MATRIC NUMBER: 17/MHS01/033

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COURSE: NEURO PHYSIOLOGY

ASSIGNMENT: THE PHYSIOLOGY OF SLEEP

1. Discuss the physiology of sleep.

Sleep is known as a state of unconsciousness from which an individual can be roused from. The individual is unaware of the environment and is unable to perform activities that require consciousness. The individual can be roused from sleep by sensory stimuli or other stimuli.

The **sleep-wake cycle** is one of the body’s regulatory mechanisms, and it has a circadian rhythm of about 24h. In new borns, the cycle has many cycles and it isn’t established until about 2years of age. In adults, it spans about 7-8hours of sleep and 16-17hours of wakefulness.

**TYPES OF SLEEP**

There are different types of sleep:

1. **Non-rapid Eye Movement Sleep (NREM):** this is the type of sleep without the movement of the eyeballs. It is also called slow-wave sleep because brain waves are very slow during this type of sleep. Dreams don’t occur in this sleep, and it makes up about 70-80% of total sleeping period. It is followed by Rapid Eye Movement Sleep (REM).

2. **Rapid Eye Movement Sleep**: REM sleep is the type of sleep associated with rapid conjugate movements of the eyeballs, which occurs frequently during the period. It makes up about 20%-30% of sleep time, and though the eyeballs move, the sleep is deep. It is important as it plays an important role is consolidation of memory. Dreams also occur during this period.

**FACTORS AFFECTING SLEEP**

Sleep is affected by a series of factors. Behavior wise, sleeplessness reliably and substantially influences sleep. Alternately, anxiety and emotional stimuli that release epinephrine prevent sleep and cause the activation of RAS.

The following other factors favor an individual’s experience of natural sleep to a modest degree:

1. Darkened room

2. Silence

3. Physical and mental relaxation

4. Comfortable surrounding temperature

5. Sex

6. Hunger

7. Low frequency stimulation.

**STAGES OF SLEEP**

Stage 1: Stage of drowsiness

Alpha waves are diminished and abolished. EEG shows only low voltage fluctuations and infrequent delta waves.

Stage 2: Stage of light sleep

It is characterized by spindle bursts at a frequency of 14 per second, superimposed by low voltage delta waves.

Stage 3: Stage of Medium sleep

In this stage, the spindle bursts disappear. The frequency of delta waves decreases to 1 or 2 per second and amplitude increases to 100microvolts.

Stage 4: Stage of deep sleep

Delta waves become more prominent with low frequency and high amplitude.

**MECHANISM OF SLEEP**

Sleep occurs as a result of the activity of **sleep inducing centers** in the brain. Damage to these centers results in insomnia.

**Sleep centers** are complex pathways between the reticular formation of brainstem, diencephalon and cerebral cortex that are involved in the onset and maintenance of sleep. The two centers that induce sleep are on the brainstem. They are

1. **Raphe Nucleus**: it is situated in the lower pons and medulla. Its activation results in **NON-REM** sleep. It is due to the release of **serotonin** by the nerve fibers arising from this nucleus.

2. **Locus Ceruleus of Pons**: its activation produces REM sleep. It is by the release of nor-adrenaline.

Some other areas of the brain that influence sleep have recently been identified in animals.

Inhibition of Ascending Reticular Activating System (ARAS) results in sleep because it is responsible for wakefulness, due to its afferent and efferent connections with the cerebral cortex. Inhibition of ARAS leads to permanent somnolence, that is coma.

**SLEEP DISORDERS**

1. Insomnia: this is the inability to sleep, or abnormal wakefulness. It’s the most common sleep disorder, and happens as a result of systemic illness or mental conditions such as psychiatric problems, alcohol addiction and drug addiction.

2. Hypersomnia: this is excess sleep or excess need to sleep. Its causes are lesions in the third ventricle, brain tumors, encephalitis, chronic bronchitis and disease of muscle. It also occurs in endocrine disorders such as myxedema and diabetes insipidus.

3. Nightmare: it is a condition during sleep that is characterized by a sense of extreme uneasiness or discomfort or by frightful dreams. It mostly occurs during REM sleep, and the individual wakes with a troubles state of mind. It occurs during drug withdrawal, alcohol withdrawal, improper food intake, digestive disorders or nervous disorders.

4. Nocturnal Enuresis: this is involuntary voiding of urine while sleeping. It is also called bet wetting.

5. Narcolepsy and Catalepsy: narcolepsy is the attack of sudden sleep. Cataplexy is sudden putburst of emotion. They are both hypothalamic disorders.

2. Discuss the role of the basal ganglia in controlling movement.

Basal ganglia refers to the scattered masses of gray matter submerged in subcortical substance of the cerebral hemisphere. It forms part of the extra pyramidal system, which is concerned with motor activities.

**COMPONENTS OF BASAL GANGLIA**

1. Corpus stiatum

2. Substantia nigra

3. Subthalamic nucleus of Luys

**THE ROLE OF BASAL GANGLIA IN REGULATING MOVEMENT**

i. Regulation of Voluntary Movement: voluntary motor activity is initiated by the cerebral cortex. It is however regulated by the basal ganglia, which works closely with the cerebral cortex. When there are lesions on the ganglia, the control mechanism is lost, and movement becomes inaccurate and awkward.

Basal ganglia has the ability to control motor activities because of the neuronal circuits between the basal ganglia and other parts of the brain involved in motor activity. Neuronal circuits arise from the three areas of the cerebral cortex:

1. The premotor area

2. The primary motor area

3. The supplementary motor area.

ii. Regulation of Conscious Movements: fibers between the cerebral cortex and caudate nucleus are concerned with regulation of conscious movements. It is also known as the cognitive control of activity. An example is when a person hears the angry buzz of bees, understands the danger and runs the other way.

iii. Regulation of Subconscious Movement: Cortical fibers reaching putamen are directly concerned with regulation of some subconscious movements, which take place during trained motor activities, that is, skilled activities such as writing the learnt alphabet, paper cutting, nail hammering etc.

**CLINICAL CORRELATES**

1. Chorea: It means rapid jerky movements and it refers to abnormal involuntary movement. Its due to lesion in caudate nucleus and putamen, and it involves the limbs.

2. Athetosis: this is another type of involuntary movement, but it refers to slow rhythmic and twisting movements. It is also caused by lesions on the caudate nucleus and putamen.

3. Parkinson’s Disease: it is a slowly progressive degenerative disease of the nervous system that is associated with destruction of brain cells which produe dopamine. It is also known as Parkinsonism or agitans.

Parkinson’s disease is caused due to lack of dopamine due to damage of basal ganglia. This is caused by destruction of substantia nigra and the nigrstriatal pathway, which has dopaminogeric fibers. Damage of the basal ganglia usually occur cause of the following:

i. viral infection of the brain e.g encephalitis

ii. cerebral arteriosclerosis

iii. injury to basal ganglia

iv. unknown causes. This is also called idiopathic parkinsonism.

v. destruction or removal of dopamine in basal ganglia. It is also known as drug-induced parkinsonism.

Symptoms of Parkisons are:

a. Tremor

b. Slowness of movement

c. Poverty of movements

d. Rigidity

e. Gait

f. Speech problems

g. Emotional changes

h. Dementia.