



Respiratory failure: defined as impairment of the respiratory function so that the arterial oxygen tension (Pao₂) is below 60 mmHg or the arterial Carbone dioxide tension (Paco₂) exceed 50 mmHg when the pt. is at rest, breathing air at sea level

□ **Types of respiratory failure**

Type I respiratory failure

A. acute type I RF, low Pao₂ with normal or low Paco₂

Develop rapidly in cases like pulmonary oedema, pneumonia, ARDS

B. chronic type I RF low Pao₂ with normal Paco₂

□ **Causes:** fibrosing alveolitis, Interstitial lung disease, chronic pulmonary oedema

Type II respiratory failure

a. Acute type II resp. failure: low pao₂ and high paco₂

Causes:

Upper air way obstruction, inhaled foreign body, acute epiglottitis, laryngeal oedema, bilateral vocal cord paralysis, sever acute asthma, Chest injuries (tension pneumothorax, massive haemothorax, flail chest), Brain stem and cervical cord lesions, Paralysis of the resp. muscles, Poisoning with narcotics and other drugs.

Chronic type II resp. failure:

Low Pao₂ and high Paco₂

Causes: e.g. chronic bronchitis and other progressive resp. disease

Type of resp. failure to be admitted to the ICU

1. Damage of resp. center in the brain e.g. (drug intoxication, status epilepticus, eclampsia, head trauma and CVA)
2. Upper motor neuron lesions e.g. High cervical spinal injury (above C4)
3. Lower motor neuron lesion e.g. Poliomyelitis
4. Peripheral nerves disease (Gillian barre syndrome, tetanus)
5. Myoneural junction diseases, (Myasthenia gravis, muscle



relaxants)

6. Structural impairment of chest walls e.g. Flail chest
7. Upper resp. tract lesions: (Epiglottitis, bilateral vocal cord paralysis, laryngotracheobronchitis (croup))
8. Lower resp. tract diseases: (Status asthmaticus, aspiration e.g. Gastric contents, food, muconium or foreign body)
9. Alveolar diseases (parenchymal): Pulmonary constriction, pulmonary oedema, near drowning, adult or neonatal resp. distress syndrome.

The clinical diagnosis of resp. failure

It is based on 2 facts

- a. The disease itself direct the attention
- b. The effects of hypoxemia on CNS, CVS, AND RESP. SYSTEM

1. The effect of hypoxemia on the brain

Restlessness, anxiety, apathy, exhaustion, disorientation, finally coma

2. The effects hypoxemia on the CVS

Dusky coloration of the skin and mucous membranes, which may progress to cyanosis ,Pallor occur due to sympathetic over activity .Cold moist extremities (sweating), tachycardia, ectopic beats or dysrhythmia

3. The effect of hypoxemia on the resp. system

Tachypnea, dyspnea, shallow breaths, or irregular and grunting resp. use of accessory muscles of respiration, tracheal tug, and difficult speech .

*if 2 of the previous 3 points are present then resp. failure is surely present

* If the all 3 points are present then the patient is in extreme danger and cardiac arrest may occur if the patient is not treated.

□ Treatment of resp. failure

1. Supplementary oxygen e.g. By mask , nasal cannulaetc



2. Tracheal intubation

Indications are:

- I. Loss of protective upper air way reflexes
- II. Loss of effective cough
- III. Coma
- IV. For mechanical ventilation

Routes: I. supraglottis (nasal, oral)

II. Infraglottis: tracheotomy

* Nasal intubation

Advantages: 1. Provide greater stability with fixation, 2. better tolerated by the pt.

Disadvantages

Trauma, infection, ulceration of external naris, difficult in suction of secretion .

*oral intubation

Advantages :

1. Permit the use of large internal diameter tubes , this facilitate suctioning and the passage of fibro optic bronchoscope

Disadvantages :

Poorly tolerated by the patient and difficult to be fixed

If intubation is intended to be continued more than 10 days then tracheotomy should be done, otherwise there is a high risk of upper air way complications e.g. (laryngeal stenosis, and vocal cord paralysis)

Complication of supra or infra glottis are

Tracheal stenosis :Tracheomalacia at the site of mucosal contact with cuff of the tube

3. Mechanical support of ventilation.

Judged on clinical grounds e.g. Fatigue, and pulmonary measurement e.g.



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Msc. Ali Fadhil
alifadhilz@uomus.edu.iq

inadequate tidal volume or blood gas estimation

I. Clinical indices.

- a) Resp. rate is more than 35 breath per minute
- b) Evidence of fatigue of resp. muscles (rapid shallow respiration, deterioration of consciousness)
- c) Tidal volume is less than 5 ml/Kg
- d) Vital capacity is less than 15ml /Kg
- e) Maximum insp. Force is less than 25 cm H₂O
- f) Forced expiratory volume in 1 sec. (FEV₁) is less than 10 ml/Kg
- g) Minute ventilation less than 3L/min or more than 20

II. Respiratory gas tension

- a) Pao₂ is less than 70 mmHg despite an inspired O₂ that exceed 40%
- b) Alveolar /arterial po₂ difference is more than 450 mmHg when breathing 100% O₂
- c) Arterial PCO₂ is more than 56 mmHg and it is increasing (in the absence of chronic hypercapnea)
- d) The ratio of physiological dead space /tidal volume (VD /VT ratio) is more than 0.6

Initial ventilator setting

- Using flow generator because it compensates for the change of compliance and air way resistance changes
- FIO₂ =50% O₂
- VT =10 -15 ml/Kg
- Frequency 8 -12 /min
- Insp./Exp. Ratio =1/2 -1/3
- Insp. Pressure 20 cm H₂O
- Pressure support 20 cmH₂O
- Flow trigger 2L/min
- Pressure trigger -1 to-3 cm H₂O
- Sighs. Nil, formerly thought to prevent atelectasis, but no longer considered effective
- Subsequent adjustment of ventilator is needed according to the measurement of Pao₂, Paco₂, pH



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Msc. Ali Fadhil
alifadhilz@uomus.edu.iq

- Initial mode of ventilation is volume controlled mode
- Assisted controlled mode is used if the pt. is able to produce negative pressure of less 5 cm H₂O
- PEEP, it is recommended when Pao₂ is less than 60 mmHg when Fio₂ is 50%. When PEEP is high (>15cm H₂O) may over- distend open alveoli thereby causing compression of alveolar capillaries resulting in decrease of v/Q ratio
- Best PEEP is the one which improve pao₂ without decreasing the cardiac output.

ICU

By : MSc. ALI FADHIL

3rd stage