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THE RESPIRATORY RHYTHM IN NERVOUS DISORDERS*

CLARENCE W. OLSEN, M.D.

Of late years there has been growing interest in the respiratory rhythm in relation to various nervous disorders. Two circumstances potent in stimulating this interest are the remarkable modifications of respiration in some cases of epidemic encephalitis and the discovery that tetany can be produced in some individuals by hyperventilation alone.

The rhythm of respiration can be affected in several ways. For the present purpose three fundamental types of dysrhythmia will be discussed separately, under these headings: periodic breathing, apnea, and hyperventilation.

PERIODIC BREATHING

Our knowledge of disturbances in respiratory rhythm can be traced back to the Hippocratic writings, which contain a description of periodic breathing. This abnormal rhythm is known as Cheyne-Stokes respiration. John Cheyne (1818) described it in connection with a case of apoplexy due to a hemorrhagic lesion of the left cerebral hemisphere. William Stokes (1854) emphasized the terminal nature of the symptom. However, a similar pattern is sometimes observed during sleep, fatigue, and lowered oxygen tension. It consists of alternating periods of arrest in expiration and regular respiration which may build up to a peak of hyperventilation between gradually deepening and diminishing inspirations.

APNEA

Apnea is of two types, depending on the

phase of respiration in which the movements are suspended.

Breath holding is a form of expiratory apnea that occurs in crying children. After a full expiration the child suddenly becomes silent, with arrest in the expiratory phase. In consequence of this, cyanosis, syncope, or even convulsions occur. Nevertheless, it is stated that neither death nor injury to the nervous system results from this type of attack. It is a symptom of emotion, and one that is uncommon after the age of five years. It will be noted that breath holding follows expiratory effort with constricted glottis.

The other type of apnea occurs in the inspiratory phase. It is normally associated with physical effort, such as weight lifting, jumping, pushing, or straining at stool. A grunting type of expiration usually follows the period of apnea. Repeated respirations of the grunting type are commonly seen in infants and also in adults who suffer from emotional stress. It occurs with anger and fear, and it frequently accompanies pain. It is related to the Valsalva phenomenon, and may have serious physical consequences. The original description of this is quoted by Dawson as follows: If the glottis be closed after a deep inspiration, and a strenuous and prolonged respiratory effort be made, such pressure can be exerted on the heart and intrathoracic vessels that the movement and flow of the blood are temporarily arrested.

HYPERPNEA

It is not a new observation to recognize that heavy breathing frequently accompanies emo-

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tional tension. Many individuals who hyperventilate constantly are unaware of it. They are, however, almost without exception conscious of certain symptoms that can be initiated or aggravated by voluntary forced respiration.

In 1920 Collip and Backus studied the effects of hyperpnea on the carbon dioxide combining power of the plasma, the carbon dioxide tension of the alveolar air, and the excretion of acid and basic phosphate and ammonia by the kidney. Also in 1920 Grant and Goldman reported the experimental production of tetany by forced respiration. Barker and Sprunt (1922) observed tetany associated with hyperventilation in "a psychoneurotic patient convalescent from encephalitis." With these observations as a starting point, there have appeared during the past twenty-five years numerous articles dealing with the phenomena associated with hyperventilation.

The important chemical changes in the alveolar air, the blood plasma, and the urine are briefly as follows: The carbon dioxide tension of the alveolar air is diminished by half; the carbon dioxide combining power of the plasma drops correspondingly, and there is distinct increase in the alkalinity of the blood; in the urine, there is decreased acidity with lowered content of ammonia, and increased concentration of phosphates, accompanied by diuresis.

The remarkable symptoms of voluntary hyperpnea are described by Best and Taylor (1945), using the data collected by Fidler. There may be exhilaration or collapse. Tetany is evident in varying degree, and in various muscle groups. A common effect is a peculiar change in the expression of the eyes, due to contraction of the surrounding muscles, and especially the inner part of the upper lid. Tremors and even clonic movements can occur. Temperamental changes are apparent. The subjective experiences are numerous.

They have been compared to mild intoxication, or feelings experienced in sudden rise to high altitude. On recovery, the individual may recognize that his senses have been dulled appreciably.

CLINICAL CORRELATIONS

Nielsen and Roth (1929) made a study of the correlation of respiratory tracings with clinical diagnoses. They had available 20,000 spiograms recorded by the Benedict-Roth apparatus, incidental to the determination of metabolism. "An irregular irregularity of the inspiratory and expiratory lines" they found to be associated with clinical diagnoses of "hypotension, neurotic and psychotic states, mucous colitis and endocrine disturbances." The authors conclude that the respiratory types are not caused by abnormal physical states.

Finesinger, (1943) also using the Benedict-Roth tracings, found frequent sighing and major fluctuations of the respiratory depth to be strongly indicative of psychoneurosis. The greatest incidence of irregularity occurs in anxiety neurosis. Sighing is also more frequent in schizophrenic than in normal individuals.

Corwin and Barry (1940) observed a relation between frequent periods of apnea in expiration (expiratory plateaux) during day-dreaming in normals and schizophrenics.

The relation between hyperventilation and all kinds of physical complaints has been emphasized repeatedly. A representative discussion is that of Stead and Warren (1943). Transient changes in the electrocardiogram and the electroencephalogram have been definitely related to the effects of hyperventilation. The latter changes are aggravated by hypoglycemia.

DISCUSSION

The writer is impressed with the fact that transient disturbances of respiratory rhythm

are capable of producing definite changes in body chemistry, accompanied by disturbing symptoms. The idea that the changes must always be transient seems to be implied in many reports bearing on the subject. This is not reasonable, and it is likely that as our knowledge of clinical correlations accumulates, it will be evident that disturbances of respiratory rhythm continued over a long time result in certain irreversible alterations in the nervous system, both focal and diffuse.

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eclipses the light that might come from a study of the dynamics of the disease process." He added, "We take such a primary concern for the cause as perfectly natural. I wonder if we don't exclude thereby some other very important aspects of disease? . . . Witness the singular freshness of Howard Rusk's ideas upon the possibilities of intelligent convalescent care. . . . If we had cared as much for therapy as for etiology, we should have little to learn from Rusk, instead of much."

To the physician who is interested in physical medicine, it is pleasing to observe that medical educators having the broad vision of Calvin and Gregg foresee advances and transitions in medical education which indicate a diversion of interest of medical educators from

their preoccupation with etiology and an advancement into a stage in which therapy begins to assume its rightful place in medical education. It is reassuring, moreover, to perceive that proper attention to the treatment of the patient as a person and as a whole is beginning to receive serious consideration. Certainly, the importance of the maintenance of dynamic equilibrium will become more and more apparent as this new trend develops, and just as certainly, physical medicine will continue to forge to the front as this trend becomes more evident.

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