

CHAPTER 2

Patterns of Micturition in Infancy. An Introduction to the Study of Enuresis

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It is classically held that micturition in infancy is a reflex act mediated by brain stem centres in response to a critical intravesical pressure. Enuresis has been compared with this form of 'automatic' bladder functioning, and it has been suggested that bed-wetting represents the abnormal persistence of a condition, which is physiological at an earlier age.

Wertheimer (1938) disagrees with this theory. He has cast doubt on whether a so-called 'physiological' state of automatic bladder functioning in infancy ever occurs. In the course of 30 observations on a number of infants, he stated that none had passed urine during sleep. 'All the infants woke before passing urine, most to the accompaniment of restless movements and crying, others more quietly with only slight motor activity. Some of the infants went back to sleep before completing the act of micturition'.

It was to study this question that the investigations described here were carried out.

Subjects

Observations were made in a Residential Nursery for healthy infants. The fact that these infants were being raised away from a normal family environment may, of course, have affected their behaviour, and given bias to these observations. No attempt has been made to influence the micturition habits of these infants by any 'toilet training' techniques.

We studied the micturition behaviour of 42 children (23 girls, 19 boys) between the ages of one and seventeen and a half months of age. The sexes were proportionately represented over the different age groups. Fifteen of the children were aged between one and three months, 15 between four and seven months, and 12 between eight and seventeen and a half months.

Methods and Results

The first part of the study involved simple observations on the state of wakefulness and on whether or not the child had passed urine at the time of nappy changing.

The results are set out in Table I and summarised in Table II. Because of the small number of subjects involved, no attempt has been made to distinguish between the observations made on girls and those made on boys.

Given the fact that observations made more than once on the same child have been added to observations made on different children, it is, at first sight, difficult to

TABLE I
State of wakefulness and nocturnal wetting

<i>Age (months)</i>	<i>No. of cases</i>	<i>Awake and Wet (per cent)</i>	<i>Awake and Dry (per cent)</i>	<i>Asleep and Wet (per cent)</i>	<i>Asleep and Dry (per cent)</i>
1 - 3	15	71.3	17.3	10.6	0.8
4 - 7	15	79.3	5.7	13.4	1.6
8 - 17.5	12	82.6	5.6	8.3	3.5
Number of Observations		1865	226	264	45

TABLE II
Wakefulness and nocturnal wetting in relation to age

<i>Age (months)</i>	<i>Awake (per cent)</i>	<i>Wet (per cent)</i>
1 - 3	88.6	81.9
4 - 7	85.0	92.8
8 - 17.5	88.2	91.0

know what significance these results carry. However, it is noticeable that children in the four to seven months age group are more likely to be wet at the time of changing. Furthermore, if the ratio *Awake and Wet/Awake and Dry* and the ratio *Asleep and Wet/Asleep and Dry* are examined for each age group, it is clear that the infants in the youngest group were more likely to be wet and asleep than the children in the oldest group who were, conversely, more likely to be awake when wet.

In our opinion, these observations may be explained in one of two ways. Either the skin surface of the newborn infants is extremely tolerant to the sensations which accompany being 'wet' (perhaps because of the resemblance between this state and the intra-uterine state when the fetus is bathed in amniotic fluid), or, alternatively, the association between being wet and being awake is in some way related to the process of cortical myelinisation which has occurred during the early weeks of extra-uterine life. There remains the problem of whether the infant who is wet and awake awakes because it is wet, or wakes before micturition because it feels the need to pass urine.

In order to examine this question more thoroughly, we devised an apparatus which signals the onset of micturition in the infant. The apparatus consists of a tube used to collect urine. One end is attached to the penis of the male infant; the other end is fitted with a system of electrodes in circuit with a luminous signal. This signal is lit when the electrodes are brought into contact by the interposition of urine.

Using this apparatus, it was possible to study the behaviour associated with the onset of micturition in a sample of twelve male infants. Use of the apparatus did not appear to affect the infants in any way, and the positioning of the tube was such that closure of the electric circuit could not result in the transmission of any current to the infant.

The apparatus was used only between the hours of 9 p.m. and 8 a.m. Our observations were confined to the night time, because it was felt that the external stimuli present during the day would interfere with the behaviours we were anxious

to observe. We were also mindful of such phenomena as the passage of urine after a meal, or during the course of a medical examination, and were anxious to avoid such artefactual conditions.

Our observations were of a preliminary nature, forming the basis on which we hope to establish a more systematic and extensive study.

There was a tendency for older children to pass urine more frequently than younger children. However, this was not uniformly the case, and one may speculate on the factors which lead to the more frequent passage of urine. Are there individual differences in frequency which may later predispose to the presence of enuresis? This sort of question can only be studied by prospective observations.

The volume of urine passed seemed to be extremely variable, and seemed unrelated both to the time of night when micturition took place and to the age and weight of the infant. Once again, one may speculate on the existence of individual differences which could predispose to enuresis.

On the whole, the total volume of urine passed in a 24-hour period was related to the number of times that urine was passed within that period. Even taking into account the factors which may initiate micturition at this age, it is somewhat surprising to find such variability in micturition frequency, total urinary output and volume per micturition. One would, perhaps, expect more uniformity if the functioning of the infantile bladder was entirely automatic, responding to a given and broadly similar intravesical pressure, arrived at as a result of filling the bladder to a broadly similar volume of urine. Admittedly, the volume of the bladder contents is only one factor influencing the intravesical pressure. The rate of urinary production, and with it the bladder filling rate, also exert some influence. However, in view of the regularity and constancy of the fluid intake during the period under observation, one would be surprised if these factors had played much part in producing the observed variations.

Using the same apparatus, 40 direct observations were also made of the infants' behaviour at the time of onset of micturition. On 15 occasions the infant was asleep at the time of micturition, and in 25 cases the infant was awake. In two cases, simultaneous electroencephalographic observations were made. In both these cases, a change was noted in the rhythm of deep sleep, following which the child became restless, made noises, awoke, and then passed urine.

Micturition took place most frequently just before midnight and at around 5 a.m., the former time being more common than the latter. The volume of urine passed seemed unrelated to the time at which it was passed. In several cases, a fairly copious micturition was followed a few minutes later by the passage of a smaller volume of urine.

Discussion

These observations show that the passage of urine at night, in infancy, occurs most commonly in the waking state. We are, therefore, in a position to confirm Wertheimer's (1938) statement that 'If the infant wets himself, it is because the infant's attendants have themselves forgotten the primitive language of infancy. The infant wets because we do not understand it and we therefore oblige it to wet. However he does not wet without protest—he cries'. Difficulty in keeping an infant dry arises

because he does not pass urine each time that he wakes and cries, and also because of the frequency with which he passes urine. Thus, if we apply the accepted definitions of enuresis, we must conclude that this condition does not occur in infancy.

Two types of enuresis are usually described.

- (1) 'Primary' or life-long enuresis, which dates from birth, and which is by far the commonest form, representing between 76 and 79 per cent of all cases, according to the findings in the present study.
- (2) Acquired enuresis, which appears after an interval of nocturnal continence. This is less common; furthermore, we need to subtract from the number of cases reported those cases which are not true cases of acquired enuresis. These are children who were not continent before the appearance of (frequent) enuresis, and had experienced occasional 'accidents' before bladder control had broken down completely. They are better categorised with the cases of so-called 'primary' enuresis.

The 'primary' nocturnal enuretic is a child who has not developed nocturnal continence at the usual age. Children with primary nocturnal enuresis have nearly always been dry by day from the age of about two years, but the acquisition of nocturnal continence has not followed in the normal way.

It is perhaps worthwhile at this juncture to review the stages of development of the acquisition of sphincter control in the young child. Launay (Launay and Fayol 1953, Launay 1959) has contrasted the variability of the age of acquisition of bladder control with the uniformity with which normal children learn to walk. Gesell and Amatruda (1941) have studied this subject, and have summarised many hundreds of observations as follows.

- 15 *Months*. The child passes urine fairly regularly when placed on the pot. He does not ask to be put on the pot, does not defer micturition until put on the pot, and has fairly frequent 'accidents'.
- 18 *Months*. The child passes urine at regular intervals. He will not ask to be put on the pot, but defers micturition for a reasonable period, and if potted regularly has only infrequent 'accidents'.
- 24 *Months*. The child makes his needs known in a regular and consistent fashion, and does not wet at night if lifted between 10 p.m. and midnight.
- 3 *Years*. Child goes to the lavatory alone, both during the day and night, and is usually dry at night.

On the basis of these observations, we could regard any child who after the age of three years is persistently wet during the day or the night as being enuretic. However, although parents may consider nocturnal incontinence between the ages of three and four years as being inconvenient, they are not usually concerned, and many regard it as being the period which covers the extreme limit of normality. We define nocturnal enuresis as persistent nocturnal incontinence after the age of four years.

As our observations show that the majority of young infants awake before passing urine, we feel it is incorrect to talk of 'congenital enuresis'. Rather, we would like to postulate that diurnal or nocturnal enuresis of the primary sort may arise as a result of defective or faulty training, with the result that bad habits start and are perpetuated.

There are numerous examples which demonstrate that if we could only anticipate the moment when the infant wishes to pass urine he would rapidly reach the stage where he would prefer to be dry rather than wet. This would be a positive choice made by the infant, and not a consequence of discipline imposed by the mother.

The quality of care given to a child appears to be an important factor in determining the genesis of primary (so-called 'congenital') enuresis. This may influence the child at an early stage, or only appear secondarily, following an event which has had the effect of interrupting the established relationship between mother and child. There would appear to be some sort of critical period, which, in our experience, occurs at around 36 months, following which sphincter training becomes much more difficult.

In our opinion, distinction needs to be drawn between those so-called 'congenital nocturnal enuretics' who wet the bed at night because of a disturbance of rhythm of urine production, and who alone merit the label of 'congenital enuretics', and those in whom the primary, lifelong, enuresis has arisen as a result of erroneous training.

The genesis of acquired enuresis poses important questions. It is our feeling that it is mainly, but not exclusively, in these cases that one finds an emotional aetiology underlying the condition.

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