

Enuresis: a Descriptive Analysis and a Controlled Trial

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Introduction

Nocturnal enuresis is a common disability which has been of interest to the medical profession for several centuries. It is a condition which is ill-understood because of a tendency to ascribe it to one cause rather than to a number of causes, and because various physicians have approached the problem from their own specialist view-points. While treatment has ranged from magic in earlier times to the more recent mechanical devices, there has been little research into the efficacy of different treatments.

The aims of this present study were: (a) to undertake a descriptive analysis of an unselected sample of bed-wetters; and (b) to compare the results obtained from treatment with imipramine ('Tofranil'), a buzzer and pad, and a placebo.

Method

A non-hospital sample of bed-wetters was obtained from the general school-population of Newcastle upon Tyne. With the aid of the School Medical Service, 15 schools were surveyed which were judged to be representative of all areas of the city.

A total of 2,472 children aged between eight and ten years were covered by the survey. Replies were received for 1,931 of the children, of whom 132 were reported to be 'enuretic' on our criterion of wetting the bed at least three nights each week. The families of these children were contacted and followed-up by local health visitors, school medical officers and the research staff of the Nuffield Psychiatric Department. Of the 132 children who attended the clinic, 38 were excluded from the study for various reasons: 23 because of lack of co-operation or because they were already dry at the time they attended the clinic; seven were not within the age-range or did not meet our criterion of enuresis; six were already receiving treatment elsewhere; and two were 'lost' early in the trial. There were thus 94 children with enuresis included in this study.

When the children and their mothers attended the clinic, assessments were made of family, social, physical, psychological and behavioural variables. The children's histories were obtained from interviews with the mothers and the children were screened by a paediatrician to exclude any genito-urinary anomalies

detectable on physical examination. A clean mid-stream specimen of urine was examined chemically and microscopically and no significant anomalies were discovered. However, since the method did not include urine culture, it is possible that it was not sufficiently sensitive to detect all urinary infections.

The children were randomly divided into three groups for treatment: one group of 35 children who received imipramine; a second group of 32 who were treated with the pad and buzzer; and the third group of 27 children who received the placebo. For some analyses, the non-placebo groups were combined in order to make comparisons with the results in the placebo group.

The trial was divided into four stages: (a) status at beginning of treatment; (b) status one month later while on treatment; (c) status two months later at end of treatment; and (d) status four months later at follow-up.

Results were calculated in terms of percentage improvement, using the formula:

$$\frac{\text{wetting per month before treatment} - \text{wetting per month after treatment}}{\text{wetting per month before treatment}} \times 100$$

Descriptive Analysis

Only the 94 children who took part in the clinical trial are included in this analysis, which must lead to some unavoidable bias (for example, by the exclusion of the children who were not co-operative).

Age and Sex Distribution

The mean age was 9 years 4 months (range 8 to 10 years). The sex ratio was 1 female to 1.5 males (38 girls and 56 boys).

Milestones

The milestone selected was the age at which the children in the study could

walk three steps alone. The mean age at which this milestone was achieved was 15.9 months, which is approximately two months later than the norms cited by Neligan and Prudham (1969). This developmental delay is in keeping with the suggestion that the mean intelligence level of enuretic children is below average, but it may also be due to a delay in motor maturation.

Handedness

In 13 of the 94 cases (13.8 per cent) the mothers reported the child to be significantly ambidextrous. This percentage is similar to that in a random sample of Newcastle upon Tyne children two years younger than those in our series, of whom 14.6 per cent were found to be ambidextrous (Scott 1972).

Social Class

In this present study, and in two other important studies on enuresis (Miller *et al.* 1960, Barbour *et al.* 1963), an excess of cases was found in social classes IV and V (Table I). Comparative figures derived from a random sample of the population of a city (Newcastle Child Development Study: Neligan 1971) confirm this finding. Rutter *et al.* (1972) describe only a weak and inconsistent association between enuresis and social class, but this may reflect intrinsic differences between the populations studied in Newcastle and on the Isle of Wight.

Toilet Facilities

Poor toilet facilities were found in a large proportion of our cases, 35 of whom had only outside toilets.

Family Size

There was a mean of 3.9 children per family in our cases, which is somewhat higher than the mean of 3.2 in another random sample of Newcastle school-

TABLE I
Social class

Social class	Miller et al. (1960) (Enuretics)	Barbour et al. (1963) (Enuretics)	Neligan (1971) (Random sample)	Present Study (Enuretics)
	%	%	%	%
I + II	3.0	14.0	9.9	5.0
III	51.0	34.0	59.0	44.0
IV + V plus	46.0	52.0	30.4	51.0

children (Neligan *et al.* 1972). This again is probably an indication of the slightly lower social class of our enuretic children.

Marital Status of Parents

Parental separation or divorce was reported in 14 of the 94 families, which confirms the association between certain types of broken homes and enuresis reported by Rowntree (1955).

Neuropsychiatric History

In approximately one-third of the families in this study one of the parents was assessed as having or having had emotional disturbance severe enough to make them consult their family doctor. In five families one of the parents was epileptic and in seven families one of the siblings was epileptic.

Parental Personalities

The personalities of both parents were rated on a five-point scale in terms of extroversion and introversion, with only the end points of the scale being defined. The ratings for the mothers were based on their own reports and on the psychiatrist's clinical impressions; the ratings of the fathers were based solely on the descriptions given by the mothers. As this was a clinical exercise there are no norms available, but it was found that distributions for both parents were skewed in the direction of extroversion (mean for mothers 2.7, for fathers 2.9).

Patterns of Toilet Training

The use of psychological or physical pressure in toilet training has been termed 'coercive' (Hushka 1942), and others have suggested that such pressure is significant in the origin of enuresis. In our study, only eight of the mothers described themselves as having been markedly coercive. It is possible that some mothers under-reported their coercive attitude to toilet training, or that coercion has been exaggerated as a cause of enuresis. Support for this latter possibility comes from the work of Lovibond (1964), whose research led him to the conclusion that strict night-training was not significant in the origin of enuresis, and from Douglas *et al.* (1958), who found a correlation between earlier toilet training and earlier nocturnal dryness.

Ratings of Children's Behaviour

Using the mothers' reports, the children were rated for 17 features on a four-point scale, partially modified from the Wolff (1967) version of the MacFarlane scale. Only the extreme points of the scale were defined and the scale was consistently one-tailed, ranging from absence (0) to abnormality (4). The mothers were questioned in a standard way so as to elicit immediately rateable descriptions of what the children did in specific situations. The picture that emerged was of a cheerful and easy-going group of children who showed little extreme behaviour (Table II), except that a high proportion of the

TABLE II
Behavioural features

	Scores				
	1	2	3	4	
Attention span—good	38	28	16	12	Poor
Bodily self consciousness—nil	27	36	18	13	Very modest
Reaction to social discipline—reasonable	26	28	28	12	Very over-reactive
Sib. relations—reasonably good	62	19	10	3	Constant friction and quarrelling
Abnormal timidity—nil	40	28	15	12	Extreme
Recklessness—nil	53	23	10	8	Foolhardy ignoral of danger
Feelings—not easily hurt	14	18	41	21	Supersensitive
Approachable and sociable	60	21	10	3	Solitary
Usually cheerful and happy	68	18	6	2	Usually unhappy
Usually not sulky or moody	58	18	12	6	Usually sulky and moody
No specific fears	56	16	14	8	Fears
Cautious with belongings	64	18	9	3	Habitually very destructive
No obsessiveness	39	33	18	6	Obsessively neat and tidy
Somatic complaints—never	57	24	11	2	Daily
Mannerisms—never	81	9	2	2	Daily
Absence of shy reactions	38	31	19	6	Shy reactions
Normally reactive	30	32	17	15	Highly strung and unstable

children's feelings were extremely easily hurt, and they were highly strung, over-reactive or modest.

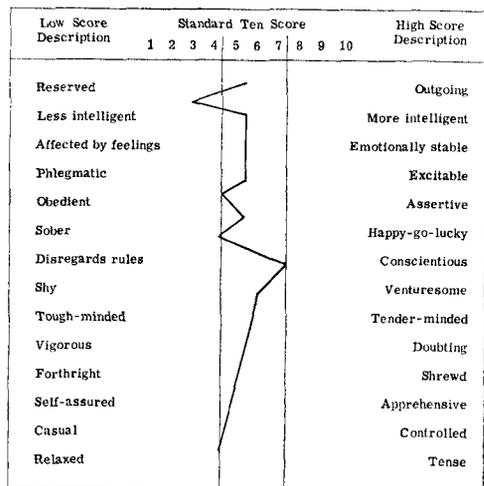
The children were also rated by the psychiatrists on a four-point scale of normality or abnormality, points 3 and 4 being indicative of clear-cut or marked psychiatric abnormality. Of the 94 children, 25 (27 per cent) were assessed as being clearly or markedly abnormal psychiatrically. This is similar to the percentage of 32.5 described by Shaffer *et al.* (1968) in their study of enuresis.

Personality Tests

The Cattell Personality Questionnaire was administered to the children. The usual method of presentation had to be varied slightly in that the questions were read to those children who were still unable to read. While it is not possible to say how this variation in the method influenced the results, there was evidence of broad internal validity (demonstrated by significant interscale correlations) and of external validity (demonstrated by significant correlations between scores on this questionnaire and on other tests).

On the personality factors, the children proved to be quite unexceptionally average (Table III). The questionnaire also provides a rough estimate of intelligence, and there was a suggestion that the mean intelligence level of these enuretic children was slightly below average, but this needs to be checked by using standard psychological tests which give more valid assessments of intelligence.

TABLE III
Cattell Personality Questionnaire



Two second-order factors, extroversion and anxiety, are also measured by this questionnaire, and again the children were found to be unexceptional.

Mean Reading Quotient

Measured by the Sentence Reading Test (N.F.E.R.), the mean reading quotient (92.1) fell within the low average range, which suggests a slightly better level of educational functioning than might have been expected from the suggestion of a slightly below-average mean level of intelligence in the results of the personality test.

Family History of Delayed Bladder Control

Delayed bladder control was defined as bed-wetting occurring after the age of five years. In 44 families, one or more of the siblings had been bed-wetters, and in 59 families the mothers reported a history of delayed bladder control either in themselves or in another member of the family. These figures are likely to be under-estimated, since they depend upon the accuracy of the mothers' reports, but the high frequency reported (more than 60 per cent) does suggest that enuresis in our population had at least a partially

familial basis. Hallgren's (1957) findings that 39 per cent of fathers and 23 per cent of mothers in his study had been similarly affected also suggest that genetic factors are involved in nocturnal enuresis.

In 21 of our 94 cases the enuresis was reported as being of the 'secondary' variety (*i.e.*, it had occurred after an earlier period of bladder control; the other 73 children had a continuous pattern of bed-wetting. This is similar to the Bristol study (Barbour *et al.* 1963), in which 79 out of 93 cases were 'primary' enuretics. That the symptom continues does not mean that the cause has remained the same. However, the unusual variation in achievement of bladder control up to and beyond the age of six years merits explanation, the most plausible being the influence of an important developmental or maturational component.

Analysis of Results of Controlled Trial

Tables IV and V show the main findings of the study. We were able to follow all 94 cases at one and two months, but 10 cases were lost to follow-up at four months. It can be seen from Table IV that there was a mean over-all improvement of approximately 50 per cent with the

TABLE IV
Mean number of wet nights per month, numbers of children in each group, and percentage improvement

	<i>Mean wet nights per month</i>							
	<i>Total series</i>		<i>Placebo</i>		<i>Buzzer</i>		<i>Imipramine</i>	
	<i>No. of wetnights</i>	<i>No. of children</i>	<i>No. of wetnights</i>	<i>No. of children</i>	<i>No. of wetnights</i>	<i>No. of children</i>	<i>No. of wetnights</i>	<i>No. of children</i>
Before treatment	21.9	94	20.9	27	22.0	32	22.7	35
Month 1	10.8	94	11.3	27	11.1	32	10.0	35
Month 2	9.7	94	11.0	27	9.1	32	9.3	35
Month 4	11.4	84	11.3	26	9.3	28	13.4	30
Mean wetting gradient, before treatment to Month 2	12.2		9.9		12.9		13.4	
<i>Percentage Improvement</i>	%		%		%		%	
Month 1	54.0	94	49.9	27	51.6	32	59.4	35
Month 2	59.8	94	52.8	27	61.7	32	63.5	35
Month 4	54.8	84	54.3	26	63.5	28	42.7	30

TABLE V
Levels of improvement

Percentage improvement over number of wet nights per month	Placebo		Buzzer		Imipramine	
	% of children improved	No.	% of children improved	No.	% of children improved	No.
Over 80%—Month 1	11·0	3/27	15·0	5/32	37·0	13/35
Month 2	18·0	5/27	52·0	17/32	45·0	16/35
Month 4	42·0	11/26	50·0	14/28	30·0	9/30
Gradient 2 to 4 months at 80% level	+24·0		-2·0		-15·0	
Over 40%—Month 1	62·0	17/27	69·0	22/32	71·0	25/35
Month 2	59·0	16/27	72·0	23/32	80·0	28/35
Month 4	58·0	15/26	71·0	20/28	60·0	18/30
Gradient 2 to 4 months at 40% level	-1·0		-1·0		-20·0	

placebo, which was maintained after treatment ended. The group on imipramine showed a rapid initial improvement, but a drastic deterioration after treatment stopped. Improvement in the buzzer group was slow initially, but was maintained and even improved after the end of the treatment period. The drop in percentage improvement in the imipramine group can only be explained as a type of 'rebound' phenomenon after treatment stopped at two months.

Levels of Improvement

In a more detailed analysis of improvement, two levels of improvement were studied: the marginal (40 per cent) level and the high (80 per cent or more) level. The rapid improvement and the rapid loss of this improvement in the imipramine group was again evident (Table V), as was the steady improvement in the placebo group at the 80 per cent level, and the even higher level of improvement at the 40 per cent level.

The superiority of buzzer treatment over placebo treatment (for 80 per cent improvement at two months) reaches a highly significant level ($\chi^2 = 7.4$, $p < 0.01$), while improvement at two months with imipramine is also significantly greater

than with the placebo ($\chi^2 = 5$, probability = 0.025). These findings support a previous finding that, on a short-term basis, imipramine is superior to placebo (Poussaint and Ditman 1965), and they suggest that both the buzzer and imipramine are more efficient than the placebo for very high levels of improvement at two months.

At marginal levels of improvement (40 per cent) and better, imipramine appeared to be the most successful regime. None of the differences proved to be significant, although that between imipramine and placebo was nearly so ($\chi^2 = 3.2$). Even at this marginal level, however, a steep decline was seen after imipramine was stopped.

The 80 per cent or higher improvement level constitutes a cure or almost a cure: these children were either completely dry or relapsed only occasionally. Tables IV and V show that at this level the maximum reduction in frequency of enuresis occurs during the first month with imipramine but during the second month with the buzzer.

Relapse Rates

The gradient percentage figures in Table V indicate the relapse or improvement

between month two and month four of the trial. It can be seen that there were high relapse rates with imipramine at both the 40 per cent and the 80 per cent levels. There appears to be a negligible rate of relapse in the buzzer group, which supports the view that a learning process occurs with the buzzer regime.

Comparison Between Methods of Treatment

Imipramine acted rapidly in the improvement of enuresis during the first two months, but since the improvement was not maintained once treatment was stopped, it may well be that patients need to be maintained on the drug for longer than two months. It is also possible that a 'rebound' effect occurs after the drug is stopped, leading to a dramatic fall in the level of improvement. This effect has been described by Poussaint and Ditman (1965), but there has been little other evidence in support of the hypothesis and Shaffer *et al.* (1968) argue against it. Poussaint and Ditman also report that gradual withdrawal of the drug leads to less dramatic relapses, but their study has been the only one to use the gradual withdrawal technique. The basis of improvement of enuresis with drugs is still the subject of alternative hypotheses (Blackwell and Currah 1972).

A number of studies have substantiated the non-sustained response after treatment with imipramine (Meijer 1965, Thomson *et al.* 1967, Shaffer *et al.* 1968), and other studies have shown that enuresis can mostly be controlled again by re-starting imipramine treatment. This treatment can therefore be considered a simple method of temporarily suppressing a troublesome type of behaviour.

While treatment with the buzzer regime produces slow initial improvement, the levels are maintained even after treatment is stopped. As has already been mentioned, this does suggest that a learning mechanism

is involved. The high relapse rate reported by Turner and Young (1966) was not substantiated by our own study, but our follow-up period was shorter.

The well-known placebo effect is demonstrated again in this study, with a steady improvement occurring over the four months of observation. This again raises the question whether the achievement of dryness with a placebo includes a learning component. One view has suggested a lessening of the anxiety which may have been inhibiting learning (Mac Keith 1968).

No non-treatment group was included in our study, so we have no direct evidence of the rate of spontaneous improvement in enuretic children. de Jonge (1969) reported a spontaneous remission rate of 15 per cent per year between the ages of 6 and 12 years. Werry and Cohrssen (1965) provide evidence of a remission rate of 11 per cent in three months (one child cured and two greatly improved from a total of 27). The high level of improvement rates in the imipramine and buzzer groups in this present study compare very favourably with these spontaneous rates of remission.

Discussion

There have been a number of studies on enuresis (Meijer 1965, Friday and Feldman 1966, Thomson *et al.* 1967, Agarwala and Heycock 1968, Shaffer *et al.* 1968, Forsyth and Merrett 1969), but often the results have been of limited value because of inadequate information, inadequate follow-up, or because of too small a group of children to achieve reliable results.

In this present study, we have tried to avoid as many pit-falls as possible and have attempted to answer certain specific questions from the study of a relatively unselected group of enuretic children.

The Origins of Enuresis

The extensive literature on the subject

leaves little doubt that there are multiple origins for nocturnal enuresis. The four major theories so far are that enuresis is (a) an anatomical disorder, (b) a habit deficiency, (c) an expression of emotional disturbance, or (d) a developmental delay. These theories are discussed in detail elsewhere (Kolvin and Taunch 1972), but merit brief mention here.

(a) *Anatomical disorder.* It has been pointed out that when cases with demonstrable physical aetiologies, such as urinary tract anomalies or infections, are excluded, the remaining cases—which constitute the great majority—have no obvious explanation (Angell 1969).

(b) *Habit deficiency.* The evidence in support of this theory is well summarised by Lovibond (1964). In its simplest version it accounts for the main body of enuresis in terms of faulty habit training. Lovibond sees the basis of this faulty training as threefold: faulty learning or conditioning; a low level of conditionability; and the occasional breakdown of an acquired habit as a result of serious psychological stress. This theory does not preclude the emergence of emotional disturbance which is secondary or reactive to enuresis.

No evidence for or against the habit deficiency theory is provided by the results of this study. Improvement with the buzzer treatment does not necessarily offer support: it is equally tenable to argue that the improvement was brought about by learning new patterns or responses as by unlearning maladaptive patterns of behaviour. A new 'habit deficiency' theory could be propounded: that the main body of enuresis can be explained by delayed learning of a habit pattern. It is, of course, quite conceivable that learning at the toilet-training stage could be impeded or that later learning could be inhibited by emotional factors (Mac Keith 1968).

(c) *Emotional disturbance.* According to

this theory, enuresis has a predominantly deep-seated psychological origin which is likely to respond to psychological treatment. There has been little hard evidence in support of this concept, and any evidence that has been offered has usually been derived from uncontrolled clinical impressions. The present study demonstrates that enuresis is not generally associated with widespread current psychological maladjustment (Cullen 1966) and that there is little difference between the personalities of enuretic and non-enuretic children.

Mac Keith (1968) has modernised this psychological hypothesis by suggesting a differentiation between earlier, transient psychological experience which had prevented learning of nocturnal bladder control at the usual age, and later disturbance, sometimes secondary to enuresis, which prevents later learning of control.

The statistical evaluation of the data from this present study provides important correlations between sleep patterns, somatic symptoms, psychiatric disturbance in the child, and primary or secondary enuresis (Kolvin *et al.* 1972). It is tempting to try to tie the features together into plausible two-factor theories: one of primary enuresis associated with psychological stability and a tendency to sleep deeply, without somatic symptoms or nocturnal restlessness; the other of secondary enuresis associated with psychological instability. These two simple theories are critically examined in another paper (Kolvin and Taunch 1972).

(d) *Developmental delay.* Bakwin (1961) views enuresis as a developmental disorder related to difficulties in controlling the emptying of the bladder, largely hereditarily determined. Barbour *et al.* (1963) also make a strong case for regarding enuresis as a developmental delay, in that improvement appears to be age-related and that the anomalies found by intensive investiga-

tions merely delayed the gaining of bladder control rather than preventing it occurring. Further, Barbour and colleagues were unable to demonstrate physical or psychological factors which were consistently associated with persistent enuresis, and they speculated that the primary 'fault' in enuresis may be analogous to the 'fault' underlying developmental delays in speech and writing, and be due to structural and neurophysiological immaturity subserving bladder control.

Such developmental delay may be exaggerated by 'errors' of learning at the toilet-training stage, by inhibition of learning at this stage, by transient emotional factors, or by the presence of minor anatomical abnormalities which create increased difficulties in learning. In any individual, a combination of these factors may be present.

Further support for the developmental disorder theory comes from this present study, both from the high proportion of cases with a family history of enuresis and from evidence suggesting that primary enuresis is associated with delay in achieving developmental milestones (see Kolvin *et al.* 1972). Nevertheless, psychological factors are undoubtedly involved, as evidenced by the high sensitivity and the high frequency of psychological disturbance of the enuretic children in this study. The frequency of psychological disturbance in this study, and in that of Shaffer *et al.* (1968), was about 30 per cent, which is significantly higher than the 6 per cent found by Rutter and Graham (1966) in their Isle of Wight study, and is more than twice the frequency found in a random sample of Newcastle school-children (Kolvin, personal communication). It is not possible to say whether these psychological factors are primary or secondary to the enuresis.

It is interesting that there were no personality aberrations, but of course

this does not imply that enuretic children with different personality patterns are not responsive to different types of treatment.

The multiple regression and cluster analysis undertaken on data from this study (Kolvin *et al.* 1972) provides further evidence in favour of the suggestion that there are at least two main factors involved in nocturnal enuresis: (a) familial-cum-maturational; and (b) psychological. It is unlikely that these factors constitute opposite ends of the same dimension and are more likely to be orthogonal to one another.

Conclusions

This is one of the few studies to use an unselected (non-hospital) sample of enuretic children between the ages of eight and ten years for both a descriptive analysis and a controlled trial of treatment.

The salient background features included an excess of males; some slight delay in the achievement of the major motor milestone of walking; an excess of cases in the lower social class compared with the general population; and a higher mean family size than in a random sample of Newcastle school-children. In one-third of the families one of the parents had emotional disturbance. Little in the way of coercion during toilet training was described by the parents. The enuretic children were mainly cheerful, but there tended to be an excess of modesty and sensitivity in their behavioural profile; approximately 30 per cent were rated as being psychiatrically disturbed. In more than 60 per cent of cases there was a family history of delayed bladder control, and over 75 per cent of the children had primary enuresis, which suggest an important familial and maturational component in enuresis. In a high percentage (35 per cent) of cases the social facilities were poor. The children were unexceptional on personality testing, ex-

cept for the possibility of slightly lower than average intelligence (Cattell).

The controlled trial of treatment showed that response was almost immediate with imipramine but that the response was poorly maintained after the drug was stopped. The response to the pad and buzzer was less immediate but was maintained after treatment ended. There was a slow but surprisingly well-maintained improvement with the placebo. It is suggested that improvement on the buzzer regime is dependent upon a learning process.

With imipramine, the maximum reduction in frequency of nocturnal enuresis occurs in the first month; with the buzzer, it occurs in the second month.

It is suggested that, in the main body of enuresis, there is delayed learning of a habit pattern rather than early faulty habit training. A strong case can be made from the results of this study for the hypothesis that the major factor in enuresis is a disorder of development. A second factor composed of psychological features can also be adduced.

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SUMMARY

A descriptive analysis is provided of a group of 94 enuretic school-children between 8 and 10 years of age, and the results of a clinical trial of treatment are reported.

The descriptive analysis revealed that there was an excess of males in the group, that there had been a slight delay in the attainment of a major motor milestone (learning to walk), and that there was an excess of children from the lower social class. It was also found that in one-third of the families one parent had an emotional disturbance, and approximately 30 per cent of the children themselves were rated as being psychiatrically disturbed. In more than 60 per cent of the cases there was a family history of delayed bladder control, and more than 75 per cent of the children in the study had primary enuresis. This analysis suggests that enuresis is basically a delayed learning of a habit pattern and that there may also be an important familial component involved. It is concluded that the major factor in enuresis is a disorder of development, which may be compounded by psychological features.

For the controlled trial, the children were randomly divided into three groups: the first was treated with imipramine ('Tofranil'), the second with a pad and buzzer technique, and the third with a placebo. The children were assessed at the beginning of treatment, at one month while on treatment, at two months when treatment ended, and at follow-up four months after treatment had begun. In the imipramine group, there had been an almost immediate improvement after treatment started, but the improvement was poorly maintained when the drug was stopped. In the pad and buzzer group, improvement was slower to begin but was well maintained after treatment stopped. There was a slow but surprisingly well-maintained improvement in the group given the placebo.

RÉSUMÉ

Enurésie: Analyse descriptive et essai contrôlé de traitement

Cette étude fournit une analyse descriptive d'un groupe de 94 écoliers énurétiques de 8 à 10 ans et rapporte les résultats d'un essai contrôlé de traitement.

L'analyse descriptive révèle un excès de garçons dans le groupe, un léger retard dans les acquisitions motrices essentielles (marche) et un excès de cas dans la classe sociale la plus simple. Il a été observé que dans un tiers des familles, l'un des parents avait des troubles émotifs et aproximativement 30 pour cent des enfants eux-mêmes ont été classés comme ayant des manifestations psychiatriques. Dans plus de 60 pour cent des cas, il a été noté des antécédents familiaux de retard de contrôle vésical et que 75 pour cent des enfants du groupe avait une énurésie primaire. Cette analyse suggère que l'énurésie relève fondamentalement d'un retard d'apprentissage et qu'un facteur familial important peut être associé. Il est conclu que le facteur majeur de l'énurésie est un trouble du développement dans lequel peuvent intervenir des facteurs psychologiques.

Pour l'essai de traitement, les enfants ont été divisés en trois groupes: le premier groupe traité par imipramine ('Tofranil'), le second par avertisseur sonore et le troisième par placebo. Les enfants ont été examinés en début de traitement, au bout d'un mois, puis au bout de deux mois à la fin du traitement et une dernière fois quatre mois après le début du traitement. On a pu observer une amélioration quasi immédiate par l'imipramine mais avec un maintien de résultats très médiocre à l'arrêt de la prise du médicament. Dans le groupe traité par avertisseur sonore, les résultats ont été plus lents à se manifester mais se sont bien maintenus à l'arrêt du traitement. Le groupe traité par placebo a présenté une légère amélioration qui s'est bien maintenue par la suite.

ZUSAMMENFASSUNG

Enuresis: Eine beschreibende Analyse und ein kontrollierter Versuch

Diese Studie gibt eine beschreibende Analyse von einer Gruppe von 94 enuretischen Schulkindern zwischen 8 und 10 Jahren und berichtet über die Ergebnisse eines kontrollierten Behandlungsversuches. Die descriptive Untersuchung zeigte, daß in der Gruppe ein Überschuß an männlichen Probanden war, daß die Entwicklung der wichtigsten motorischen Fähigkeiten verzögert erfolgte (laufenlernen) und daß die Mehrzahl der Fälle aus niedrigen sozialen Schichten kam. Man fand, daß bei einem Drittel der Familien ein Elternteil emotionale Störungen hatte und daß etwa 30 Prozent der Kinder selbst als psychisch gestört beurteilt wurden. Mehr als 60 Prozent der Fälle hatte in der Familienanamnese eine verspätete Blasenkontrolle und mehr als 75 Prozent der Kinder in dieser Studie hatten eine primäre Enuresis. Diese Analyse stellt zur Diskussion, daß die Enuresis grundsätzlich ein verzögertes Erlernen eines Gewohnheitsmusters darstellt und daß außerdem eine wichtige familiäre Komponente beteiligt ist. Es wird angenommen, daß eine Entwicklungsstörung der wichtigste Faktor für die Enuresis ist, die sich möglicherweise aus psychologischen Faktoren zusammensetzt.

Für den kontrollierten Versuch wurden die Kinder in drei Gruppen eingeteilt: die erste wurde mit Imipramin ('Tofranil') behandelt, die zweite mit der Kissen und Summ-technik und die dritte mit einem Placebo. Die Kinder wurden untersucht beim Behandlungsbeginn, nach einem Monat unter der Therapie, nach zwei Monaten kurz nach Absetzen der Therapie und nach vier Monaten Beobachtung seit Therapiebeginn. Es zeigte sich eine fast sofortige Besserung bei den Fällen, die mit Imipramin behandelt wurden, jedoch rezidierten diese fast vollständig nach Absetzen des Präparates. Bei der Gruppe mit Kissen und Summtherapie stellte sich die Besserung langsamer ein, blieb jedoch nach Beendigung der Behandlung bestehen. Bei den mit Placebo behandelten Kindern fand sich eine langsame aber beständige Besserung.

REFERENCES

- Agarwala, S., Heycock, J. B. (1968) 'A controlled trial of imipramine (Tofranil) in the treatment of childhood enuresis.' *British Journal of Clinical Practice*, **22**, 296.
- Angell, J. C. (1969) 'The management of urinary incontinence.' *British Journal of Hospital Medicine*, **2**, 1013.
- Bakwin, H. (1961) 'Enuresis in children.' *Journal of Pediatrics*, **58**, 806.
- Barbour, R. F., Borland, E. M., Boyd, M. M., Miller, A., Oppé, T. E. (1963) 'Enuresis as a disorder in development.' *British Medical Journal*, **2**, 787.
- Blackwell, B., Currah, J. (1972) 'The psychopharmacology of enuresis.' In Kolvin, I., Mac Keith, R. C., Meadow, S. R. (Eds.) *Recent Advances in the Knowledge of Bladder Control in Children*. London: S.I.M.P. with Heinemann Medical Books (in press).
- Cullen, K. J. (1966) 'Clinical observations concerning behaviour disorders in children.' *Medical Journal of Australia*, **1**, 712.
- Douglas, J. W. B., Bloomfield, J. M. (1958) *Children under Five*. London: Allen and Unwin.
- Forsyth, W. I., Merrett, J. D. (1969) 'A controlled trial of imipramine (Tofranil) and nortriptyline (Allegron).' *British Journal of Clinical Practice*, **23**, 210.
- Friday, G. A., Feldman, E. C. (1966) 'Treatment of enuretic children with imipramine (Tofranil).' *Clinical Pediatrics*, **5**, 175.
- Hallgren, B. (1957) 'Enuresis: a clinical and genetic study.' *Acta Neurologica et Psychologica Scandinavica*, **32**, Suppl. 114.
- Huschka, M. (1942) 'The child's response to coercive bowel training.' *Psychosomatic Medicine*, **4**, 301.
- Jonge, G. A. de (1969) *Kinderen met Enuresis*. Assen: van Gorcum.
- Kolvin, I., Taunch, J. (1972) 'A dual theory of nocturnal enuresis.' In Kolvin, I., Mac Keith, R. C., Meadow, S. R. (Eds.) *Recent Advances in the Knowledge of Bladder Control in Children*. London: S.I.M.P. with Heinemann Medical Books (in press).
- Garside, R. F., Taunch, J., Currah, J., McNay, R. A., Nolan, J., Shaw, M. B. (1972) 'Predicting improvement in nocturnal enuresis.' In Kolvin, I., Mac Keith, R. C., Meadow, S. R. (Eds.) *Recent Advances in the Knowledge of Bladder Control in Children*. London: S.I.M.P. with Heinemann Medical Books (in press).
- Lovibond, S. H. (1964) *Conditioning and Enuresis*. Oxford: Pergamon.
- Mac Keith, R. C. (1968) 'A recent factor in the origin of primary nocturnal enuresis: anxiety in the third year of life.' *Developmental Medicine and Child Neurology*, **10**, 465.
- Meijer, A. (1965) 'Value of imipramine in bedwetting children.' *Diseases of the Nervous System*, **26**, 309.
- Miller, F. J. W., Court, S. D. M., Walton, W. S., Knox, E. G. (1960) *Growing Up in Newcastle upon Tyne*. London: O.U.P.
- Neligan, G. A. (1971) Personal communication.
- Prudham, D. (1969) 'Norms for four standard developmental milestones by sex, social class, and place in family.' *Developmental Medicine and Child Neurology*, **11**, 413.
- Kolvin, I., Scott, D. McI. (1972) *Children of Low Birthweight*. (Monograph in preparation.)
- Poussaint, E., Ditman, K. S. (1965) 'A controlled study of imipramine (Tofranil) in the treatment of childhood enuresis.' *Journal of Pediatrics*, **67**, 283.
- Rowntree, G. (1955) 'Early childhood in broken families.' *Population Studies*, **8**, 247.
- Rutter, M., Graham, P. (1966) 'Psychiatric disorders in 10- and 11-year-old children.' *Proceedings of the Royal Society of Medicine*, **59**, 382.
- Yule, W., Graham, P. (1972) 'Enuresis and behavioural deviance. Some epidemiological considerations (Isle of Wight surveys).' In Kolvin, I., Mac Keith, R. C., Meadow, S. R. (Eds.) *Recent Advances in the Knowledge of Bladder Control in Children*. London: S.I.M.P. with Heinemann Medical Books (in press).
- Scott, D. McI. (1972) Newcastle child development study. (Personal communication.)
- Shaffer, D., Costello, A. J., Hill, I. D. (1968) 'Control of enuresis with imipramine.' *Archives of Disease in Childhood*, **43**, 665.
- Thomson, W., Reid, W. B., Hebel, J. (1967) 'Effect of Tofranil on enuretic boys.' *Diseases of the Nervous System*, **28**, 167.
- Turner, R. K., Young, G. C. (1966) 'CNS stimulant drugs and conditioning treatment of nocturnal enuresis. A long term follow-up study.' *Behaviour Research and Therapy*, **4**, 225.
- Werry, J. S., Cohns, J. (1965) 'Enuresis—an etiologic and therapeutic study.' *Journal of Pediatrics*, **67**, 423.
- Wolff, S. (1967) 'Behaviour characteristics of primary school children referred to a psychiatric department.' *British Journal of Psychiatry*, **113**, 885.