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Respiratory failure: Classification, Epidemiology and Etiology Review

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Abstract

Respiratory failure is a detailed syndrome of the respiratory system failing to perform the function of gas exchange, oxygen intake, and carbon dioxide release. Acute respiratory failure is the most common cause of organ failure in intensive care units (ICUs) with high mortality rates. The classification can be reviewed from two categories of acute respiratory failure and chronic respiratory failure. Acute respiratory failure is often found with the failure of other vital organs. Death is caused by multiple organ dysfunction syndrome (MODS). Etiology can be seen in two categories, namely Central nervous system Depression, Impaired ventilation, Impaired equilibrium perfusion ventilation (V/Q Mismatch), Trauma, Pleural effusion, hemothorax, and pneumothorax, Acute pulmonary disease. Respiratory failure, like failure in other organ systems, can be identified based on clinical features or laboratory tests.

Introduction

Respiratory failure is a relatively common problem, which usually, though not always, is the final stage of chronic illness in the respiratory system. This situation is increasingly found as a complication of acute trauma, septicemia, or shock.

Respiratory failure, like failure in other organ systems, can be identified based on clinical features or laboratory tests. But it must be remembered that in respiratory failure, the relationship between clinical features with abnormalities from the results of laboratory tests in the normal range is indirect.

Acute respiratory failure is the most common cause of organ failure in intensive care units (ICUs) with high mortality rates. In Scandinavia (Flaatten et al., 2003). The mortality rate within 90% in acute respiratory distress syndrome (ARDS) is 41% and acute lung injury (ALI) is 42.2%. Acute respiratory failure is often followed by failure of other vital organs. Death is caused by multiple organ dysfunction syndrome (MODS). In ARDS, death from irreversible respiratory failure is 10-16%. Whereas in Germany, the incidence of acute respiratory failure, ALI, and ARDS was 77.6-88.6; 17,9-34; and 12.6-28 cases per 100,000 population per year with a mortality rate of 40%. This article discusses the classification, epidemiology, and etiology of respiratory failure.

Anatomy and physiology

The respiratory system in humans is divided into several parts. The conduit of air from the nose to reach the lungs itself includes two parts, namely the upper respiratory tract and the lower

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part of a foreign body, and as a warmer, filter, and moisturizer from the air that is inhaled by the nose. This upper respiratory tract consists of the following organs.

Upper Respiratory Airway

In general, the main function of the Upper Respiratory Airway is as an air conduction (air conduction) to the lower respiratory tract for gas exchange, protecting (protecting) the channel (Bernstein, 1992). (1) Nasal (nasal cavity), the nasal cavity is coated with a type of mucous membrane that is very rich in blood vessels. This cavity is connected with the lining of the pharynx and sinus mucous membrane which has an opening into the nasal cavity. (2) Paranasanalis sinus, paranasanalis sinus is an open area in the head bone. the name of the paranalis sinus itself which is adjusted to the name of the bone where the organ is located. This organ consists of the frontalis, ethmoidal sinus, spinodal sinus, and the maxillary sinus. resonant space. (3) Pharynx (pharynx) pharynx is a muscular tube that runs from the base of the skull to its contact with the esophagus, at the height of the cricoid cartilage. Therefore the pharynx lies behind the larynx. Larynx (throat), the larynx is located in front of the lowest part of the pharynx which separates the pharynx from the vertebrate column, the larynx extends to the top of the cerebral vertebrates and enters the trachea below.

Lower respiratory tract (Lower Airway)

Judging from the general function of the lower respiratory tract is divided into two components. First, conducive airways or what is often called the branching of the bronchial trachea (Schwartz et al., 1997). This channel consists of bronchi and bronchial trachea. The two respirator terminal units (sometimes called acini) which are conductive air ducts with the main function as a gas refiner in and out of the terminal respiratory unit are the actual gas exchange units. Alveoli itself is part of the terminal respirators unit. (1) Trachea, trachea, or windpipe has a length of approximately 9cm. This organ extends to the larynx to the top of the fifth thoracic vertebrate. From this place the trachea branched into two bronchi. The trachea is composed of 16-20 incomplete circles, in the form cartilage ring-cinin that is joined together by the fibrous tissue and completes the circle next to the back of the trachea. In addition, the trachea also contains some muscle tissue. (2) Bronchus and Bronchial, bronchus formed from the hemispheres of the trachea at the fifth thoracic vertebrate level, have a structure similar to the trachea and are covered by the same type of cells. and wider than the left, slightly higher than the pulmonary artery and take out a major branch passing under the artery, called the lower lobe bronchus.

The left bronchus is longer and thinner than the right, and stretches under the pulmonary artery before finally splitting into several branches leading to the upper and lower lobes. The main and left bronchial branches branch off again into the lobar bronchus and then become segmental lobes. These branches extend continuously into the right and left lobes. bronchi whose size is getting smaller, until finally becoming bronchial terminals, the smallest airways that do not contain alveoli (air pockets).

Bronchhiolus is not strengthened by the cartilage ring, but is surrounded by innocent muscles so that its size changes. All airways down to the terminal bronchiole are called air conduits, because their main function is as a conduit of air to the place of lung gas exchange. (1) Alveoli, alveoli (ie sinus gas exchange sites) consist of bronchioles and respirators which sometimes have small air pockets or alveoli on their walls. Alveoli are thin-walled pockets that contain air. It is through this wall that gas exchange occurs. 300 million alveoli. Small holes in the alveolar wall allow air to pass through one alveoli to another. The alveoli lining the thoracic cavity are separated by a wall called the pore Kohn. (2) Lungs, left and right parts of the lungs are located in the thoracic cavity. The lungs are also coated with pleura, namely parietal pleura and visceral pleura. In the pleural cavity there is a surfactant fluid which functions for the lubric. The right lung is divided into 3 lobes namely the superior lobe, medius lobe, inferior

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lobe. The left lung is divided into 2 lobes namely the superior lobe inferior lobe. Each lobe is wrapped in elastic tissue containing lymph vessels, arterioles, venules, bronchial venules, alveolar ducts, alveolar sacs, and alveoli. It is estimated that each lung contains 150 million alveoli, so that this organ has a large surface area for the surface/exchange of gases. (3) The thorax, diaphragm, and pleura, the thoracic cavity functions to protect the lungs, heart and large vessels. The thoracic cavity consists of 12 ribs. In the upper part of the thorax in the neck region, there are two additional muscles for the inspiration process, namely scalenus and sternocleidomastoideus. sklaneus muscles raise the first and second ribs during inspiration to expand the upper chest cavity and stabilize the chest wall

The sternocleidomatoideus muscle functions to lift the stastum of the parastomal, trapezius, and pectoralis muscles as well as additional inspiration that is useful for improving breathing work (De Mayo et al., 2005). Between the ribs there is intercostal muscle. The external intercostal muscles are muscles that move the ribs up and forward, thereby increasing the anteroposterior diameter of the chest wall.

In the afragm lies below the thoracic cavity. In a state of relaxation, the diaphragm is dome-shaped. The mechanism of regulation of the diaphragm muscle (phrenic nerve) is found in the spinal cord (spinal cord) in the 3rd cervix (C3). Therefore, if an accident occurs on the C3 nerve, then this can cause ventilation disorders.

The pleura is a serous membrane covering the lungs. There are two kinds of pleura, namely the parietal pleura that lines the thoracic cavity and the visceral pleura that covers each lung. Between the two pleura there is pleural fluid, there is pleural fluid that resembles a thin membrane that allows all of these surfaces to rub against one another during respiration, while preventing thoracic and lung separation. Pressure in the pleural space is lower than atmospheric pressure, thereby preventing lung collapse. If the pleura has problems, for example inflammation, then liquid air can enter the pleural cavity. This can cause the lungs to compress and collapse.

Classification Review

Classification can be seen from two categories, there are two, namely acute respiratory failure and chronic respiratory failure (Patrick et al., 1996). The classification is (1) Acute respiratory failure, acute respiratory failure occurs within minutes to hours, which is marked by changes in the results of life-threatening blood gas analysis. An increase in PaCO2 levels. Acute respiratory failure occurs in patients whose lungs are structurally or functionally normal before the onset of the disease occurs. (2) Chronic respiratory failure, chronic respiratory failure, occurs within a few days. It usually occurs in patients with chronic lung disease, such as chronic bronchitis and emphysema. Patients will experience tolerance to hypoxia and hypercapnia that gradually worsens.

The process of respiratory physiology in which oxygen is transferred from the air into the tissues and CO2 is released into the air (aspiration), can be divided into two stages, namely: (1) The first stage, the first stage is marked by a ventilation phase, namely the entry of a mixture of gases into and out of the lungs. This mechanism is possible because there is a difference in pressure between the atmosphere and alveoli, due to the mechanical work of the muscles. (2) In the second stage, transportation in this phase occurs from several aspects, namely: Gas diffusion between the alveoli and the capillaries of the lungs (external respiration) as well as between systemic blood and tissue cells. Distribution of blood in the pulmonary circulation and its adjustment to the distribution of air in the alveoli.

The chemical and physical reaction of O2 and CO2 with blood respimi or internal respiration is the final stage of respiration, where dioxygen dioxide is to get energy, and CO2 is formed as a waste from cell metabolic processes and released by the lungs.

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Transportation is a stage that includes the process of diffusion of gases across a thin capillary alveolar membrane (less than 0.5 mm thick). This driving force is obtained from the difference in partial pressure between the blood and the gas phase.

Perfusion is the effective transfer of gas between the alveoli and the capillaries of the lungs that require equitable distribution of air in the lungs and perfusion (blood flow) in the capillaries. In other words, the ventilation and perfusion of the pulmonary unit that is in accordance with normal people at an upright position and a resting state, then ventilation and perfusion are almost balanced, except at the apex of the lungs. Respiratory failure is inadequate ventilation caused by the inability of the lungs to maintain arterial oxygenation or adequately dispose of carbon dioxide (Westenkirchner, 1983; McCord, 1999).

Epidemiological Review

Acute respiratory failure is the most frequent cause of organ failure in ICUs with high mortality rates. In Scandinavia, the mortality rate within 90% in acute respiratory distress syndrome (ARDS) is 41% and acute lung injury (ALI) is 42.2%. Acute respiratory failure is often found with the failure of other vital organs. Death is caused by multiple organ dysfunction syndrome (MODS) (Bone, 1996).

In ARDS, death from irreversible respiratory failure is 10-16%. Whereas in Germany, the acute respiratory failure, ALI, and ARDS are 77.6-88.6; 17,9-34; and 12.6-28 cases per 100,000 population per year with a mortality rate of 40%. There are two kinds of respiratory failure namely acute respiratory failure and chronic respiratory failure where each has a different understanding. Acute respiratory failure is breath failure that arises in patients who are the lungs normal structurally or functionally before the onset of the disease arises. Whereas chronic respiratory failure occurs in patients with chronic lung diseases such as chronic bronchitis, emphysema, and black lung disease (coal mining disease). Patients experience tolerance to hypoxia and hypercapnia which gradually worsens. After acute respiratory failure, the lungs usually return to their original strength. In chronic respiratory failure, irreversible damage to the natural lung structures.

The indicator of respiratory failure has respiratory frequency and vital capacity, normal breathing frequency is 16-20 x/min. If more than 20x/min actions taken provide ventilator assistance because "breathing work" becomes high resulting in fatigue. Digital capacity is a measure of ventilation (normal 10-20 ml/kg).

The most important cause of respiratory failure is inadequate ventilation where upper airway obstruction occurs. The respiratory center that controls breathing is located under the brain stem (pons and medulla) (Benarroch, 2007). In the case of patients with anesthesia, head injury, stroke, brain tumor, encephalitis, meningitis, hypoxia, and hypercapnia have the ability to suppress the respiratory center. So that breathing becomes slow and shallow. In the postoperative period with anesthesia may occur inadequate breathing because there are agents suppressing breathing with the effects released or by increasing the effects of analgesic opioids. Pneumonia or with lung disease can lead to acute respiratory failure.

Etiology Review

This can be seen in two categories: (1) Central nervous system depression: Causes respiratory failure due to inadequate ventilation. The respiratory center that controls breathing is located under the brain stem (pons and medulla) so that breathing is slow and shallow. (2) Ventilation disorders: Ventilation disorders are caused by intrapulmonary or extrapulmonary abnormalities. Intrapulmonary disorders include abnormalities in the lower airways, pulmonary circulation, tissue, and alveolar-capillary areas. Extrapulmonary abnormalities are caused by acute and chronic obstruction. Acute obstruction is caused by flexion of the neck in an unconscious patient, larcasm spasms, or larinkal edema, acute epiglottis, and tumors of the

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trachea. Chronic obstruction, for example in emphysema, chronic bronchitis, asthma, COPD, cystic fibrosis, bronchiectasis especially accompanied by sepsis. (3) Impaired balance of perfusion ventilation (V/Q Mismatch): Increased dead space (loss space), as in thromboembolism, emphysema, and bronchiectasis. (4) Trauma: Caused by motorized vehicles can be a cause of respiratory failure. Accidents that result in head injury, unconsciousness, and bleeding from the nose and mouth can lead to upper airway obstruction and respiratory depression. Hemothorax, pneumothorax, and rib fractures can occur and may cause respiratory failure. Flail chest can occur and can lead to respiratory failure. Treatment is to improve underlying pathology (5) Pleural effusion, hemothorax, and pneumothorax: These are conditions that interfere with ventilation through inhibiting lung expansion. This condition is usually caused by underlying lung disease, pleural disease or trauma, and injury and can cause respiratory failure. (6) Acute pulmonary disease: pneumonia is caused by bacteria and viruses. Chemical pneumonia or pneumonia is caused by aspirating irritating vapors and acidic stomach material. Bronchial asthma, atelectasis, pulmonary embolism, and pulmonary edema are some other conditions that cause respiratory failure. Supporting examination, examination of hypoxemic arterial blood gases. First level, Light: PaO2 <80 mmHg, Second level, Medium: PaO2 <60 mmHg Last level, Weight: PaO2 <40 mmHg.

Pulse oximetry can show a decrease in arterial oxygen saturation. Serum hemoglobin and hematocrit levels show decreased oxygen-carrying capacity. Electrolytes show hypokalemia and hypochloremia, hypokalemia can occur due to compensatory hyperventilation which is the body's attempt to correct acidosis. Hypochloremia usually occurs in metabolic alkalosis. Examination of blood cultures can find pathogenic germs. Pulmonary artery catheterization helps distinguish pulmonary or cardiovascular causes during acute respiratory failure and monitor hemodynamic pressure.

This strength can be seen from the ability of tissues to enter oxygen and remove carbon dioxide. Indications of respiratory failure are PaO2 <60mmHg or PaCO2> 45mmHg, and or both (Smeltzer & Bare, 2005). Respiratory failure occurs when the lung can no longer fulfill its primary function in gas exchange, namely arterial blood oxygenation and carbon dioxide removal (Grocott et al., 2009). Therefore, respiratory failure is a respiratory system that fails to perform the functions of gas exchange, oxygen intake, and carbon dioxide release.

Conclusion

Acute respiratory failure is the most frequent cause of organ failure in intensive care units (ICUs) with high mortality rates. The classification can be reviewed from two categories of acute respiratory failure and chronic respiratory failure. Acute respiratory failure is often found with failure of other vital organs. Death is caused by multiple organ dysfunction syndrome (MODS). Etiology can be seen in two categories, namely Central nervous system Depression, Impaired ventilation, Impaired balance of perfusion ventilation (V/Q Missmatch), Trauma, Pleural effusion, hemothorax and pneumothorax, Acute pulmonary disease.

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