth of respiration, called casmal, and respiration caused by diabetic ketoacidosis.

Apnea

Period of cessation of breathing, its time is different. Apnea can occur during a variety of respiratory disorders, such as sleep apnea. If the patient is not supported, life may be in danger. Regular periods in which the number and depth of breathing increase, then decrease to form a mirror (usually 20 seconds of apnea) [107].

Biot's respiration

Normal periods of breathing (3 to 2 breaths) followed by variable periods of apnea (10 seconds of apnea per minute). The protrusion of the intercostal spaces when exhaling indicates an obstruction to the outflow of air (such as emphysema). Asymmetric retraction in the intercostal spaces on the affected side occurs due to increased pressure in the inner part of the same side. This condition may be due to air buildup in the pleural cavity (pneumothorax) or increased fluid pressure in the pleura (pleural effusion). Muscle retraction between the ribs, especially when it occurs asymmetrically, is a sign of obstruction of the sub-branches of the bronchial tree. The palm is used to show deep lesions in the chest and the fingertips are used to touch wounds and subcutaneous masses. The sensation of sound and the resulting vibration in the chest wall that is felt by touch is called tactile

vibration. To create it, the patient is asked to repeat the number 99 with each movement of the examiner's hand on the chest. For this reason, in patients with emphysema, where air accumulates in the lungs, tactile vibration is reduced, but in cases such as pneumonia, tactile vibration is increased in the upper part of the affected lobe. In obese people, tactile vibration is less appreciated. If the tactile vibration test is abnormal, a speech resonance sound test is performed. During the hearing, when the client speaks normally and a vague and muffled voice is heard. The sound is loud in the middle of the chest on the large airways and is calmer towards the peripheral part. The presence of congestion in the lungs causes the sounds to be louder in hearing. Because density increases the transmission of sound vibration, bronchophony is the increase in the intensity and resolution of sound resonance. In this way, when the client repeats the number 99, the sound is heard clearer than normal. In the presence of bronchophony, the egophony is examined, which is a change in sound relative to the letter E, which indicates congestion in the lungs. When the client repeats the letter E, the sound is heard clearly and clearly. Whisperd pectori loquy is a condition in which the client whispers words 3, 2, and 1 and is heard on a perfectly clear surface. The thoracic percussion usually starts at the dorsal surface of the chest and requires the patient to be seated. The head is bent forward and the arms and hands are placed on either side of the legs. This position causes the shoulders to be spaced apart and more space is provided for examination. Resonance is the natural sound when knocking, but in cases such as COPD, the sound of hyperresonance is heard due to air trapped in the lungs. The drum is also used to check the expansion of the diaphragm. The client is asked to take a deep breath and hold it, while the back of the lungs is tapped. Note that the resonance sound changes to opaque and this part is marked automatically. This is then repeated on exhalation. Normally the distance between the two signs should be between 3-6 cm. In women, this length is shorter. This sign is on the right side of the chest because it is slightly higher than the normal sounds of breathing: vesicular, bronchovascular, bronchial and tracheal [108].

Periodic sputum testing may be necessary for patients taking antibiotics or corticosteroids and for patients taking long-term immunosuppressive drugs, as these substances suppress the symptoms of infection. Coughing and spitting out is a useful way to collect samples. The patient is instructed to clean their nose, throat and mouth so that the sputum is not contaminated with oral secretions and germs. Then take a few deep breaths, then cough and collect the sputum in a sterile container. If the patient is unable to expel the sputum himself, use a nebulizer, an aerosol with saturated saline, propylene glycol, or other materials, or use ultrasonic nebulizers. Otherwise, endotracheal aspiration is used. It is best to take a sputum sample early in the morning when the sputum has accumulated in the lungs overnight and should be sent to the lab within 2 hours. Because sputum stays in the environment for a long time, it causes the growth of microorganisms and their contamination in the hot air of the room.

Chest Xray

The lungs are usually photographed when inhaling, because the lungs have the maximum dilation and all parts are well visible. The diaphragm is also lowered and the lungs are better examined. In pneumothorax or large artery occlusion, a photograph is taken when exhaling.

Bronchoscopy

Strict bronchoscopy cannot be performed in the patient's bedside, but must be performed in the operating room. For bronchoscopy, the patient should fast for 6 hours. Prior to bronchoscopy,

atropine is commonly used to suppress vagal stimulation and cough reflex and relieve patient anxiety. Symptoms of vagal irritation include bradycardia, dysrhythmia, and decreased BP. You should keep in mind that prescribing painkillers to a patient with respiratory failure can cause respiratory arrest. In rigid bronchoscopy, a roll is placed under the patient's neck to extend the neck, but in fiber optic bronchoscopy, a pillow is placed under the patient's head and neck. Before doing so, the patient should not eat anything until the cough reflex returns through the mouth, as anesthetics, analgesics, and anesthesia affect the larynx and there is no swallowing reflex for several hours. Whenever the reflex cough reflex, the nurse can use ice cubes with fluids for the patient. Also, to prevent laryngeal edema, the patient is placed in a semi-sitting position. Patient control is important for increased pulse, hemoptysis, hypoxia, and decreased BP and dyspnea after bronchoscopy. If the patient has a sore throat, it can be treated with a normal saline gargle (after the gag reflex returns). Respiratory sounds should also be controlled within 24 hours. Thoracoscopy is a diagnostic procedure by which the pleural cavity is examined with an endoscope, and bronchography is the observation of the tracheobronchial tree using X-ray radiography after injecting an iodinated dye into the bronchi. It is commonly used to diagnose bronchiectasis. This test is not used in patients with severe cough or sputum. With flexible fiber-optic bronchoscopy, the use of this method is reduced, as it may affect lung function, so only one lung is examined at a time. Usually the only discomfort associated with this procedure is the patient's tendency to cough. The patient should be out of midnight the day before the NPO test and take complete oral hygiene measures (reducing the chance of bacteria entering the lungs). Dentures, glasses or contact lenses come out. Atropine and diazepam may be needed. The patient is instructed not to swallow the local anesthetic aspirated into his throat. Also try not to cough during the test, because the cough prevents the bronchioles from filling completely and the contrast material is removed before the test is completed. After the test, the patient is NPO until anesthesia is resolved and the gag reflex is established, and it usually takes about 2 hours. Positive drainage may be performed to drain the contrast agent. The patient is encouraged to steal. The patient is instructed that his or her body temperature will usually rise slightly 2-3 days after the test. Gargling with warm saline can relieve sore throat. Usually 2-4 hours after the test, the patient regains the ability to perform normal activities. In thoracoscopy, thoracentesis, biopsy, use of CO2 laser to evacuate air bubbles, and treatment of pneumothorax and treatment of peripheral lung nodules are possible. Care must be taken if a chest tube is implanted in the patient. Thoracentesis refers to the extraction of fluid from the pleural space, which can be diagnostic and therapeutic. The nurse should explain to the patient that he or she should remain immobile during the procedure. He may also feel pressured. The position of the patient is very important during thoracentesis.

In general, this method is possible in three situations:

- ✓ He sits on the edge of the bed with his arms and legs supported and the patient's head rests on a small pillow on the table below the bed (best position).
- ✓ The patient is placed in a chair upside down and his head and arms are placed on the back of the chair.
- ✓ If the patient cannot sit, he is placed sideways on the side where the test is not performed.

The patient should rest in bed and have a lung x-ray taken to control complications after thoracentesis (such as pneumothorax). Respiratory rate, symmetrical chest movement, dizziness, chest tightness, weakness and

fainting, cough, hemoptysis, bloody and foamy mucus, rapid pulse, and symptoms of hypoxemia should be evaluated.

Note: Thoracentesis, under ultrasonography, causes the least complications, and if fluid has accumulated in a part of the pleural cavity, ultrasound is the best way to determine where the thoracic needle enters. The second and third spaces between the ribs are in the clavicular midline. Because air accumulates in the upper parts, but fluid collects at the base of the lungs. Because the external pleura is so sensitive, local sensation should be performed before inserting the thoracic needle. Sudden chest or shoulder pain is a sign of stimulation of the visceral pleura and diaphragm with a needle. In acupuncture biopsy, when the needle reaches the pleura, the patient must hold his or her breath while exhaling. Slowly place your index finger or thumb on the created hole to prevent leakage of secretions around. It is important to record and report dyspnea, bleeding, or infection after a biopsy (such as bronchoscopy and thoracoscopy) [105-107].

The main method that stimulates the nasal mucosa can be allergic or non-allergic. The allergic type is classified in certain seasons of the year during the period of permanent plant pollination. Rhinitis is caused by factors such as environmental factors (temperature changes with humidity, odors with food), age changes, systemic diseases [108-110], medications (antihypertensive drugs, OCP and continued use of inhaled drops) and foreign body. Rhinorrhea, purulent discharge from the nose, itching of the nasal mucosa and upper palate and sneezing are symptoms of rhinitis. If the rhinitis is a viral cold, symptomatic treatment is given. If it is allergic, it is possible to be alone and identify the type of allergy [111]. Antihistamines are used to treat sneezing, itching, and rhinorrhea. In cases of severe congestion, intranasal corticosteroids may be used. Eye drops are also prescribed to relieve inflammation [112], redness of the eyes. Rinsing the nose with saline with an aerosol spray may soothe the patient, expel nasal secretions better, and reduce vision. When using nasal spray, make sure that the patient sits upright, the spray does not hit the nasal septum, there is a gap of one minute between the first and second puff [113].

The main and common problems of ICU patients

Many of the patients' problems are due to the body's response to the disease and the nature of the ICU environment. The main and common problems in intensive care patients include airway maintenance, daily rhythm disturbances, ventilation support, prevention of the effects of mobility restriction [114], circulatory support, personal hygiene, fluid balance, nutrition, excretion, pain relief, communication, anxiety Stress, maintaining sensory balance, family support, oral care due to the patient's vulnerability to infections, and the loss of natural oral cleansing mechanisms are a priority in critically ill patients [114]. The presence of an oral endotracheal tube causes compression problems and will prevent full access to the oral cavity and its full examination.

Conclusion

The presence of C-shaped cartilage facing each other in the chip has this property that prevents the tube from closing. The inhalation phase is an active and energy-intensive operation, but the exhalation is inactive and consumes very little energy. Respiratory diseases such as chronic obstructive pulmonary disease (COPD) also require energy to be exhaled. Inhalation time is about breathing time and exhalation time is about breathing time. The point where the trachea divides into two branches is called the carina. The right bronchus is shorter, wider and straighter. The left lung has 2 lobes and the right lung has 3 lobes. Each lung lobe is divided into 2-5 segments by lines coming from the pleura.

There are 10 segments in the right lung and 8 segments in the left lung. Identifying these divisions is very important in performing postural drainage and is helpful in treatment. The bronchus is divided into smaller branches that consist of connective tissue and are surrounded by arteries, capillaries, and nerves. These bifurcations are divided into smaller divisions called bronchioles, which have no arteries, are made of soft muscle tissue, and also contain mucus-secreting glands. Inside the bronchioles are also composed of celiac cells that flush foreign matter and secretions into the main airways. The bronchioles terminate in the terminal bronchioles, which no longer have mucus-secreting cells. Respiratory bronchioles are the subsequent branches that end in the alveolar ducts and then the alveoli.

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