•REGULATION OF RESPIRATION -NERVOUS REGULATION

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•OBJECTIVES

By the end of this session, the student should be able to:

- Identify CNS regions (respiratory centers) that share in the

generation and control of cyclic breathing.

- Describe receptors and neural pathways of the reflexes involved in regulation of respiration
- The spontaneous respiration is regulated by two mechanisms
- Nervous Regulatory Mechanism
- Chemical Regulatory Mechanism
- **NERVOUS REGULATORY MECHANISM**

- Automatic Control of Respiration
- Brainstem
- Voluntary Control of Respiration
- Cerebral cortex

- Automatic Control Of Respiration

It is brought about by two centre located in the brainstem

- Medullary respiratory center
- Pontine respiratory center

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Medullary respiratory center

- It consists of two types of neurons – **I** neurons and **E** neurons that are active during inspiration and expiration only respectively.
- These neurons are located in two groups in the medulla
- Dorsal respiratory group

- Ventral respiratory group
- **Dorsal Respiratory Group–**
- Near Nucleus Tractus Solitarius
- Consists of primarily inspiratory(I) neurons
- Basic rhythm of respiration is generated here in the form *inspiratory ramp signals.*
- Receive afferents from airways and chemoreceptors
- **Ventral Respiratory Group–**
- Near nucleus ambigous and retroambigous.
- Inactive during normal quiet breathing

- Contributes to the extra respiratory drive.

Inspiratory(I) and Expiratory(E) neurons have *reciprocal innervations.*

Inspiratory Ramp Signal:

- It begins weakly and then increases steadily in a ramp manner for about 2 seconds ,ceases abruptly for approx. 3 seconds which allows elastic recoil of the lungs and chest wall to cause expiration, and then another cycle begins.

- The advantage of the ramp signal is that it causes a steady increase in the volume of the lungs during inspiration., rather than inspiratory gasps.

• Pontine Respiratory Center

- It is subdivided into two groups
- **Lower Pons–**
- Called apneustic center
- Tonically active and activates the *I neurons*
- Inhibited by the afferents from the vagus nerve from airway and the lungs.

- **Upper Pons–**
- Called Pneumotaxic center
- Contains *both I and E neurons*
- Active in both phases of respiration
- Inhibits neurons in lower pons.

- Thus rhytmicity of the neurons in the medullary respiratory center is spontaneous but it is modified by
- Neurons in the Pons

- Afferents in the vagus nerve from receptors in the lungs and airways.

- **Voluntary control of respiration**
- Acts through *the* *corticospinal tract* which originates from the cerebral cortex to end on the spinal motor neurons innervating the respiratory group of muscles. Thus this pathway bypasses the medullary respiratory neurons.

- Factors affecting respiratory center

Hering-Breuer Inflation Reflex:

- Steady inflation of the lungs stimulates *the stretch receptors* in the walls of bronchi and bronchioles, this in turn stimulates the vagus nerve. The vagus nerve then inhibits the apneustic centre thus switching off the inspiration .
- This is a protective mechanism preventing excess inflation of the lungs. The threshold for this reflex is tidal volume more than 1.5 litres(T.V.≥1.5l)

Afferent from pharynx trachea and bronchi-from trachea to bronchioles there are myelinated nerve endings of vagal fibres that function as *Irritant Receptors.*

- **Cough reflex**-deep inspiration followed by a forced expiration against a closed glottis. The glottis is then suddenly opened producing an explosive outflow of air.
- **Sneezing reflex**-it is a similar expiratory effort with a continuously open glottis.

- **Swallowing or deglutition reflex**- During swallowing movement respiration is inhibited(*deglutition apnea)*. Afferent from glossopharyngeal nerve(IX) inhibits the respiration. This reflex is protective in nature and prevents

aspiration of food particles into the respiratory tract.

- **Hiccup** –spasmodic contraction of diaphragm producing an inspiration during which glottis suddenly closes producing a sound.

Afferent from Baroreceptors and Chemoreceptors:

- **Baroreceptors**– Baroreceptors in carotid and aortic sinus get stimulated by high blood pressure and cause inhibition of respiration by inhibiting respiratory center.

- **Chemoreceptors**– Chemoreceptors in aortic and carotid bodies get stimulated by low oxygen and high carbon dioxide. These impulses through vagus and glossopharyngeal nerve increase rate and depth of respiration.

•SUMMARY

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- Describe receptors and neural pathways of the reflexes involved in regulation of respiration

THANKS .....