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# **Pneumonia associated with Mechanical ventilation**

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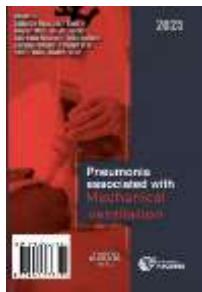


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## PNEUMONIA ASSOCIATED WITH MECHANICAL VENTILATION

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## **SUMMARY**

It is necessary to point out that this medical literary work shows us a synthesized overview of daily life in the areas of pulmonology, emergency medicine, and critical care wards, where respiratory infections are a daily occurrence.

Therefore, we can describe the conceptual terms of pleuro-pulmonary morphology as a chapter, and in the second chapter, we can visualize the radiological interpretation of diseases of the respiratory system.

In the third chapter, we mention respiratory diseases as such for a brief overview for the physician reading this book. In the fourth chapter, we elaborate on the medical applications of mechanical ventilation and its benefits for the patient.

**Keywords:** **Invasive ventilation, Intubation, Intensive care**

# FOREWORD

It is necessary to show you that this medical literary work shows us a synthesized range of what is the daily living in the areas of pulmonology, emergency and critical care rooms in which respiratory infections are the bread and butter.

Therefore we can describe as a chapter the conceptual designations of the Pleuro-pulmonary morphology, in the 2nd chapter we can visualize about the radiological interpretation of diseases of the respiratory system.

In chapter 3 we mention respiratory diseases as such for a brief review of the doctor who reads this book, in chapter 4 we elaborate by mentioning the medical applications of mechanical ventilation and its benefit to the patient

As for the other chapters are a small conglomeration of the many concepts about mechanical ventilation and its clinical-surgical utility, to finish, it is feasible for us as editors put in your hands this medical account of pneumology



# Thanks

It is my pleasure to have in mind the people who were part of this work as my medical colleagues, teaching friends who made sure that this copy of the medical literature was released to the scientific community, As such I leave my heartfelt thanks to them and therefore without fail to God who has given me strength for the publication of this book.

**x**

# Dedication

I want to dedicate this medical literature to my parents who have been the fundamental pillar in me for the realization of it.





# CHAPTER 1

## Morphology Pulmonary pleura Pleural anatomy

In the description of these structures we can say the following:

- They are dynamic covers
- They are formed of a membranous and fibrous tissue
- Its function is synchronized with the respiratory cycles
- They contain a substance called pleural fluid that prevents them from suffering any ulceration by participating in the respiratory cycle as lubricant of the same

### Surrounding structures around the pleura

- Common carotid artery
- Internal jugular vein
- Right subclavian artery
- Left subclavian artery
- 1st rib
- 4th rib
- Horizontal fissure
- Right lung
- Left lung
- Oblique fissure
- Right vertebral line of pleural reflection
- Rib insertion of diaphragm
- 10th rib
- Vertex of right lung
- Apex of the left lung
- Right sternal line
- Left sternal line
- Cardiac cleft of the left lung
- Oblique fissure
- Bare area of the pericardium
- Apex of the heart

- Lingula
- Left costal line of pleural reflection
- Vertebra T12

The nomination of these structures has been made to remind our health professionals when performing any invasive procedure and avoid the injury of any morphological structure as far as possible

### **Parietal pleura**

While it is true, it is the structure that is in contact with:

- The ribs: on the outside
- Parietal pleura: inside

This cover has the following divisions

- Costal pleura: it has lateral parts like the sternum, ribs, costal cartilage thoracic vertebrae and intercostal membrane that serve as protection for this thoracic structure
- Mediastinal pleura: it is intended for the sides of the mediastinum and continues upwards with the cervical pleura
- Diaphragmatic pleura: it is responsible for covering the top of the diaphragm and is in contact with the junction of the pericardium
- Pleural fascia: it is the connection of the diaphragmatic pleura with that which is part of the muscular fibers of the diaphragm

### **Visceral pleura**

Also called pulmonary pleura is attached to structures such as:

- Lung
- Horizontal fissure
- Oblique fissure

It has connection with the parietal pleura thanks to:

- Lung hilum: here are the bronchial pulmonary vessels that form the lung root

## **Cervical pleura**

This is the one that occupies the highest part of the lung called vertex, so it forms a structure called:

- Pleural dome: that is determined by a fibrous-membranous space of approximately 3 cm located topographically at the level of the upper part of the clavicle in its middle third and adjacent to the first rib
- This structure is performed in detail to prevent injury structures when performing invasive medical procedures.
- It should be noted that whenever the supraclavicular vascular reference triangle is used, the patient is placed in Tredelemburg to avoid injury to the lung and thus produce a tension pneumothorax

## **Pleural reflections**

These are places where the pleura performs a double of it and have the following names:

- Recesso costodiafragmático
- Pauses cost phrenic

The importance of knowing how to locate these structures is as follows:

- Radiological reading of a pneumonia
- The topographical location at the time of auscultation
- The topographical location at the time of making some drainage In

addition to these descriptions we have the following pleural forms:

- Reflex line of the costal pleura
- Reflection line of the vertebral pleura

## **Lungs**

They are organs of insufflation and retraction thanks to the respiratory cycle controlled by the medulla specifically in its back

**The right lung has:**

- Horizontal fissure
- Oblique fissure
- Lower lobe
- Middle lobe
- Upper lobe
- Vertex
- Front edge
- Bottom edge

**The left lung has:**

- Oblique fissure
- Cardiac cleft
- Lingula
- Vertex
- Front edge
- Bottom edge

**In relation to the coastal faces we have the following topographic structures:**

- Upper lobe of right lung
- Rib face of right lung
- Horizontal fissure
- Lower lobe of right lung
- Costal portion of the parietal pleura
- Hepatic portion of diaphragm
- Aorto-esophageal portion of the diaphragm
- Left portion of diaphragm
- Right vagus nerve
- Left ganglion nerve
- Trachea
- Vertex of right lung
- Apex of the left lung
- Right phrenic nerve
- Left phrenic nerve
- Origin of recurrent laryngeal nerve
- Oesophageal tracheal canal

- Upper lobe of left lung
- Right lung root
- Left lung root
- Parietal lamina of serous pericardium
- Fibrous pericardium
- Right oblique fissure
- Left oblique fissure
- Mediastinal face of the lung
- Lower lobe of left lung
- Receso costodiaphragmatic

### **Right pulmonary hilum**

The following are the structures that form part of these clusters of anatomical morphologies:

- Pulmonary arteries
- Pleural sleeve
- Pulmonary vessels
- Pulmonary ligament
- Middle lobular bronchus
- Lower lobular bronchus
- Bronchopulmonary lymph
- Bronchial vessels
- Main right bronchus
- Upper lobular bronchus

### **Left pulmonary hilum**

The following are the structures that form part of these clusters of anatomical morphologies:

- Bronchial vessels
- Pleural sleeve
- Bronchopulmonary lymph nodes
- Pulmonary veins
- Pulmonary ligament
- Lower lobular bronchus
- Left main bronchus
- Upper lobular bronchus

- Pulmonary artery

## **Pulmonary circulation**

It consists of the following vessels:

- Right pulmonary artery
- Lobular and segmental arteries
- Tronco pulmonar
- Left pulmonary artery
- Lobular and segmental veins
- Left pulmonary veins
- Superior vena cava
- Inferior vena cava

## **Bronchial irrigation**

It consists of the following vessels:

- Right upper posterior intercostal artery
- Arch of the aorta
- Left upper intercostal artery
- Bronchial arteries
- Esophageal artery
- Aorta torácica

## **Bronchial drainage**

It consists of the following vessels:

- Right brachiocephalic vein
- Superior vena cava
- Right bronchial veins
- Vena ácigos
- Left upper intercostal vein
- Left brachiocephalic vein
- Left bronchial veins
- Vena ácigos
- Vena hemiacigios
- Accessory hemiacigios vein

## **Pulmonary lymphatic drainage**

It consists of the following vessels:

- Paratracheal lymph nodes
- Nódulo cervical profundo inferior
- Right lymphatic duct in relation to the subclavian angle
- Right subclavian lymphatic trunk
- Right subclavian vein
- Broncho-mediastinic trunk right
- Upper tracheo-bronchial nodules
- Hiliar bronchopulmonary nodule
- Nódulos intra- pulmonares
- Subpleural lymph plexus
- Interlobular lymph vessels
- Deep bronchial plexus
- Nódulo cervical profundo inferior
- Chest tube
- Left bronchiomediastinal trunk
- Aortic arch nodule
- Hiliar bronchopulmonary nodules
- Nódulos pulmonares
- Drainage of the deep lymph plexus

The direction of drainage is one direction from the left upper lobe and another from the right lung and left lower lobe

## **Innervation of the lungs and pleura**

Parasympathetic ganglion cells have the following functions:

- Bronco- constrictors
- Vasodilators
- Secret-motor

Sympathetic ganglion cells have the following functions:

- Bronchodilators
- Vasoconstrictors

Sympathetic fibers come from axons and center cells originated in the paravertebral sympathetic ganglia

Parasympathetic fibers come from the vagal trunks that make their way along the thorax

The sensory ganglia of the vagus nerve emit visceral afferent fibers that form pulmonary plexuses, which are responsible for the following functions:

- Sensitivity to toux reflex
- Sensation of stretching by the muscles of the bronchi
- Responsible for the reflection of Hering Breuer
- They act on the thorax baroreceptors
- It also acts on the chemoreceptors of which they are responsible for the buffer substances and their PH-metry

# CHAPTER 2

## Interpretation of a chest x-ray

We must know first how to send an order of Rx to the imaging area and it is as follows:

- Standard AP thorax rx, lateral and oblique
- Portable chest x-ray

In situations where the patient is not admitted to a hospital area, you may have these radiological options for better diagnosis of which are:

- Patient performing a forced inspiration to release the lung bases
- Patient must raise the upper limbs in front of him to mobilize the shoulder blades and can show the upper lobes and pulmonary vertices

Factors that increase the vascular and cardiac tissue will be named below:

- Position of the half-frame
- Decrease in craniocaudal gradient
- Inadequate inspiration
- A short focus length to the x-ray film

### Determination of cardiothoracic index

It is the measurement of:

- The heart length
- The length of the hemitorax
- The cardiac length is divided over the total hemitorax

- The result of the equation must be less than 0.5
- In pediatric patients a value greater than 0.65 can be considered normal for their morphological conditions

### **Primary pathological definition**

This is called in the marking of the radiography as an infiltrator of any kind and it is called the sign of the silhouette that is nothing more than the demonstration of lung disease to be ruled out

### **Type assessment and radiographic quality**

- The chest plate is marked
- It is checked if the spinous processes are well centered
- The posterior arch of the ninth or tenth rib is assessed by seeing if the superimposed diaphragm is seen

### **Assessment of the chest wall: bones and soft parts**

- The neck is evaluated by seeing that the trachea is centered and has the proper diameter
- The shoulder girdle is assessed by seeing if they are rotated to have a much clearer view of the lung
- The ribs are evaluated by determining their position and path or by seeing if they have a loss of the continuity line
- In the case of x-rays to female patients of values breast shadow if it has symmetry and the existence of some nodule as incidental finding
- The soft tissue assessment explores the determination of subcutaneous emphysema in which it is related to a tension pneumothorax
- The evaluation of free air in the subphrenic space is fundamental

### **Evaluation of diaphragm and pleural covers**

- In the visualization of diaphragmatic domes should be determined their harmonious shape with smooth edges, it should be taken into account that the half-afragma right for morphological reasons must be a little higher than the left

- In the evaluation of the cost-phrenic angle it should be determined if there is any thickening of this recess or some pleural effusion
- In the pleural assessment should be visualized the existence of loss of continuity line, calcifications or some artifact that prevents a proper diagnosis of the thorax plate
- As for the assessment of cracks should not have a width greater than 2mm

### **Assessment of mediastinum and lung roots**

- When visualizing the upper mediastinum by determining its width and position, such as size of the aorta at its angle of 180 degrees at the level of the pulmonary trunk
- Visualize venous return by looking at the dimensions and morphology of the superior and inferior vena cava
- View the direction of the trachea and main bronchi
- The bifurcation angle of the trachea should have a projection of 55 to 70 degrees
- As far as the heart is concerned, the cardiothoracic index assessment is ideal
- Other radiological manifestations are calcification of the aortic arch or heart valve structures or coronary artery defects as incidental findings
- As for the position of the bronchi we have that the left is a little higher than the right so it helps the diagnosis of massive atelectasis by the introduction of the endotracheal tube in the inadequate measure

### **Evaluation of pulmonary parenchyma**

- The dimensions of the tracheobronchial tree and pulmonary vascularization should be evaluated
- Display of added images as diffuse or focal

### **Evaluation of foreign materials**

- Visualization of the central venous catheter at the 4th or 5th intercostal space
- The visualization of the hemodialysis catheter at the level of the right atrium

- Proper placement of the endotracheal tube 2 to 4 cm above the carina
- Placement of chest drain tubes in the appropriate position, but their location is different if there is air drainage, liquid content or secretion of some kind
- The presence of pacemakers in every chronic cardiac patient, this being the location of the atrial or ventricular electrode

### **Rx in paediatrics**

The presence of radiopaque images in pediatric irritability is due to the following causes:

- Crying of the boy or girl
- Prolonged expiratory exertion
- Positioning of the diaphragm above its normal location
- The dynamics of the above concepts causes increased pulmonary vascularization appearing congested or accentuated
- Therefore, it is essential to always evaluate the thorax radiography so that it is only a diagnostic rejection of a possible pneumonia

### **Assessment of pulmonary congestion and edema**

Below we describe small physiopathological notions of which are:

- Altered pulmonary venous return
- Retrograde stasis occurs in the pulmonary veins
- Increase in central venous pressure which should be around 8 to 12 cmH<sub>2</sub>O
- At the microscopic capillary level, a transudation is produced, with its first transfer to the interstice and then to the alveolar sacs

At the radiological level we have the following descriptions:

- In the interstitial component it is described as linear and reticular opacities
- At the level of the syletics of the organs we have a poor definition of them as blurred visualization

- This may be accompanied by cardiomegaly with interpretation of increased cardiothoracic index
- The presence of pleural effusions as radiopaque opacities in the pleural recesses or in its absence if malignant is massive

### **Pulmonary emphysema and its radiological correlation**

- The increase in the size of the pulmonary vessels should be carefully observed
- Evaluation of the B lines in Kerley
- This presents small pleural effusions and cloisonne

### **Assessment of alveolar pulmonary edema**

- Presence of shadows in airspace
- Presence of the butterfly wing sign

### **Diagnostic scheme of pulmonary edema**

- The vascular plot is determined if it has an increase in its proportions
- Lower right lobe artery greater than 18 mm diameter in men
- Lower right lobe artery greater than 16 mm diameter in women
- Display of the B lines of Kerley
- Poor definition of pulmonary and cardiac vascular syletics
- Blurred vision of diaphragmatic domes
- Accentuated and irregular lung roots
- Thickening of interlobular cysts
- Presence of confluent opacities
- Increased vascular plot visualization
- Increased cardiothoracic index
- Pleural effusions from right to left

### **Radiological interpretation of pneumoconiosis**

- The quality of the plate must be good
- Avoiding technical deficiencies
- Depending on the quality of the plaque, the lung and pleura should be evaluated
- Prevent a chest plate from being unreported due to technical failures

## **Opacities of smaller diameter**

- Less than 1.5 mm also called micro-nodules
- Dimensions from 1.5 to 3 mm
- From 3 to 10 mm

## **Assessment of larger opacities**

- Presence of 1 or more opacities greater than 1cm that do not pass a combined transverse dimension greater than 5cm
- One or more opacities with heterogeneous diameter not exceeding the area of the upper right zone
- Presence of one or more opacities exceeding the area of the upper right zone

## **Pleural abnormalities**

- Dimensions between 3 to 5mm
- Dimensions Greater than 5 mm at 10 mm limit
- Dimensions greater than 10 mm
- Presence of calcifications with a combined length less than 2 mm
- Presence of one or more calcifications with a dimension of 2 to 10 cm
- Presence of one or more calcifications with a dimension close to and greater than 10cm

## **Additional sources of pneumoconiosis**

- Anthracosis that is nothing but produced by coal dust
- Siderosis which is nothing more than iron oxide
- Bauxite that is nothing more than the presence of aluminum in the body
- Berylliosis which is nothing more than that produced by aircraft debris

## **Among others we have that are for the contact of hard metals:**

- Presence of zinc in the organism
- Presence of tungsten in the body

- Presence of titanium in the body
- Presence of vanadium in the body
- Cobalt in the body

### **Origins of organic substance pneumoconiosis**

- That which is produced by the wet hay
- Weevils or grains like this
- One that is produced by the protein of excrement in poultry farms.
- Presence of mold in wood and cork workers
- Workers processing malt or mouldy barley
- Those who work in the processing of cheese in which a characteristic mold is produced

# CHAPTER 3

## Infections of respiratory system

### Acute bronchitis

In its literary description it is defined as:

- Inflammation
- Diffuse
- Auto limitada

**With the following symptoms:**

- Dry cough
- Dyspnea
- No expectoration
- Lack of appetite
- Adinamia
- Usually no fever
- Lasts approximately 3 weeks

**Epidemiological description**

- Approximately 60 per 1,000 inhabitants
- Populations at risk are pediatric, elderly and chronic smokers
- Usually occurs in rainy weather

## **Etiological description**

**Almost half of the cases are viral in origin, of which they are:**

- Influenza A and B viruses
- Coronavirus
- Rinovirus
- Adenovirus
- Enterovirus
- Methaneumovirus
- Measles virus
- Rubiola virus

## **Atypical bacteria**

- Mycoplasma pneumoniae
- Corynebacterium pneumoniae
- Bordetella Pertussis

## **Polymicrobial bronchitis**

This entity is established on the existence of another respiratory disease plus the bacteria mentioned which are:

- Staphylococcus aureus
- Streptococcus pneumoniae
- Haemophilus influenzae
- Mycoplasma catarrhalis

## **Description of the pathophysiology**

Below we will detail some concepts about this disease of which are:

- Disruption of bronchial epithelium due to infection
- Lymphocytic infiltration
- Edema of the bronchial mucosa
- Hyperresponse vagal
- Histamine release mediated by Ig E
- Release of pro-inflammatory cytokines

## **Diagnóstico diferencial**

- Pneumonia
- Chronic bronchitis
- Asma
- Whooping cough
- Flu
- Sinusitis
- Heart failure
- Gastroesophageal reflux

## **Therapeutic measures**

- Adequate hydration
- Humidification of the airways
- Antitussives
- B2 agonists in spray
- Mucolytic
- Antibiotic therapy for that which is produced by bacteria

## **Out of hospital pneumonia**

- It is described as an infection of the lung tissue due to a community microbial agent that has multiple etiologies

## **Description of the epidemiology**

- The amount of infection of this pathology is from 2 to 13 per thousand patients in the world population except some pandemic problem
- Typically 15% of the hospitalized population needs a continuous monitoring area as a clinical observation area
- Of this 15% only 5% need critical care unit

## **Description of the etiology**

- Streptococcus pneumoniae
- Mycoplasma pneumoniae
- Corynebacterium pneumoniae

- Legionella pneumophila
- Coxiella burnetti
- Influenza A and B viruses
- Parainfluenza virus 1,2 and 3
- Adenovirus

It should be emphasized that if this disease is caused by a virus, it is because the bacterial infection is a product of the exacerbation of the pulmonary viral infection

### **Predisposing factors for out-of-hospital pneumonia**

- Presence of enteric Gram-negative
- Stay in asylums
- Presentation of other concomitant diseases
- The co-existence of prior antibiotic treatment

### **Facilities for the pseudomone auriginosis to infect the lung of:**

- Presence of bronchiectasis
- Lack of caloric protein intake
- Recent antibiotic therapy
- Glucocorticoid therapy

### **Facilities for staphylococcus aureus to infect the lung are as follows:**

- Stay in asylums
- Recent influenza virus infection
- Presence of diabetes mellitus
- Presence of renal failure
- Intravenous drug addiction

### **Facilities for anaerobic bacteria to infect the lung are as follows:**

- History of chronic drinking
- Poor oral hygiene
- Stay in asylums

- Changes in the level of consciousness
- Aspiration pneumonitis

**Facilities for penicillin-resistant streptococcus pneumoniae to infect the lung are as follows:**

- History of chronic drinking
- Age under 2 and over 65
- Immunosuppression
- Presence of concomitant diseases
- Epidemiological niche in day care centres
- Treatment with B-lactams in the last 3 months

### **Description of pathological anatomy**

- Neutrophil infiltration
- Exudation of plasma proteins
- Necrosis in certain cases
- Abscesses in certain cases
- Fibrosis in certain cases

### **Presentation of the symptoms**

The signs and symptoms described below are:

- Cough
- Expectoration
- Dyspnea
- Pleurisy
- Hemoptysis
- Adinamia
- Loss of weight
- Fever
- Tachycardia if there is a systemic inflammatory response

### **Determination of supplementary examinations**

- Gram staining and sputum culture
- Blood culture
- Detection of antigens

- Serological studies
- Polymerase chain reaction
- Thoracentesis
- Microscopy and pleural fluid culture
- Aspiration puncture with transthoracic fine needle
- Bronchoalveolar lavage
- Lung biopsy

## **Pronostico**

This is decided after the following determinations

### **Bad forecast:**

- Bacterial atypia
- Patients with neoplasms
- Patients with human immunodeficiency virus
- Patients with immunological diseases
- Mental deterioration
- Leukocytosis major or equal to  $30 \times 10^9$  per liter
- Leukopenia less than or equal to 4 times  $10^9$  per liter
- Extensive radiological spread
- $\text{PaO}_2/\text{FiO}_2$  less than 250
- Persistent hypercapnia

### **Good forecast**

- The patient complies with home treatment
- Patient complies with strict diet at home
- Those who are hospitalized keep their minds busy

## **Antimicrobial therapy**

Patients with outpatient treatment

- It is you may give amoxicillin orally every 8 hours as directed by your doctor
- Clarithromycin may be given orally 500mg every 12 hours as directed by your doctor

- Azithromycin 500mg may be given orally each day as directed by your doctor
- Levofloxacin is given orally 500mg every 12 hours as directed by your doctor
- Moxifloxacin can be given orally 400mg each day as directed by your doctor

### **Treatment of hospitalized patients**

- Cefotaxime may be given intravenously 1 gram every 6 hours as directed by your doctor
- Ceftriaxone may be given 1 -2 grams intravenously every 24 hours as directed by your doctor
- It is may give amoxicillin plus clavulanic acid intravenous 1000/200 mg every 8 hours as directed by your doctor
- Azithromycin may be given intravenously 500mg/daily as directed by your doctor
- Moxifloxacin 500mg can be given intravenously every 24 hours as directed by your doctor
- You can give levofloxacin 500mg intravenously 1g each day according to the doctor's instructions
- Cefepime can be given intravenously 1-2g every 12 hours as directed by your doctor
- Piperacillin plus tazobactam intravenous 4000/500mg may be given every 8 hours according to the doctor's instructions
- Meropenem may be given intravenously from 0.5 to 1 gram every 6 to 8 hours as directed by your doctor

### **Possible indications in which the empirical treatment fails of which are:**

- Inappropriate therapy
- Pathogens that have created antimicrobial resistance
- Atypical micro-organisms
- Inappropriate route of administration
- Malabsorption syndrome
- Deficiency of complementation
- Impairment of the immune system
- Recurrent pneumonia
- Systemic immunosuppression

- Empyema
- Septic foci in other organs
- Phlebitis or catheter infection
- Presence of medicated fever
- Existence of nosocomial pneumonia
- Kidney failure
- Heart failure
- Adult respiratory distress syndrome
- Presence of atelectasis
- Presence of pulmonary infarction
- Presence of bronchogenic carcinoma
- Acute pulmonary edema
- Pulmonary hemorrhage
- Eosinophilic pneumonia
- Pneumonitis due to hypersensitivity
- Acute interstitial pneumonia
- Presence of foreign body

### **Pneumococcal vaccine**

- Has a polysaccharide characteristic
- Contains about 23 pneumococcal serotypes
- It is effective in preventing invasive pneumococcal disease
- Immunocompromised
- Patients with chronic diseases
- Splenectomized patients
- Patients with lymphoma
- Patients with multiple myeloma
- Patients with chronic renal failure
- Patients with some type of transplant
- Patients with AIDS or infected with HIV and are carriers only
- Patients over 65 years old

### **In-hospital pneumonia**

Also called nosocomial has the following characteristics of which are:

conceptual

- It is an inflammatory process
- It is an infectious process
- Acquired within the hospital unit
- The infection is put into action after 48 hours of hospital stay
- For patients in critical care units, ventilator-associated pneumonia
- And it is the largest diagnosis of any patient in a critical care unit

### **Description of the epidemiology**

- It is estimated that there are about 6 to 7 patients for every 1,000 medical admissions who went through an in-hospital pneumonia
- Ventilator-associated pneumonia has an incidence of 8 cases per 1000 days of mechanical ventilation in intensive care
- Therefore these 2 pathological entities lead to high morbidity and mortality

### **Description of the etiology**

We will then nominate the microorganisms isolated within the hospitals of which they are:

- Gram-negative bacilli
- *Pseudomona auriginosa* spp
- Methicillin resistant *Staphylococcus aureus*
- *Staphylococcus aureus* sensitive to methicillin
- *Aspergillus* spp
- *Candida* spp
- *Criptococo* spp
- *Stenotrophomona maltophilia*
- *Haemophilus influenzae*
- *Serratia* spp
- *Acinetobacter* spp
- Polymicrobial origin

## **Predisposing factors for patient-specific in-hospital pneumonia**

- Presence of concomitant chronic diseases
- Presence of chronic obstructive pulmonary disease
- Presence of rare lung diseases
- Presence of diseases of the nervous system
- Presence of neuromuscular diseases
- Presence of diabetes mellitus
- Presence of renal failure during dialysis
- Presence of chronic liver disease
- Background of tobacco
- Background of alcohol
- Changes in the level of consciousness
- Acute sinus syndrome
- Chronic sinus syndrome
- Traumatic brain injury
- Protein/calorie deficit
- Presence of immunosuppression
- Abnormal oral polymicrobial colonization
- Abnormal gastric polymicrobial colonization
- Critical states as shock any of them
- States of acidosis

## **External to the patient**

- Orotracheal intubation
- Tracheostomy device
- Aerosols
- Patient in prolonged bed
- Antibiótico-terapia prolongada
- Gastric antisecretors
- Cytotoxic drugs
- Glucocorticoids
- Depressors of the central nervous system
- Nasogastric tube nutrition
- Enterogastric tube nutrition
- Complicated surgical emergency

- Transfusion greater than 4 units of blood products
- Bad hand washing
- Poor asepsis and antisepsis when performing a procedure

### **Clinical picture of the patient with in-hospital pneumonia**

- Neutropenic patients
- Infiltrado radiológico
- Purulent respiratory secretions
- Fever
- Hypoxemia
- leukocytosis
- increase in vocal vibrations
- Frémito
- Tubaric breath
- Matidez to the percussion
- Crackling rattles
- Subcrepitant rumbles
- Metabolic acidosis
- Lactacidemia
- Neurological impairment
- Hemodynamic instability
- Tachypnea
- Secondary cyanosis
- Lobular or segmental condensation
- Presence of leukopenia in elderly patients

### **Determination of supplementary examinations**

- Gram staining and sputum culture
- Blood culture
- Detection of antigens
- Serological studies
- Polymerase chain reaction
- Thoracentesis
- Microscopy and pleural fluid culture
- Aspiration puncture with transthoracic fine needle
- Bronchoalveolar lavage
- Lung biopsy

## **Predisposing factors for multi-resistant micro-organisms**

- Check antibiotic treatment in the last 90 days
- Carrying out antibiogram before starting antibiotic therapy
- Hospitalization for 2 or more days in the last 3 months
- Stay in the palliative care service
- Home IV treatment because a lung infection treated at home should always be with oral antibiotics
- Dialysis repeated in the last 30 days
- Healing of wounds at home
- Infection with a multi-resistant pathogen
- Immunosuppressive disease or treatment

## **Potentially lethal microorganisms *Pseudomonas***

### ***auriginosa*:**

- Colonization due to prolonged stay in UCI
- Presence of corticosteroid treatment
- Previous antibiotic treatment without result
- Lung disease with structural damage
- It is capable of producing ulcerations in mucosa
- Capable of producing skin ulcerations
- Its appearance on the skin is yellow-greenish
- Has a characteristic apple smell

### ***Staphylococcus aureus***

- Patients in a coma
- Patients with traumatic brain injury
- Patients with decompensated diabetes mellitus
- Patients with chronic renal failure

### ***Streptococcus Pneumoniae***

- Ineffective antibiotic therapy
- Recurrent infections in children

### ***Legionella pneumophila***

- Patients with high doses of corticosteroids
- Patients with hematologic neoplasms

### **Anaerobic**

- Recent abdominal operation
- Esophageal tracheal aspiration

### **Acinetobacter Baumannii**

- Extended stay in UCI
- Multiple broad-spectrum antibiotic resistance
- Failure of one or more organs

### **Treatment initial for neumónicos with multi-resistant microbial**

- Ceftriaxone can be used for bacteria such as *Streptococcus pneumoniae* and *Haemophilus influenzae*
- Levofloxacin and Moxifloxacin can be used for bacteria such as methicillin-sensitive *Staphylococcus aureus*
- It is may use ampicillin plus sulbactam in bacteria such as enteric gram-negative bacilli and *Escherichia coli*
- Ertapenem can be used to bacteria as *klebsiella pneumoniae*, *enterobacter* spp. *Proteus* spp and *serratia marcescens*

### **Antibiotic therapy for pneumonics with ineffective treatment for multidrug-resistant microbes**

#### **Ceftazidime and Cefepime may be used for:**

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus* sensitive to methicillin
- Gram negative enteric bacilli
- *Escherichia coli*
- *Pseudomonas* spp.
- *Klebsiella pneumoniae* Blee resistant
- Bacterias Gram negativas no fermentadas
- Methicillin-resistant *Staphylococcus aureus*

**Imepenem and Meropenem can be used for:**

- Streptococcus pneumoniae
- Haemophilus influenzae
- Staphylococcus aureus sensitive to methicillin
- Gram negative enteric bacilli
- Escherichia coli
- Klebsiella pneumoniae Blee resistant
- Pseudomona spp
- Bacterias Gram negativas no fermentadas
- Methicillin resistant Staphylococcus aureus

**Piperacillin plus tazobactam may be used for:**

- Streptococcus pneumoniae
- Haemophilus influenzae
- Staphylococcus aureus sensitive to methicillin
- Gram negative enteric bacilli
- Escherichia coli
- Klebsiella pneumoniae Blee resistant
- Pseudomona spp
- Bacterias Gram negativas no fermentadas
- Methicillin resistant Staphylococcus aureus

**Amikacin + Piperacillin plus tazobactam may be used for:**

- Streptococcus pneumoniae
- Haemophilus influenzae
- Staphylococcus aureus sensitive to methicillin
- Gram negative enteric bacilli
- Escherichia coli
- Klebsiella pneumoniae Blee resistant
- Pseudomona spp
- Bacterias Gram negativas no fermentadas
- Methicillin resistant Staphylococcus aureus

**Linezolid or vancomycin + amikacin may be used for:**

- Streptococcus pneumoniae

- Haemophilus influenzae
- Staphylococcus aureus sensitive to methicillin
- Gram negative enteric bacilli
- Escherichia coli
- Klebsiella pneumoniae Blee resistant
- Pseudomona spp
- Bacterias Gram negativas no fermentadas
- Methicillin resistant Staphylococcus aureus

It should be noted that for the use of these broad-spectrum antibiotics an indispensable chemical tool is:

- Antibiogram

With this exam we decided that antibiotics should be mixed to reverse the infection of the patient therefore it is vital to have always on hand

### **Pulmonary abscess and necrotizing pneumonia**

It is the presentation of all purulent secretion at the level of the lung tissue consequently parenchyma necrosis is produced forming cavities with hydroaero levels producing both 2 pathologies called:

- Empyema
- Tension pneumothorax

When dealing with necrotizing pneumonia the primary infection is always in the:

- Oral cavity

### **Determination of the etiology**

We will name the bacteria linked to this disease of which are:

- Anaerobic bacteria
- Bacilos Gram negativos

- *Pectoestreptococcus* spp
- *Pectoestreptococcus melaninogenicus*
- *Porphyromonas* spp
- *Fusobacterium* spp
- *Bacteroides* spp
- Gram negative aerobic bacilli
- *Klebsiella pneumoniae*
- *Enterobacter* spp
- *Serratia* spp
- *Pseudomonas* spp
- *Escherichia coli*
- *Proteus* spp
- *Nocardia* spp
- *Legionella* spp

### **Predisposing factors for primary lung abscess**

- Bronchoaspiration pneumonitis
- Loss of mental state
- Physiological alteration of the vocal cords
- Upper airway instrumentation
- Dental disease
- Pre-existing lung disease
- Bronchopulmonary neoplasia
- Bronchial obstruction
- Pulmonary infarction
- Pre-existing pneumonia
- Bronchogenic cysts
- Emphysematous blisters

### **Description of the pathogenesis**

- Massive bronchopulmonary aspiration
- Nocturnal physiological micro-aspirations
- Functional micro aspirations
- Bacteria oropharyngeal concentration is 10 to 6 CFU/ML
- Has a predominance of anaerobic bacteria

## **Presentation of clinical picture**

- High fever
- Chills
- Sweating
- Pleurisy
- Hypoxemia
- Leukocytosis
- Increase in vocal vibrations
- Tuberous breath
- Matidez to the percussion
- Crackling rattles
- Subcrepitant rumbles
- Metabolic acidosis
- Lactacidemia
- Neurological impairment
- Hemodynamic instability
- Tachypnea
- Secondary cyanosis

## **Diagnóstico**

- Gram staining and sputum culture
- Blood culture
- Detection of antigens
- Serological studies
- Polymerase chain reaction
- Thoracentesis
- Microscopy and pleural fluid culture
- Aspiration puncture with transthoracic fine needle
- Bronchoalveolar lavage
- Lung biopsy

# CHAPTER 4

## Mechanical ventilation

### Conventional fan modes

These have the following concepts:

- They are control variables
- Are phase variables
- They are conditional variables
- They have the feature that they always deliver the same tidal volume
- If it is ventilation by volume We choose to modify the current volume
- Once adjusted the current volume airway pressure or PAW is left as slope variable

Volume controlled assisted mode and its variables

- We have the trigger variable
- This can be by pressure or by flow that must be activated by the patient
- This can be timed and must be activated by the mechanical fan
- We have the limit variable per flow
- We have the variable of cycling by volume or by time

**Trigger or inspiration start variable**

- This may be determined by pressure or flow
- It is a change in pressure that must be identified by the mechanical fan at the end of exhalation for delivery of the preset tidal volume
- The programming of the same should vary approximately between 0.5 - 2 cmH<sub>2</sub>O

- Can also be adjusted with a trigger of 1 to 3 liters per minute
- The trigger must not be too sensitive to prevent the trigger threshold from producing hyperventilation or asynchronous patient-ventilator as such
- In diseases such as respiratory distress, traumatic brain injury, endocrine hypertension, acute respiratory acidosis the trigger in these entities is for time because the ventilator has all the control of breathing and therefore does not have spontaneous expirations by the pharmacological sedation that this entails to treat the diseases mentioned above fulfilling the ventilator mechanical as a life support measure

### **Expiratory control**

- In current fans this is possible thanks to the option called PEEP
- In the old fans this was impossible so the presentation of Barotrauma was very frequent
- The ventilatory mechanics of this part of the respiratory cycle in the mechanical ventilator manifests as passive air flow due to the pressure gradient at microscopic level between the alveolar pressure at the end of exhalation and atmospheric pressure

### **Programming the mechanical fan**

- Current volume or tidal volume of 6 to 8 ml/kg
- A breathing rate of 12 cycles per minute is programmed
- An inspiratory flow of 60l/min is given
- An inspiratory time of 1 to 1.5 seconds is set
- A 40% FIO<sub>2</sub> is programmed and escalated according to the needs of the patient or ventilatory mode
- A physiological PEEP of approximately 5 to 8 cmH<sub>2</sub>O
- Variable is placed on trigger from: 0.5 to 2 cmH<sub>2</sub>O
- You can schedule an inspiratory pause time that may be optional

### **Mechanical fan alarms**

- It must be understood that the sound of these alarms produces noise pollution for medical personnel

- Therefore, its programming depends solely and exclusively on the ICU doctor
- Usually its use is intended for ventilatory modes such as assisted controlled or IPPV

### **Pressure support**

- It is a ventilatory mode
- Responsible for supporting the spontaneous inspirational effort
- A pre-set positive pressure is determined
- Its ventilatory principle is determined by the patient's onset which is limited by variables such as pressure and flow cycling
- The range of a minimum flow level should be approximately 25% of the initial peak flow which is located between 2 to 6 liters per minute

### **Indications**

- Pathological states such as stable COPD in which partial oxygen pressure improves although it is still in clinical study
- Pathological states of COPD with failed ventilatory weaning in which patients have fewer days of hospital stay, less percentage of pneumonia, less percentage of reintubation and usually improve survival
- Pathological states such as COPD with bronchiectasis
- COPD regrouped

### **Complications**

- Lacerations or ulcerations in the pressure zone of the positive pressure mask over its area of use
- Prolonged intubation
- Rebreathing de CO<sub>2</sub>
- Nocturnal micro-aspiration in case the patient cannot handle his secretions
- Gastric distension
- Hemodynamic instability in patients with failed preload
- Cardiac arrhythmias
- Claustrophobia

## **Contraindications**

- Multiple organ failure
- State of asystole
- Glasgow coma scale less than 8
- Heart arrhythmias difficult to treat
- Hemodynamic instability
- Pathological states in areas such as neurosurgery and maxillofacial surgery
- Deformations
- Difficult airway handling
- High risk of bronchopulmonary aspiration
- Poor management of secretions by the patient
- Airway blocked by a foreign body or mucosal edema
- Patient irritable non-collaborator

## **Clinical determination**

- Support pressure is programmed to obtain a tidal volume of 7 to 10ml/kg or a respiratory rate of 20 to 30 per minute
- The support pressure doses depend on the patient's need, so often values greater than 25 cmH<sub>2</sub>O are needed when ventilatory demands are increased
- When ventilatory weaning is needed use values between 15 and 20 cmH<sub>2</sub>O with respiratory frequency and do not exceed the respiratory frequencies of 25 to 30 breaths per minute
- It should be known that its use gives the patient greater quality of adaptation to spontaneous breathing when it is progressing from one ventilatory mode to another
- The amount of support pressure will depend solely and exclusively on the patient and its synchronization with the mechanical ventilator
- It should always be mandatory to use this ventilatory quality for weaning as it decreases the failure rate of this procedure in addition to the multidisciplinary team when performing it that always be aware of the appearance of an adverse reaction and act immediately

## **Disadvantages in conventional fan modes**

- Asynchronous at the beginning of inspiration
- Asynchronous during the total cycle of inspiration
- Asynchronous exhalation
- The PEEPi is little affected because the flow is not enough to be affected
- Within the modifications of the ventilatory modes there is an option in which you can enhance the inspiratory flow which is called ventilatory support pressure

## **Ways to optimize trigger**

- The type and sensitivity of the triggering force by the mechanical fan is determined
- Therefore this constant modifiable is according to the forms modifiable by the ventilator to the patient as far as its sensitivity as such
- A low ventilatory response cycle can be established with decreased running volumes, longer expiratory time channelling and decreased expiratory resistance
- Increase muscle pressure during triggering by decreasing the score on the Ramsey scale in the ventilated patient
- Therefore it is necessary to synchronize a current volume, respiratory frequency and inspiratory flow
- I have the idea of always setting a break to cycling
- The level at support pressure and pressurisation in spontaneous mode should be assessed

## **Evaluation of pressure curves**

- At the early termination of mechanical inspiration in the opening of the expiratory valve, the inspiratory flow returns according to the completion of the final phase of inspiration.
- If the patient has a continuous muscle strength can come to trigger in such a way that the expiratory flow can reach zero
- A delay in the expiratory valve must be assessed in which there is a decrease in inspiratory flow and therefore an increase in airway pressure

## **Factors that are related to the patient**

- One of the main determinations is the action of the respiratory center in which the little trigger is detected by the receptors of this region of the spinal cord and returns as a slow muscle and bone force to the ventilator determinations
- As for the neutral inspiratory time, it can be manifested in a double shot due to insufficient demands on the patient's respiratory needs
- If we talk about the mechanics of the respiratory system it can be established that the peak inspiratory flow should be approximately 25% and the amount being 5 liters per minute
- This microscopic pressure at the level of the alveolar sacs controls the autoPEEP in which it is determined by airway flow
- It is essential to think that within the factors associated with the patient we have major pathologies of weight such as SEPSIS with one of the main causes in which the patient needs ventilatory support and therefore the continuous evaluation of parameters according to dose responses according to the prognosis of the patient assessed in an intensive care unit

To get a big idea of these respiratory manipulations one should emphasize the following determinations of which are:

- Experience of intensivists at the patient's command
- the organized channelling of multidisciplinary health personnel
- avoid sudden change in parameters without evidence of improvement or complication by the patient's therapeutic response

## **Management of the patient unadapted to the ventilator Assess the presence of:**

- fever
- bladder retention
- acute episodes of delirium
- generalized anxiety syndrome

### **The respiratory examination assesses:**

- The presence of bronchospasm
- The presence of pneumothorax
- The presence of atelectasis
- The presence of secretions
- The presence of acute lung edema
- If hyperinflation states

### **Lack of elasticity of the chest wall:**

- States of chronic liver disease such as ascitis
- States of abdominal hypertension

### **Evaluation of the mechanical fan**

- The trigger is determined by flow pressure
- The determination of the current volume can be high or low
- The programming of the respiratory rate can be high or low
- Inspiratory flow
- Determination of SPV
- Monitoring of autoPEEP
- Evaluation of the Ramsey scale by means of the dose response of drugs inhibiting the central nervous system and those relaxing body muscles

### **Pressure and volume curve determinations**

- The curve path ranges from 0 to 40 cmH<sub>2</sub>O
- The curve is evidenced by generalized constants

The curve will depend on:

- Pressures
- Extensibility
- Resistance

- Volume
- The axis of the curve will have a rightward direction with a decrease in elasticity
- The axis of the curve has a shift to the left with an increase in flexibility
- Hysteresis expresses an effect on the surface tension that demonstrates a low distensibility
- Oxygen pressure is determined by the quality of alveolar recruitment in which a preserved perfusion manifests itself
- Whenever alveolar recruitment is to be carried out it should be accompanied by perfusion
- Pulmonary distension is represented by hemodynamic changes
- The rise of dead space is represented by the degree of hypercapnia
- The reflex of Hering Breuer is determined by tachypnea

### **Respiratory failure type I hypoxemia**

Then we have the following causes;

- May occur in Chronic Obstructive Pulmonary Disease
- May be presented in pneumonic conditions
- May occur in idiopathic fibrous lung disease
- It may occur in diseases such as pneumothorax
- May occur in diseases such as Pulmonary infarction
- May occur in diseases such as decompensated pulmonary arterial hypertension
- May occur in diseases such as pneumoconiosis
- May occur in granulomatous diseases of lung tissue
- May occur in congenital cyanotic diseases
- It may occur in morphological lesions such as bronchiectasis
- May present in adult respiratory distress syndrome
- It may occur in diseases that are linked to fatty embolism
- It may occur in morphological pathologies such as cyphoscoliosis
- May occur in silent diseases such as obesity

## **Hypercapnic type II respiratory failure**

- May occur in pathological states as chronic obstructive pulmonary disease
- It may present in pathological states as severe asthma
- May occur in pathological states such as toxicological syndromes
- May occur in pathological states as myasthenia gravis
- May occur in pathological states such as Polyneuropathy
- May present in pathological states such as polio
- May be submitted in pathological states such as primary muscular disorders
- It may present in pathological states such as porfiaria
- It may present in pathological states such as cervical cordectomy
- May occur in pathological states such as cervical or cerebral injury
- May occur in pathological states such as alveolar hypoventilation
- May be submitted in pathological states such as hypoventilation obesity syndrome
- May occur in pathological states such as pulmonary edema
- May be submitted in pathological states such as adult respiratory distress syndrome
- May occur in pathological states as myxedema
- May present in pathological states such as tetanus

## **Acute respiratory failure due to primary exchanger failure**

- Diagnosis of adult respiratory distress syndrome
- Diagnosis of cardiogenic acute lung edema
- Diagnosis of long-term pneumonia
- Diagnosis of pulmonary thromboembolism
- Diagnosis of atelectasis
- Diagnosis of asthmatic crisis
- Diagnosis of massive pleural effusion
- Diagnosis of alveolar hemorrhage
- Diagnosis of extensive pneumothorax

### **In a chronic form**

- Diagnosis of chronic airflow obstruction
- Diagnosis of diffuse pulmonary fibrosis

Respiratory failure due to primary ventilatory pump failure

### **In acute form**

- Diagnosis of respiratory center failure
- Diagnosis of traumatic brain injury
- Diagnosis of Guillain-Barré syndrome
- Diagnosis of myasthenia gravis
- Diagnosis of phosphorous organ poisoning
- Diagnosis of botulism
- Diagnosis of intermittent acute porphyria
- Diagnosis of hypokalemia
- Diagnosis of hypomagnesemia
- Diagnosis of hypophosphatemia

### **Of chronic origin**

- Thoracoplasty procedure
- Diagnosis of cyphoscoliosis
- Sleep apnea syndrome
- Diagnosis of primary alveolar hypoventilation
- Diagnosis of amyotrophic lateral sclerosis
- Diagnosis of Duchenne muscular dystrophy

## **Description of the pathophysiological mechanisms of hypercapnia**

The following concepts will be described below:

- Note that there is ventilator pump damage
- There is a reduction in the ventilatory impulse
- The existence of some morphological defects in the chest wall
- Presence of muscle fatigue
- Loss of mechanisms to exercise respiratory cycles
- When there is an impedance rise
- When there is a decreased amount of gas exchange

- When there is decreased functional residual capacity
- Anomalies in the V/Q ratio
- Intrapulmonary shunt
- When there are abnormalities in the ventilator pump and gas exchange

### **Pathophysiological mechanisms of fatigue**

- Increase in respiratory muscle load
- Increase in strength and duration of respiratory muscle contractions
- Increase in respiratory pressure index and diaphragmatic cycling time
- Increase in respiratory muscle energy demand with adequate flow of blood, oxygen and nutrients
- The physiopathological equation of fatigue is nothing more than the demand for respiratory work in conjunction with the split postload for blood input and output oxygen and nutrients

### **Development of hypercapnic respiratory failure**

- There is a decrease in the production of force in the amount of gaseous flow entering the ventilatory path
- There is a dysfunction of the inspiratory muscles
- There is an increase in impedance
- There is an increase in the conduction resistance of respiratory flow
- There is an increase in thoracopulmonary resistance

### **Causes of respiratory failure** **by central nervous system dysfunction**

- When there is the existence of sleep apnea
- When there is primary alveolar hypoventilation
- When there is the existence of metabolic alkalosis
- When there is severe malnutrition
- When there is hypothyroidism
- When there is the existence of drug use depressant the central nervous system

- When there is the existence of morphological damage of the central nervous system
- When there is the existence of tumors
- When there is sepsis
- When there is the existence of stroke

**Causes of respiratory failure due to peripheral nervous system dysfunction**

- When there is toxicological substance poisoning
- When there is the existence of botulism
- When there is aquatic animal poisoning
- When there is the existence of bilateral phrenic paralysis
- When there is diphtheria
- When there is intermittent acute porphyria
- When there is the existence of substances similar to cholinesterase
- When there is the existence of autoimmune diseases such as Myasthenia gravis
- When there is the existence of Eaton's syndrome Lambert
- When there is the existence of Charcot's disease - Marie - Tooth
- When there is the existence of Polyneuropathy
- When there is the existence of Guillain-Barré syndrome
- When the existence of Sclerosis Amyotrophic side of Charcot
- When there is polio
- When there is the existence of spinal trauma
- When there is the existence of metastatic infiltrative neoplasms of the spinal cord
- When there is the existence of hematomyelia
- When there is the existence of syringomyelia
- When there is the existence of transverse myelitis
- When there is the existence of spinal infarctions

**Causes of respiratory failure due to dysfunction of the respiratory muscles**

- When there is the existence of muscular dystrophies
- When there is the existence of myotonies
- When there is the existence of rhabdomyolysis

- When there is the existence of idiopathic periodic paralysis
- When there is polio
- When there is eosinophilic myalgia
- When there is the existence of infectious myositis
- When there is hypothyroidism
- When there is hyperadrenocorticism
- When the existence of diseases related to glycogen metabolism
- When there is the existence of hypophosphatemia
- When the existence of hypercalcemia
- When there is the existence of hypokalemia
- When there is the existence of hypermagnasemia
- When there is the existence of hypomagnasemia

### **Causes of respiratory failure for chest wall and pleura dysfunction**

This together is called impedance of which we have the following anomalies:

- When there is the existence of ankylosing spondylitis
- When there is the existence of Volet costal
- When there is fibrothorax
- When there is obesity
- When there is the existence of cyphoscoliosis
- When there is the existence of surgical procedures such as a thoracoplasty

### **Causes of respiratory failure due to upper airway dysfunction**

This together is called impedance of which we have the following anomalies:

- When there is the existence of epiglottitis
- When there is the presence of edema in the larynx due to both anaphylaxis and trauma
- When there is the existence of retropharyngeal bleeding

- When there is bilateral paralysis of the vocal cords
- When there is the existence of tracheal stenosis
- When there is the existence of tracheomalacia
- When there is the existence of hypopnea sleep apnea syndrome
- When there is an idiopathic airway obstruction
- When there is the existence of amygdalin hypertrophy
- When there is adenoidopathy
- When there is the existence of obstructive goitre

### **Causes of respiratory failure due to lung dysfunction**

- When there is the existence of respiratory failure

regroup

- ed chronicl
- When there is low acute airway obstruction
- Where there are severe airspace restrictions
- When pneumothorax is present
- When there is existence of massive pleural effusion
- When there is the existence of pneumomediastinum
- When there is the existence of interstitial emphysema
- When there is the existence of atelectasis
- When there is the existence of massive hemoptysis
- When there is obstruction of the pulmonary vasculature

### **Outline of the systems, apparatus and organs involved in lung physiology**

Below we detail the following designations:

- The intervention of the central nervous system
- The intervention of the peripheral nervous system
- Intervention of the respiratory muscles
- The chest wall intervention
- The intervention of the pleura
- Upper airway intervention
- The intervention of the extra-pulmonary compartment
- The intervention of the lungs
- Intervention of the lung compartment

## **Details of the clinical presentation of hypoxia and hypercapnia**

We will detail the following acapites:

- The presence of neurological failure
- The presence of personality changes
- The presence of mental confusion
- The presence of generalized anxiety syndrome
- The presence of seizures
- The presence of Coma
- The presence of circulatory compromise
- The presence of tachypnea
- The presence of tachycardia
- The presence of hypotension or hypotension of vascular disorders
- The presence of angor pectoris
- The presence of signs of hypoxemia
- The presence of tachypnea
- The presence of cyanosis
- The presence of headache
- The presence of sopor
- The presence of stupor
- The presence of seizures
- The presence of asterixis
- The presence of myoclonus
- The presence of papillary edema
- The presence of arrhythmias

### **Main causes of cardiovascular dyspnea**

- Diagnosis of heart failure
- The diagnosis of ischemic heart disease
- Diagnosis of congenital or valvular heart disease
- Diagnosis of myocarditis or pericarditis
- Diagnosis of cardiac arrhythmias
- Diagnosis of cardiac tumors

### **Main causes of intrapulmonary dyspnea**

- The diagnosis of pulmonary edema
- The diagnosis of bronchiectasis

- The diagnosis of pneumothorax
- The diagnosis of pulmonary embolism
- The diagnosis of pulmonary hypertension
- The diagnosis of interstitial lung disease
- The diagnosis of lung tumors
- The diagnosis of epiglottitis
- The diagnosis of laryngitis
- The diagnosis of tracheitis
- Diagnosis of laryngeal carcinoma
- Diagnosis of tracheobronchial stenosis
- The diagnosis of tracheal tumors
- The diagnosis of rhinopharyngitis
- The diagnosis of diphtheria
- The diagnosis of whooping cough
- The diagnosis of bronchiolitis
- The diagnosis of croup
- The diagnosis of tuberculosis
- The diagnosis of suffocation by immersion
- The diagnosis of suffocation by immersion
- The diagnosis of pleuropatias
- Diagnosis of acute cyphoscoliosis
- Diagnosis of bilateral diaphragmatic paralysis

### **Major causes of infrequent dyspnea**

- The diagnosis of hiatal hernia
- The diagnosis of obesity
- Diagnosis of generalized anxiety syndrome
- Diagnosis of panic attack syndromes
- The diagnosis of nervous hyperventilation syndrome
- Diagnosis of spinal cord paralysis
- The Diagnosis of hypopnoic obstructive sleep apnea syndrome
- The diagnosis of pulmonary hypertension by geographical altitude
- Diagnosis of hypersensitivity to toxicological substances
- The diagnosis of Volet costal
- The diagnosis of esophagopathies
- The diagnosis of thyroid goitre

**According to the American Thorax Society, chronic respiratory failure has the following characteristics:**

- Oxygen blood pressure is below 55 mmHg despite the respective medical therapy
- An oxygen blood pressure that is between 55 and 60 mmHg that is associated with pulmonary hypertension of causes such as polycitemia vera or in its defect Cor- pulmonale with a hematocrit greater than 55%
- Oxygen blood pressure is less than 55 mmHg during sleep exercise in all your cycles

# CHAPTER 5

## Mechanical ventilation and respiratory distress

**As for the medical conjectures on this disease we can say the following:**

- The installation clinical chart has an approximate amount of 7 days
- Visualization of bilateral pulmonary opacities with opacities at the level of the cost.-diaphragmatic and costophrenic recesses
- Kerley B-lines can also be seen as well as nodulations and sign of the butterfly as diffuse and intense opacity in radiological reading plus pleural effusions

**The assessment of pulmonary edema should be as follows:**

- Echocardiography
- Invasive surveillance

**The FIO2 must be programmed by the following parameters:**

- By the PAFI measurements
- With an approximate physiological PEEP of 5 to 8 cmH20
- Mild ADHD: PAFI between 200 - 300
- Moderate ARDS between 100 - 200
- Severe ARDS less than or equal to

**100 Causes of acute intrapulmonary**

**lung injury**

- Bronchopulmonary aspiration
- Pulmonary infection of a single infectious or heterogeneous focus being totally diffuse

- Pneumonia of bacterial origin
- Viral pneumonia
- Pneumonia caused by parasites
- Pneumonic patient with mycosis
- Pulmonary contusion
- Inhalation of toxicological
- Cases of suffocation by drowning
- Post-transplantation of lung

## **Extrapulmonares**

- Sepsis
- States of hypovolemic shock
- Fractures leading to Volez costal
- Injuries that produce injury of 2 or more body cavities
- Administration of blood products to the patient
- Acute pancreatitis with necrotizing phase
- Post-cardiopulmonary bypass lesions
- Transplantation of central circulation organs such as liver, heart, kidney and lung
- Toxicológicos

## **Factors complicating adult respiratory distress syndrome**

### **Pathological entities**

- States of Shock
- Aspiration of gastric content
- States of sepsis
- Lung disease cases

### **Surgical entities**

- Surgery of the spine
- Surgical interventions for acute abdomen
- Cardiac interventions
- Aortic vascular surgery

## **High-risk traumatic entities**

- Serious brain injury
- Injury by inhalation of toxic substances
- States of suffocation by drowning
- Pulmonary contusion
- Fractures causing multiple rib

## **High risk factors**

- Patients with a history of alcoholism
- Patients with a body mass index greater than 30
- States of Hypoalbuminemia
- Chemotherapeutic procedures
- FIO<sub>2</sub> greater than 35% or supplemental oxygen greater than 4 litres per minute
- Tachypnea with a respiratory rate greater than 30 x min
- Arterial oxygen saturation less than 95%
- Acidosis with a pHmetry below 7.35
- Decompensated diabetes mellitus

## **Factors that cause lung damage due to invasive mechanical ventilation**

- Presence of volutrauma
- Functional residual capacity as well as lung surface extent
- Presence of atelectrauma
- Lung volume magnification at the end of inspiration
- Level of PEEP
- Inspiratory cycling flow and flow parameters
- Respiratory cycling per minute
- Vascular capacitance pressure
- Extent of initial injury

## **Predictors of NIHL failure**

- Patients over 40 years of age
- Inability of patient ventilator synchronization
- Lack of control over air leakage by VMNI mask

- Failure to improve tachypnea and oxygenation in the first hours of ventilatory treatment
- Presence of moderate or acute respiratory distress
- Increased respiratory rate in VMNI mode
- Patient who needs vasopressors
- Patient who needs kidney replacement

### **Management of respiratory distress with mechanical ventilator**

- The mechanical fan is programmed in assisted mode or IPPV
- Tidal volume amount is 6L/min
- Channel breathing rate between 12 to 35 breaths per minute
- Pressure Plateau not exceeding 30 cmH2O
- Program the mechanical fan with an inspiratory oxygen fraction of 100%
- Place a PEEP of 8, 12 or 15 cmH2O
- Calculation of the ideal weight in men is  $50 + 2.3 \text{ per height in centimeters divided by } 2.5$  -60 in men
- Calculation of the ideal weight is  $45.5 + 2.3 \text{ per height in centimeters divided for } 2.5 - 60$
- Once the PAFI is in a range greater than or equal to 200 the PEEP should immediately fall because it has no utility and avoids the consequence of a barotrauma

### **Alveolar recruitment manoeuvres**

- Sustained pressure or ventilatory mode in CPAP of 40 cmH2O for 30 to 45 cm seconds
- The airway pressure represented as Pmax should be maximum up to 60 cmH2O with a PEEP of 45 cmH2O
- The key maneuver of alveolar recruitment is the continuous elevation of the PEEP as the ventilatory therapy process is carried out on the patient
- The way to visualize the progress of alveolar recruitment is with a chest computed tomography
- It can also be evaluated with electrical impedance tomography

## **Ventilation in prone position**

- Has utility due to the most prominent physiopathological mechanisms of oxygenation
- Improving the postero-basal oxygenation regions thus decreasing the pulmonary short circuit shunt
- There is a multi-center study in which it is established that a PAFI less than 150 with a FIO<sub>2</sub> greater than 60% and PEEP greater than or equal to 11 cmH<sub>2</sub>O decreased mortality as a result of therapeutic maneuvers

## **Drugs administered in the respiratory distress**

- They are drugs that give the patient's musculature
- Its prolonged use produces muscular atrophy and the difficult way of ventilatory weaning
- Once the patient is weaned as recovery progresses, the existence of critical patient Polyneuropathy should be evaluated
- A study has been done in which it is established that a PAFI less than 150 cmH<sub>2</sub>O with a continuous drip the pulmonary oxygenation arrives much faster

## **Corticoids**

- They have anti-inflammatory activity inhibiting the production of cytokines
- At high doses they have a stabilising effect on cell membranes

## **Concepts of immuno-nutrition**

- The pathophysiological principles of respiratory distress is an increased catalytic metabolism due to imminent inflammatory response
- Feeding should be started early
- The preferred route of administration is enteral, nasogastric or naso-junel

- The dose is approximately 25 cal/kg and a protein intake of 1.2 - 2g/kg/day
- This already established diet plus the use of omega 3 is useful to decrease the inflammatory response

### **Genetic therapy**

- Lung injury can be mitigated by genetic decoding of the keratinocyte growth factor
- The release of pro-inflammatory cytokines can be reduced with genetic modifications of IL-10
- Apoptosis and the release of pro-inflammatory substances can be somewhat reduced with heme oxidase

# CHAPTER 6

## Mechanical ventilation during circulatory support

### Designation of devices for circulatory assistance

The following is a list of the instruments for advanced life support procedure:

this

- The use of aortic counter-pulsation balloon is valued and pumps are used as:
  - Roller pumps
  - Centrifugal pumps
  - Using advanced life support ECMO Artificial ventricles

These may be:

- Of pneumatic material
- Of electromechanical material

According to their type of function they may be:

- With left ventricular assist functionality
- With right ventricular assist functionality
- With functionality for biventricular assistance

### Detail of hemodynamic parameters to indicate mechanical circulatory assistance

- The heart rate functionality is taken to be less than 1.8L/m/min
- An average blood pressure below 60 mmHg is taken
- Left atrium pressure that should be greater than 20 mmHg
- Decreased 20 ml/h diuresis maintained
- Maximum organ-caring inotropic support is given

central circulation indicator

### **Details of indications for extra-corporal life support**

- A total static pulmonary distensibility is programmed in which it must be less than 0.5 ml/cmH20/Kg
- There must be an intrapulmonary shunt greater than 30% with FIO2 greater than 60%
- The time of mechanical ventilation should not be more than 10 days
- Use measures for reversible clinical pictures **Nomination**

### **of indications for mechanical ventilation Physiological**

#### **indications**

- Management of arterial and venous gases
- Management of respiratory inputs and outputs with V/Q balance
- Reduction of inspiratory and espiratory force

#### **Clinical indications**

- Reversal of hypoxemia
- Reversal of acidosis states
- Rest of the muscles of respiratory cycling
- Decrease in intracranial pressure
- Decrease in systemic oxygen consumption

# CHAPTER 7

## Non-invasive mechanical ventilation

While true this part of mechanical ventilation is very important especially for the ventilatory progress in which the patient while having a better synchrony patient ventilator the total weaning of mechanical ventilation will be less traumatic

### Indications

- That the patient has sleep apnea- hypopnea or also called SAHOS
- Patients they have a re-diagnosis of your chronic obstructive pulmonary disease
- Pneumonic states in which there is acute respiratory insufficiency not hypercapnia
- States of stable chronic obstructive pulmonary disease
- Presence of bronchiectasis
- Diagnosis of amyotrophic lateral sclerosis
- Diagnosis of cyphoscoliosis or restrictive disease
- Pulmonary hypoventilation syndrome
- Patients with diseases immunosuppressive and that have pneumonia
- Postpneumonectomy syndrome
- Ventilatory disconnection
- Diagnosis of acute lung edema
- In unique situations of metabolic surgery
- In postoperative COPD situations
- Palliative care

### Contraindications

- Irritable patient with inability to cooperate
- Intolerance to positive pressure system
- Poor management of lung secretions

- Encephalopathic states with neurological impairment
- Upper digestive hemorrhage
- Hemodynamic instability
- Cardiac electrical disorders of the heart
- Foreign body in airway
- Astyolia
- Multiple organ dysfunction
- Facial deformities
- Facial trauma
- Neurosurgery and maxillofacial surgery

## **Complications**

- Ulcerations of the nose
- Bronco-small aspirations
- Conjunctivitis
- Distension of stomach
- Rebreathing de CO<sub>2</sub>
- Cardiac arrhythmias
- Hemodynamic instability
- Claustrophobia
- Delay in orotracheal intubation

## **Mechanisms by which VMNI fails**

- Proper pressure support does not guarantee a good level of the alveolar volume
- Lack of upper airway permeability
- Misapplied interface
- Lack of patient ventilator synchrony

## **Systemic evaluation of NIV**

- evidence of improvement such as drowsiness, dyspnea and marked respiratory fatigue
- Degree of patient acceptance and satisfaction
- Sleep assessment is ideal
- Partial oxygen pressure and carbon dioxide partial pressure period estimation
- Oxygen saturation at night under ventilation with or without

## Capnografia continua transcutanea

### Management of NIHL in renal failure

- Diaphragmatic activity should be assessed
- A general examination of the patient's respiratory clinic should be performed
- Evaluation of the patient ventilator Asynchrony
- Position the patient at an approximate angle of 30 and 45 degrees in the most comfortable position
- Fits a mask that covers the largest dimensions of the face without leakage through any slit of the same
- The patient is programmed with PSV of 5cmH<sub>2</sub>O
- A 3cmH<sub>2</sub>O PEP is programmed
- The target volume is 5 to 7 ml/kg
- There should be a ventilation frequency of less than 30 breaths per minute
- The change of PEEP is modified according to the production of autoPEEP
- The FIO<sub>2</sub> is adjusted with oxygen saturation values between 88 to 92%
- Leak verification is essential for that the fan adequately compensates
- The respective humidification of the ventilation system is carried out
- The evaluation of dyspnea gives us an idea of arterial gases and ventilatory mechanics
- If the patient does not tolerate NIHL, the option of switching to invasive mechanical ventilation should be considered
- If the airway pressures are greater than 20 cmH<sub>2</sub>O so proceed to place the mask with a system of harnesses

### Complications

- Ulcerations of the nose
- Bronco-small aspirations
- Conjunctivitis
- Distension of stomach
- Rebreathing de CO<sub>2</sub>
- Cardiac arrhythmias
- Hemodynamic instability

- Claustrophobia
- Delay in orotracheal intubation
- Presence of hypotension or hemodynamic instability in patients who do not have a satisfactory pre-load greater than 20cmH20 IPAP and/or 8 to 10 cmH20 EPAP
- Arrhythmias in patients with coronary artery disease

## **Contraindications**

- Irritable patient with inability to cooperate
- Intolerance to positive pressure system
- Poor management of lung secretions
- Encephalopathic states with neurological impairment
- Upper digestive hemorrhage
- Hemodynamic instability
- Cardiac electrical disorders of the heart
- Foreign body in airway
- Astyolia
- Multiple organ dysfunction
- Facial deformities
- Facial trauma
- Neurosurgery and maxillofacial surgery
- Glasgow coma scale less than 10

## **Advantages of using NIHL in patients with COPD**

- Improved survival
- Improve days of hospital stay
- Improve the days of ARM
- Reduces times of orotracheal intubation
- Indicators of clinical improvement are the decrease in respiratory rate, heart rate and ventilatory mechanics
- Must oscillate with an APACHE II scale less than 29 to have a higher success rate in critical patient
- There should be minimal leakage from the Interphase
- Improvement of respiratory acidosis in the first hour and 2 hours
- Improvement of the mental state if the patient had a clinical picture of narcosis due to marked hypercapnia

## **Relationship between anomalies of the arterial gases and its manifestations as a clinical picture**

- A Pemax less than 40 cmH<sub>2</sub>O produces an ineffective cough
- Peak expiratory flow with cough less than 160 L/min may present incapacity for cannulation
- Pdimax less than 30 cmH<sub>2</sub>O may present Orthopnea
- A vital capacity less than 20%, VN and Pimax less than 1/3 VN has a higher chance of chronic hypercapnia
- Pimax less than 50% VN increased likelihood of sleep disturbances
- Vital capacity of 1- 1.5 L or lower has a higher probability of CO<sub>2</sub> blood pressure greater than 45 mmHg
- Vital capacity less than 1 litre and Pimax less than 30 cmH<sub>2</sub>O may present a high risk of decompensation for respiratory infections

## **Clinical determinations of chronic respiratory failure with NIHL**

The following concepts are detailed:

- Hypercapnia may occur in the chronified day with a partial pressure of carbon dioxide greater than or equal to 45 mmHg
- Presence of hypercapnia at night with a blood pressure of carbon dioxide greater than or equal to 50 mmHg
- Presence of diurnal normocapnea with a night-time increase in transcutaneous carbon dioxide partial pressure greater than or equal to 10 mmHg
- Rapid and significant reduction in vital capacity

## **Other indications of NIHL**

- Prior to elective spinal surgery when vital capacity is less than 60% or forced expiratory volume in the first second

- with FEV1 less than 40%
- Gestational stage with thoracopulmonary restriction
- Within palliative treatment for dyspnea

## **Nocturnal consequences in the improvement of nocturnal hypercapnia**

The following determinations have been made:

- Decreased activity of respiratory muscles
- There is an improvement in pulmonary and thoracic distensibility as a result of decreased activity of the respiratory muscles
- There is an improvement in the sensitivity of the respiratory centers
- Sleep cycles become much more satisfying

## **Objectives of the VMNI in neuromuscular diseases**

- Relief of symptomatology
- Reduction of inspiratory and espiratory work
- There must be an improvement in gas exchange
- Optimisation of patient comfort
- Perform a patient fan synchronization
- Assessment of risk minimisation
- Avoids situations in which intubation is necessary
- Long-term improvement in quality of life and circadian rhythm
- Long-term functional improvement of the person
- Long-term improvement in survival

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