

The Inter-Relationship of the Pulmonary System, the Neuro System and Sleep

Our practice, Texas Pediatric Specialties and Family Sleep Center, has incorporated pediatric sub-specialties and adult specialties into a comprehensive medical practice based on the inter-relationship between the pulmonary system, the neurological system and the effects of both on sleep or the reverse.

First a brief overview of sleep, a key process to overall health. Many of the body's functions, regulations and systems change during sleep. The cardiovascular system experiences a change in heart rate and blood pressure as controlled by the autonomic nervous system. The sympathetic nerve activity decreases during the NREM stage of sleep (non-rapid eye movement). The respiratory(pulmonary) system changes the ventilation and respiratory flow during sleep. There is hypoventilation due to reduced pharyngeal muscle tone during the NREM stage of sleep. The cough reflex is relaxed as well. While cerebral blood flow and metabolism is decreased during NREM, there is increase in certain regions of the brain during REM (rapid eye movement). The renal system has decreased excretion of electrolytes, the urine concentrates and thus there is reduced flow. The endocrine system controlling a variety of hormones will produce growth hormone during the first hours after sleep onset. Our brainstem exhibits both sleep generating systems, where neurons shut down, and wake generating systems, whereby there is an ascending arousal system activating the forebrain.

The stages of NREM and REM are the stages of sleep as we drift from a transitional sleep-stage cycling to a slow wave cycle in NREM, and then a sawtooth wave form, dreaming, low muscle tone stage in REM sleep, your deeper sleep. Our circadian rhythm is the rhythm of our physiology and behavior that regulates our sleep patterns and thermoregulation of the body. Our sleep patterns change as we age.

Neurobiology of Sleep and Wakefulness

Believe it or not, sleep loss and sleep disorders are a common health problem. An estimated 50 -70 million people suffer from chronic sleep disorders which impairs their daily functioning, compromises their health and decreases their quality of life.

The "sleep-wake switch" is our thalamus, hypothalamus and forebrain. Conditions associated with problems in these organs are insomnia, narcolepsy, circadian rhythm disorders, and impaired sleep due to neurological disease. The brainstem functions as an on/off control mechanism for sleep. The homeostatic regulation of sleep is known as Process S (sleep) and the circadian rhythm is known as Process C (circadian), thus forming the "master clock".

