Short Notes and Clinical Cases

SLEEP AND ITS RELATIONSHIP TO SCHIZOPHRENIA

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THE essential feature of schizophrenia lies in the disconnection of mental processes that is characteristic of the disorder. Disconnection of emotion, thought and action, and want of correlation between these mainsprings of mental life, form the predominating psychological picture present in the established case. It is only in one normal phenomenon that the rational mind can come into contact with the fantastic contents of schizophrenic thought-processes. Dreaming, with its absence of realistic and adapted thinking, its want of a goal idea and its lack of interest-controlled association, bears a curious resemblance to the thought-processes present in schizophrenia. In both there is want of sequence in thought, anomalies in feeling and deficiencies in adequately expressed emotion. In both there is a tendency to think in visual rather than in verbal images. The acceptance of images as real characterizes not only the dream but also the hallucinations of the schizophrenic. Suspension of judgement, criticism and reasoning is typical in dreams and also is cardinal in schizophrenia. The exclusion of reality and the consequent absence of the need for constant adjustment form one of the characteristics of the schizophrenic 'make-up' and one of the bizarre features of dreams. The interchange of thought without speech, a feature of dreams accepted without comment in the dream-state and arousing wonder only on waking revival of the dream, may be compared with the delusional concepts of schizophrenia. Again, the condensation that Freud pointed out as one of the most important features of dreams is comparable with the speech condensation (contamination) of the schizophrenic. Above all, the fantastic, grotesque, illogical and inconsistent character of dream-thought may be compared with the autistic unadapted and regressive thinking of schizophrenia.

The similarity between the dream-state and schizophrenic mentation has been noted by Kraepelin¹ and also by Jung,² who says: 'Let the dreamer walk about and act like one awakened and we have the clinical picture of dementia præcox.'

Dreams are concomitant with the sleeping state. Psychologically considered, sleep is a state of altered consciousness. Where consciousness is entirely in abeyance a deep sleep without dreaming results, owing to the

defect of attention and the temporary loss of the processes of association. When consciousness is still present, although blunted, hypnagogic hallucinations and dreams make their appearance, the association processes persisting in an altered state.

Sleep, then, is characterized by an alteration of consciousness that results in an entire withdrawal of interest from the external world. Schizophrenia is characterized by a very similar withdrawal of interest from external reality and by mental processes that have a remarkable likeness to those of dreams.

While a detailed inquiry into the numerous theories of sleep is beyond the scope of this paper, and, indeed, as Hall ³ remarks, so little is known of the physiology of normal sleep that any pathological change must necessarily be obscure, it is the writer's intention to examine a more recently advanced theory with a view to throwing light upon the problem of the causation of schizophrenia.

THE SLEEP THEORY OF HESS

In 1932 Professor Hess ⁴ of Zurich postulated that sleep is a vegetative process by which the autonomic nervous system regulates the activity of the higher cerebral functions. He considered that the parasympathetic portion of the system serves as a mediator for a reflex mechanism whose end-organs are those centres in the brain which sustain the animal functions. It has been demonstrated by Crile ⁵ that the sympathetic portion of the autonomic nervous system is katabolic and is concerned with the preparation of the organism for activity, while the parasympathetic has been shown by Gaskell ⁶ and Cannon ⁷ to be anabolic, preserving and economizing energy. The autonomic system controls and directs the processes essential to the cellular life of the organism but, as Langdon Brown ⁸ points out, the autonomic system remains for ever beyond the control of the will. The higher psychic faculties have no regulating effect upon the functioning of the autonomic system. This fact appears to be self-evident, but what may not be so evident is that possibly the converse may be true; the autonomic system may influence the psychic faculties.

The hypothesis put forward by Hess as to the mechanism of sleep would appear to show that the parasympathetic system influences the psychic field and the organism's readiness for activity. If the parasympathetic is the regulator of sleep it is also the regulator of many of the higher psychic functions. Consciousness, which is lost in sleep, must come under its sway, as the organism in sleep loses contact with its environment. The appreciation of sensory stimuli is lost in sleep. The eyes are closed and auditory stimulation is used as a measure of the depth of sleep. The kinæsthetic sense is in abeyance and the muscles are relaxed. The changes in the circulation as shown by the pulse wave and fall in blood pressure and the respiratory alterations during sleep are changes in vegetative functions that are closely connected with physical and psychic activity.

A comparison of the physical and mental state present in sleep with the physical and mental manifestations found in schizophrenia shows a considerable degree of similarity. In schizophrenia the appreciation of sensory stimulation is blunted. Circulatory changes are shown by the cyanosis and α dema of the extremities prevalent in the schizophrenic and by the flat top of the pulse-wave. The response of the respiratory centre to CO_2 is depressed in schizophrenia and in sleep. The muscle-contraction curve in schizophrenia is flat-topped. The blood-pressure is low and the basal metabolic rate is low both in schizophrenia and sleep. Mentally both the sleeper and the schizophrenic are out of touch with reality and environmental contact is lost. A vegetative or vagotonic state is present in both. Schizophrenia regarded from this standpoint may then be likened to a modified form of sleep.

The evidence that led Hess to the conclusions that sleep was due to parasympathetic activity was in the main threefold. In the first place it is generally agreed that the parasympathetic system preserves and economizes energy, protects against strain and tends to restore activity. It effects economy and repair. Sleep is a process by which these essentials to the well-being of the organism are carried out, but, be it noted, at the cost of deficiency in preparedness for immediate action. Secondly, the parasympathetic innervates the pupillary sphincter, activation of which muscle contracts the pupil. During sleep the pupil is contracted. Hess takes this fact as evidence of a change in the equilibrium between sympathetic and parasympathetic systems, the parasympathetic predominating in sleep. Lastly, he⁹ found by experiment that activation of the parasympathetic resulted in a state of sleep. Stimulation of the parasympathetic by injections of ergotamine into the third ventricle of animals produced contraction of the pupil and a state of sleep. Electrical stimulation of the portions of the brainstem with which the regulation of vegetative functions is associated resulted in a state characteristic of physiological sleep.

Additional evidence may be deduced from Koch's¹⁰ investigations on the carotid sinus reflex in animals in which it was shown that a sleep-like inhibitory state was induced reflexly by way of the carotid sinus, parasympathetic tone being also increased.

PERSONAL STUDIES

With a view to investigating a possible involvement of the parasympathetic system in schizophrenia a series of observations was undertaken on 10 male cases of schizophrenia at Netherne Mental Hospital.

I. *Duration of Sleep in Schizophrenic Cases under Review.*—The majority of text-books state that insomnia is present in schizophrenia, but a record of the number of hours' sleep per 24 hours over a period of one week enjoyed by the cases under review does not confirm this statement. On the contrary, the total number of hours spent in sleep by the 10 schizophrenic patients was greater than the total sleeping hours of 10 normal persons taken as a control.

II. *The State of the Pupils.*—The description of a pupil as being dilated or contracted conveys but little reliable information unless a standard is laid down for comparison. Standards in use for miosis vary from 1.5 mm. to 2.5 mm. For the purpose of this observation 2 mm. was taken to show miosis. Seven of the 10 cases under review showed pupils of 2 mm., the remaining three cases having definitely dilated pupils.

III. *The Exhibition of Ergotamine.*—Ergotamine (Stoll) is a sympathetic depressant. Maier¹¹ found that it gave a durable diminution of the tonus of the sympathetic in cases of hypersympatheticotonia. Twenty drops of ergotamine tartrate (Sandoz) were given three times a day for seven days to each of the 10 cases. No material changes either in the duration of sleep or in the size of the pupils were noted.

IV. *The Carotid Sinus Reflex.*—Hering¹² has shown that the slowing of the heart consequent on pressure on the carotid artery at the level of the cricoid cartilage is due to a reflex originating in the carotid sinus. Sensory fibres supply the sinus and are carried to the medullary centres by the glossopharyngeal and vagus nerves, both nerves belonging to the cranial portion of the parasympathetic.

The reflex was obtained in each of the 10 cases of schizophrenia. The slowing of the heart varied from a maximum of 14 beats to a minimum of two with an average slowing of 7.2 beats per minute. In this connexion the investigations of Sigler¹³ on the carotid sinus reflex are of interest. He found that the most effective response to pressure on the carotid sinus was given by those who had a 'vagotonic predisposition.'

CONCLUSIONS

While it is manifestly unwise to generalize upon the above observations, it may be permissible to suggest that a state of parasympathetic stimulation may exist in schizophrenia. The negative results given by ergotamine may be due to, in part, an already intense depression of the sympathetic, an obliteration of sympathetic tonus by an overwhelming action of the parasympathetic. The main function of the parasympathetic is to preserve and economize energy. This fact may be deduced from its known action upon the bodily organs. Its inhibitory action upon the heart, its protective action on the eye, its rôle in digestion and absorption by which the bodily defences are built up—all these functions of the parasympathetic are intimately related to conservation of and provision for the proper functioning of the organism. Sleep is also a process by which economy and repair take place, resulting in a restoration of energy and a renewing of activity. Sleep according to the hypothesis of Hess is also a parasympathetic function.

The similarity between sleep and schizophrenia has been noted above, and schizophrenia has been tentatively described as a state of modified sleep. Sleep is a process by which energy is restored, or as Bryne¹⁴ maintains, sleep

may have its origin in an adaptation which enables the organism to continue to meet danger situations.

If energy is at such a low ebb that complete restoration is impossible the organism will tend to economize and conserve what little energy it has for the purposes of the bodily processes vital to existence. As it is the function of the parasympathetic to preserve the functioning powers of the organism, overaction of this portion of the autonomic system is likely to take place, resulting in all the symptoms of parasympathetic overactivity. There will exist, therefore, in such an organism the signs and symptoms of a parsimonious expenditure, a miserly hoarding of the precious gold of energy and a desperate striving to ignore demands that would deplete the treasure. A state of modified sleep might well be the biological reaction to such a contingency, a form of sleep conditioned by intense activity of that regulator of organic energy, the parasympathetic system.

Again, the parasympathetic influences the organism's readiness for activity. Nothing can be more striking than the total lack of preparedness present in the schizophrenic. Far from being prepared to face the exigencies of life he retreats from life's problems into a dream-world conditioned by his phantasies. The anabolic function of the parasympathetic is here manifested as a protective and conservative influence, economizing a diminished fund of energy and preserving the psychism from calls for immediate adaptation.

Many of the symptoms and signs of schizophrenia may then from this standpoint be regarded as symptoms and signs of overactivity of the parasympathetic, a nervous system continually working to excess combating, as the body always endeavours to combat, a deficiency in its organization. The inherent defect in schizophrenia may be a defect in vital energy. Mott postulated an inborn lack of vitality as the primary defect.

It has been the purpose of this paper to show in some slight fashion that the logical outcome of inherent want of energy is excessive activity of the parasympathetic system, an activity that may show itself in the sleep-like state of schizophrenia.

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