A Paper ON

SLEEP AND ITS DISORDERS IN CHILDHOOD.*

BY

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Of the physiology of sleep we know no more than of its pathology. Speculations as to its nature, what part is played by variations in vascularity, in blood pressure, or in osmotic pressure, whether or not there exists a sleep centre, acted upon by a hypnotoxin elaborated during the hours of wakefulness, how far the endocrine glands control the process—all such speculations afford us no help in solving the problems of sleep and its disorders in childhood.

In our discussion, therefore, we can only approach the subject with certainty from the purely clinical standpoint. We can only depict disturbances as we find them in practice, and discuss the ways and means whereby they may be combated. Views on etiology must be regarded as wholly speculative. I propose to discuss briefly in turn four examples of such disturbances.

1. Sleeplessness and continuous crying in young infants.
2. Sleeplessness in older children.
3. Night terrors.
4. Enuresis.

SLEEPLESSNESS IN YOUNG INFANTS.

Three factors may be concerned in different cases in varying degree in producing this most unhappy state: (a) pain or discomfort, (b) inherited or constitutional neuropathy, (c) faulty management.

Pain or Discomfort.

In a few cases the unrest is caused by persistent pain. Syphilitic periostitis, the subperiosteal haemorrhages of scurvy, uric acid calculi, otitis media, for example, must not be overlooked. The pains of dyspepsia are a more common cause. In intestinal colic the pain is caused by the increased vigour of the peristaltic contractions of the intestine, and is associated with the passage of a green, watery, or slimy stool, which is expelled violently from the anus with the audible escape of flatus and fluid, and which may be so irritating that it causes excoriation of the skin of the buttocks. Aerophagy with distension of the stomach is an even more common cause of abdominal discomfort. But here, as so often happens in infancy, cause and effect are hard to separate, and we are confronted with a vicious circle of symptoms, each productive of the other. The infant, in the first months of life, functions almost solely as a suction apparatus. That apparatus is effective only when the child is at rest, quiet, perhaps even drowsy. The suction act is not a voluntary but a reflex act, and the reflex is inhibited by emotional unrest. Brought to the breast sleepless, crying, and excited, the child, as it were, stammers in its attempt at suction. It substitutes a voluntary, inco-ordinate, ineffective effort for the quiet, sustained, effective suction. Gulping, straining, and choking, it secures from the breast a minimum of milk and a maximum of air. The consequent distension of the stomach is painful. The delayed peristaltic contraction of the fundus—a property of the infant's stomach which expels that amount of air which is always and inevitably swallowed with the milk—is incapable of achieving its purpose. Either eructation is prevented by the over-distension, or eructation is so violent that the fluid contents of the stomach are ejected as well as the air. To prevent "wind" we must secure sleep; to secure sleep we must prevent "wind." The infant

must be brought to the breast quiet and controlled, not in a state of emotional excitement. A single grain of chloral hydrate, given ten minutes before each of five or six feeds, for some days, will often prevent wind. When the infant is quiet and drowsy the suction reflex comes into its own again; a full meal is taken without too great aerophagy, and sound sleep follows.

Nasal obstruction from nasal catarrh is one of the most frequent causes of discomfort leading to wakefulness. Not only does the cough constantly waken the child, but the consequent nasal obstruction interferes with suction. The infant must stop breathing in order to suck, must stop sucking in order to breathe. Aerophagy and insufficient stimulation of the breast are direct results of nasal obstruction. The two commonest causes for a failure of lactation in the first months are to be found in nervous unrest in the infant, leading to inco-ordinate ineffective suction, and to nasal obstruction in the infant, which in turn is a cause of nervous unrest. A tampon of cotton-wool, which allows a few drops of adrenaline solution (1 in 5,000) to flow backwards through the nostrils before the child is put to the breast, may break the vicious circle, permit nasal breathing and effective suction, and thereby prevent aerophagy and hunger, with the consequent insomnia and crying.

Inherited Neuropathy.

The neuropathic infant generally bears in his face and aspect the stamp of his inheritance—thin, meagre, and tense, with rigid face and limbs. His hands are constantly clenched; often there is opisthotonos. The outline of the recti abdominis is visible on the retracted abdomen. The scalp is usually hairy, and the hair is lank and dark, generally massed on the vertex, thin and sparse on the temples. The slightest sound in the neighbourhood awakes him with a characteristic start. Instantly the anxious expression flows back into his face, and the inevitable crying begins. The response to the approach of a friendly face is not a smile, but a cry or a frown.

Faulty Management.

Only a few restless babies suffer from inherited neuropathy. Most infants who are sleepless and who cry constantly without any specific pain or discomfort do so because the management is at fault. The competence of a mother in handling her infant varies directly with the degree of her own self-confidence. It is through the mother or the nurse that we must work to get our effects. No infant lies quiet in the arms of a woman who is herself in a state of nervous tension. In hospitals and institutions infants sleep all the time, because they are subjected to little, perhaps to too little, psychical stimulation. They are cared for by a succession of kindly, capable young women, who are not apt to be unduly distressed by the crying of a child. In an institution the baby does not pass his time under the searchlight of his mother's face and eyes, with a constant interplay between the two—coaxing, appealing, consoling, urging, on the part of the mother—straining, striving, refusing, resisting, on the part of the child. This excessive psychical stimulus may be the cause of a restless state of fatigue. Insomnia and constant crying may follow and become persistent when the mother grows agitated and worried by the failure of her renewed attempts to dominate the opposition of the child. The best place for such an infant may be up against the mother's back, against a warm, comfortable part of her body, which takes no part in the expression of her emotions, when the searchlight of face and eyes is directed away from the child, and when her hands are free to busy themselves in occupations which divert her thoughts from the child. For when her thoughts are so diverted, peace may come, almost miraculously. The mother's agitation and the infant's restlessness may act and react upon each other in such a way that treatment, if it is to be successful, must have regard to both aspects of the problem.

Chloral is, I believe, the most effective and the most satisfactory hypnotic in infancy. A prolonged hot bath or a hot pack is often as helpful for the restless infant as it is for the adult, who in a state of acute maniacal excitement may show symptoms not dissimilar. The

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swaddling-clothes, too, with which primitive folk in all countries and all ages have encumbered the young infant are the infantile strait-waistcoat. When enveloped in the steady pressure of a light and porous shawl, so that, like Wordsworth's cloud "it moveth altogether, if it move at all," many a restless infant will fall soundly asleep. The practice of carrying an infant always upon a supporting pillow has this, perhaps, to explain its popularity—that the pillow serves to insulate the tense nervous system of the agitated mother from that of the child, and prevents the incessant struggle between the restless movements of the child and the restraining hold of the mother.

SLEEPLESSNESS IN OLDER CHILDREN.

In older children sleep is often still intimately dependent upon the support which the child derives or fails to derive from the mother. Many nervous children will sleep only in the presence of the mother. The so-called "calling out," a persistent hailing of the mother, as soon as the light is turned out and the child is left alone, is caused by the effect upon the child of the ill-concealed agitation in the mother. The parents of children who cry incessantly are apt to be sensitive persons who are unnecessarily disturbed by the cry. Many children, like moths to the candle, are compelled to exploit these emotional reactions in their parents. Refusal of food and refusal of sleep have here the same origin.

To urge a child to go to sleep is only to call attention to his own impotence in the matter. No one can go to sleep by an effort of will, and the sense of this inability is a main cause of all insomnia. A conscious effort to achieve sleep prevents sleep. On the other hand, to speak before a child of his remarkable capacity for immediate and sound sleep, to encourage the tendency natural to many children to associate sleep with certain treasured objects—the disreputable remains, perhaps, of what was once a teddy bear—to lay stress upon improvement, to make light of occasional wakefulness, is to provide helpful management. All children are at times wakeful, at times refuse food, at times wet the bed, but whether these failures are transitory and of no importance, or whether they are erected into formidable disorders, depends more than anything else upon the mother and her power to hide her own anxiety. It is the mother bird that by its warning note arouses the sense of fear and of danger in her young. Comfortable, easy-going persons, who always hope for the best, seldom find their children refusing either to eat or to sleep. There are many other points of management on the importance of which we are all agreed, but which time will not allow me to deal with. The need for adequate ventilation and for warmth can hardly be overstressed. A heavy and indigestible meal taken late at night has caused many a sleepless night. Lack of exercise no less than fatigue may cause insomnia. In a given case we must review all the circumstances of the child's life and search for the contributory causes.

THE UNSTABLE METABOLISM OF THE NERVOUS CHILD.

But when I turn from a consideration of the important part which management plays and examine the causes of insomnia which are peculiar to the child himself, I find myself on more debatable ground. One particular aspect of the sleep question in older children I should like to deal with in some detail, because it concerns very intimately, I think, the consideration of those particular disorders of which I am to speak—namely, night terrors and enuresis.

The metabolism of all children, just because they are children, is less stable than that of later life. In some nervous children this instability is a characteristic and striking peculiarity. It is not that there is any abnormality peculiar to the nervous child, but rather that biochemical reactions common to all and which do not overstep normal limits may be provocative of symptoms of great and sometimes of alarming severity.

Biochemists tell us that all the energy expended both upon muscular exertion and upon the activities of our emotional life is derived primarily from the burning of

carbohydrate. In children, starvation, pyrexia, exertion, and emotional excitement, whether pleasurable or painful, tend much more readily than in adults to exhaust that meagre reserve of carbohydrate which is stored as glycogen partly in the liver and partly in the muscles. In the absence of sufficient available carbohydrate, the metabolism is apt to become disturbed, and the evidence of this disturbance is found in a fall in the blood sugar, in an accumulation of ketone bodies in the blood, in a greater excretion of nitrogen, and in an increased accumulation of fat with a diminished content of glycogen in the liver. When the carbohydrate level is at the lowest end of the range the body appears to endeavour to achieve the synthesis of sugar out of the ample store of body fat, which is our main reserve of energy. It is a view widely held at the present time that the presence of ketone bodies in the blood in considerable amounts indicates the failure of such an attempt. Some sugar is indeed successfully derived from fat, but much of the synthesis is incomplete, and remains, as it were, at the stage of the ketone bodies. Ketonaemia, in other words, may perhaps be regarded as evidence of a failure to complete the synthesis of the necessary sugar from the stored body fat.

Individual children differ widely in their reaction to the presence of ketone bodies in the blood and to the accompanying hypoglycaemia. The nervous child, slender, thin, and pale, with his eager or too anxious expression, with a tendency to "bouts" or "turns" or "attacks," sometimes characterized by severe and incessant vomiting, but more often merely by an increased restlessness, irritability, and exhaustion; by obscure pyrexia, by anorexia, or nausea, by yawning, pallor, and a variety of vague muscular aches and pains, as well as by confused or terror-stricken dreams, has, as has long been recognized, a low tolerance for fat. It is, I think, clear from a clinical study of such cases that these sudden backslidings in physical energy and nervous control, associated often with clear evidence of hepatic inactivity, which the mother describes as bouts or turns, are the physical and nervous manifestations of the underlying disturbance of metabolism, produced by over-exertion, psychical shocks, or infective disturbances.

The reaction of young children to hypoglycaemia and ketonaemia, induced experimentally by starvation and by a diet with little sugar and a high content of fat, has recently been investigated and recorded in an interesting communication by Salomonsen. The author reviews at the same time the extensive literature on the subject of ketonaemia and hypoglycaemia. The application clinically of the work of Hilliger, Hecker, Frölich, Ross and Josephs, Cammidge, Osman and Close, and many others, presenting as it does much that is contradictory, has not yet been sufficiently defined or even sufficiently discussed.

Fifteen young children between the ages of 1 and 4 were subjected by Salomonsen to periods of starvation of from thirty-six to seventy-two hours. Within the first twenty-four hours there was invariably a rapid and extreme fall of the blood sugar; in several cases it fell below 0.04. Simultaneously the blood acetone rose from minimal amounts to figures which gave on an average nearly 0.2 part per 1,000.

Twelve children between the ages of 5 and 14 were suddenly put on a diet poor in carbohydrate and rich in fat. In both series symptoms were produced, the intensity of which varied very much in different individuals, but which comprised pallor, anorexia, somnolence, vomiting, loss of weight, increased excretion of nitrogen, hypoglycaemia, ketonuria, and sometimes a palpably enlarged liver. The author notes—and this is of especial interest in the present connexion—that he was invariably able to predict which individual children would show a strongly marked reaction. Plump, well-coloured, placid children were, as a rule, little incommoded. But in the case of certain fragile, "neuro-labile" children the different symptoms reached quite the same intensity as in a spontaneous attack of cyclical vomiting.

In these experiments we are furnished with evidence which supports the clinical observation that it is especially the nervous child who reacts most to stress, whether starvation, pyrexial infection, or emotional excitement.

HYPOGLYCAEMIA AND DISORDERS OF SLEEP.

It is clear that that particular stress which in practice is most commonly the cause of an "attack" or "bout"—I mean excessive emotional excitement—is not capable of precise investigation in the laboratory, but the reaction of the children to hypoglycaemia, induced by starvation and by a diet with insufficient carbohydrate, is highly suggestive. Nor can the laboratory furnish us with proof of what seems to me equally true, that when the metabolism of the nervous child is under strain in this particular way, when we find hypoglycaemia and ketonaemia, we encounter always an exacerbation in all nervous symptoms. It is when the child is in this state of prostration, of muscular laxity, and of pallor that he is most irritable, least controlled, and most apprehensive, and that the difficulties and struggles of the day are most likely to lead to sleeplessness, night terrors, or enuresis. As if even the physiological starvation of the night were ill tolerated at such times, we encounter a number of disturbances in nervous children which are confined to the night or undergo exacerbation in the night. In very many children with asthma, enuresis, sleep-walking, and night terrors, we may recognize the tell-tale smell of acetone in the breath. In all these conditions I believe that we may regard a low level of the blood sugar as, in some way, a cause or an indispensable part of the cause of the disturbance. The metabolism of the night differs from that of the day, because the blood sugar is at a low fasting level, and a higher proportion of the energy is derived from fat as shown by the respiratory quotient. Salomonsen found that the early morning urine always contained the highest proportion of acetone. This is in accordance with the common complaint of mothers of such children that they get up "at their worst," pale, yawning, and intensely irritable. Only after breakfast has provided the necessary carbohydrate is there improvement.

The sleep of certain children, whenever there is some degree of hypoglycaemia and ketonaemia, tends always, I think, to be abnormal. Confusion, unhappy delirium, muttering speech, restless movements, and terrifying dreams are then the after-effects of the emotions and excitements of the day.

Enuresis, in many cases I think, may be regarded as a specific night terror. It is not the child who does not care who wets the bed, but the child who cares too much, who goes to sleep fearing that the accident may happen, oppressed by the conviction that it will happen, dreaming that it does happen. As a rule he is intensely unhappy because of his failing. Sometimes, it is true, he hides his feelings and ostentatiously affects an air of unconcern. At times, too, in the interests of his daily life he does gain genuine relief. There may be intervals when he forgets it. Yet at times of exhaustion or depression the obsession is apt to return in all its old power, and these relapses are especially prone to recur in that state of pallor, prostration, irritability, and increased apprehensiveness which accompanies, and in itself indicates, a blood sugar at the lower levels of its range, ketonaemia, and an inactive liver.

I do not mean to deny in the least the importance of the psychological aspect of the problem, but, at the moment, that which I particularly wish to emphasize is the close association in childhood between mental states and states of metabolism. In the state which I have tried to describe I think that we find a powerful predisposing cause of disorders of sleep. In adults, alcohol may bring sleep because it brings courage—Dutch courage we call it—which turns the mind from worry, from the investment which has gone wrong to the investments which have succeeded; from the disappointments of the day to the hopes of to-morrow. When the blood sugar is low, the mind is apt to be agitated, restless, apprehensive. In such a case either sleep will not come to the child or sleep is light, and the unrest of mind is shown by moaning or muttering speech, by unhappy dreams, by night terrors, or by enuresis.

Rest, wise and understanding management, and a diet with a higher percentage of sugar and a somewhat lower percentage of fat, are the chief needs of the nervous

child. It is interesting to speculate how far the introduction on a large scale into the dietary of man of the most easily assimilated food stuff—sugar—has been necessary to enable him to stand the strain and to combat the nervous exhaustion of the increased speed at which he lives. To Shakespeare sugar was a rare delicacy. It is of honeyed words and honeyed smiles that he speaks. Jamaica and Demerara provided for the quiet movement of the eighteenth century. The manufacture of beet sugar on a large scale was perhaps necessary before life could accelerate. How invariably in some children travel, change, rush, excitement, and so forth may produce a characteristic bout of vomiting, of asthma, of enuresis, of insomnia, or of night terrors—disturbances in all of which some degree of hypoglycaemia may act on a predisposing cause. All of us, under a sufficient emotional strain, grow pale and lax, yawn, feel nauseated, become irritable and sleepless, and lose control, concentration, and the ability to face the difficulties of life. The British Army found the value of rum. The German troops had their pockets full of sugar. It is the same with the warfare of the nursery. The negativistic, difficult child, exhausted by his struggles with his parents, or by some emotional shock, has a high need for sugar. In practice night terrors are very often well controlled by glucose.

HYSTERIA AND ENURESIS.

I wish I could speak as confidently of the control of enuresis. But here, and especially with older children, the psychological factors concerned are more complex. In some few inveterate cases I think a true hysterical paresis of the sphincter has developed and perpetuates the incontinence. In a certain proportion of cases of enuresis, usually in boys, there is added incontinence of faeces. This form of faecal incontinence is not to be confused with the accidental discharge of a watery stool which the nervous, excited child is unable to hold. In the incontinence of faeces of which I speak, and which accompanies certain inveterate cases of enuresis, the escaped mass is hard and scybalous. The symptomatology is indeed identical with that which is found in organic paralysis of the rectum from a transverse lesion of the cord. Very slowly the hard scybalous mass protrudes and escapes through a sphincter which is toneless and parietic. The child is quite unconscious of this passage. The mucous membrane, normally so sensitive, is completely anaesthetic. The child may not even feel a finger passed through the patulous sphincter in making a rectal examination. In practice it is not easy to demonstrate a similar paresis and anaesthesia in the sphincter of the bladder; but I think that this occasional extension to the rectum, where matters are more easily investigated, does very strongly suggest the hysterical nature of some inveterate cases of enuresis.

The child is physiologically hysterical and normally open to the force of all suggestions habitually made by the grown-up people around him. The hysteria of warfare differs from the hysteria of the nursery only because the nature of the suggestions offered. Hysterical blindness, deafness, mutism, and paralysis are rare in childhood, because these are not the disasters feared by a too anxious or apprehensive mother. The mother of the child with enuresis is often most miserable and most pessimistic. Everything has been tried. Nothing succeeds. I have known mothers who could hardly speak of the difficulty without tears. I have a letter from the child of one such mother:

"Dear Doctor," she writes, "I am now quite a dry girl. What cured me was sleeping with Daddy."

Up against this large unconcerned male she had regained peace of mind and self-confidence.

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