of their own emotional, social, and economic potential to give their children all they "need." They strive to create one or two competitively successful children rather than a gregarious egalitarian sibling group.

As Bott has observed, these family types probably represent extremes in a continuum along which most families are transitional or intermediate in their organization. The families with children exhibiting onset enuresis may have functioned well within the socio-cultural milieu of a status family network in their native London borough, but, at the same time, the parents' experiences at school, and subsequently at work, and the influence of radio, television, cinema, and magazines, denigrate status values and encourage mobile values. But until rehousing and the physical separation from the native borough have occurred such tendencies have been prevented from becoming manifest. The adjustment to mobile values after rehousing is difficult, and, because of this, 25% of the original families on the estate returned to their native boroughs in the first two years. Of the remainder, 70% manifest psychoneurotic ill-health (Paulett, 1956), and, as Martin, Brotherston, and Chave (1957) have shown in a similarly rehoused population, the actual rate of admission to hospital for psychoneurotic disorder shows a significant excess over the expected rate.

If our assessment is correct, the critical emotional conflict will be focused on the determination of family size. If the number of children can be limited to two, then the mother will be able to resume work when the children are at school, secure a degree of occupational and economic independence, and create a family which functions on mobile values.

There can be no doubt that the mothers of children developing onset enuresis in association with pregnancy wished at all costs to avoid repeated pregnancies. They were quite aware of the effect of overbreeding in their own parents' generation and were determined to do more for their children than had been done for themselves. They had mostly entered marriage knowing that "people did not have so many children nowadays," but were quite unaware of the practical or the emotional problems they would have to face in achieving this end.

In discussing with the mother her child's enuresis, this sociological approach to the problem was taken. It was explained that even such an acute personal problem can result from the change in the way of life of her family and of the stress of her new social situation. She need not feel guilty about doing things differently from the way her mother did them, and the best practical solution was to utilize those emotional values compatible with a mobile family organization.

We have shown that the prognosis of onset enuresis can be improved by the treatment outlined above, and it may well be that a more traditional mode of treatment would have achieved the same results. A search through the literature, however, fails to reveal any report of treating enuresis which compares results in treated and untreated groups.

There is also no information in the literature on the prevalence of the onset type of enuresis, and the present study shows an incidence which is perhaps higher than would be expected. This is probably due to specific emotional conflicts within family life, which, while characteristic of our culture, are most clearly seen in rehoused urban communities.

Summary

Forty-four cases of onset enuresis were studied.

The precipitating factor in most cases was a maternal pregnancy.

A sociological approach was taken in discussing the problem with the mothers.

Using untreated cases for comparison, such an approach is shown to be effective in treatment.

We are indebted to Dr. Clive Spicer for statistical advice and to Dr. Elizabeth Bott and Professor Max Gluckman for helpful criticism.

REFERENCES

- Blomfield, J. M., and Douglas, J. W. B. (1956). *Lancet*, 1, 850.
 Bott, E. (1957). *Family and Social Network*. Tavistock Publications, London.
 Bransby, E. R., Blomfield, J. M., and Douglas, J. W. B. (1955). *Med. Offr.* 94, 5.
 Martin, F. M., Brotherston, J. H. F., and Chave, S. P. W. (1957). *Brit. J. prev. Soc. Med.*, 11, 196.
 Paulett, J. D. (1956). *Lancet*, 2, 37.
 Young, M., and Willmott, P. (1957). *Family and Kinship in East London*. Routledge and Paul, London.

TREATMENT OF NOCTURNAL ENURESIS BY THE ELECTRIC ALARM

BY

T. H. GILLISON, M.B., B.Sc., M.R.C.P.

AND

J. L. SKINNER, M.B., Ch.B., D.Obst.R.C.O.G.

General Practitioners, Ilkeston, Derbyshire

Eight years ago Davidson and Douglass (1950), using the method described by Mowrer and Mowrer (1938), reported on the treatment of 20 severe cases of enuresis by means of an electric alarm, but, though they obtained a high rate of cure, the method has not been widely adopted.

It has been employed locally for the past two years. During the first year four general practitioners treated 52 enuretics; then a clinic was established to which any doctor could refer his patients, and a further 48 were so treated. This paper records the results of treatment of 100 enuretics aged 3½ to 21 years (64 male and 36 female) and puts forward an explanation of the mechanism by which the electric alarm works.

Apparatus

The apparatus (Fig. 1) consists of a pad bearing spirally arranged metal electrodes which lies on the mattress under a drawsheet and is connected by a flex to a bedside bell activated by a 4½-volt dry battery. Contact of urine with

FIG. 1.—Apparatus in position.

the pad closes an electric circuit and rings the bell (the sensitivity is such that 5 ml. of urine will ring the bell); this awakens both mother and child. The child rises and empties his bladder, while the mother fixes a fresh dry section of drawsheet over the pad.

It might be thought that this technique merely prevents the bladder emptying completely, thus converting a soaking wet bed into one containing a small damp patch. Not only

does it do this (for which the mother is most grateful), but in most cases, after a period of several weeks, bed-wetting ceases altogether.

The Clinic

The clinic, staffed by members of the local branch of the Red Cross, is held one evening a week on church premises. Patients are treated only at the request of their family doctor and are seen by appointment. On an average two new cases are interviewed each week, along with follow-ups from previous weeks. This necessitates an initial outlay of about two dozen sets of pads and bells. A hire charge of two guineas, waived in cases of hardship, covers the running costs of the clinic.

Work is limited to treatment with the electric alarm, and prior investigation is left to the discretion of the patient's own doctor, who has been previously circularized to this effect. Since the clinic is held in the evening, the younger patients are frequently never seen, the parent acting as intermediary; this, however, has had no noticeable adverse effect upon the results obtained.

At the first visit the apparatus is supplied to the parent, or patient, after demonstrating its use. Parents are advised not to lift the child when they retire or to restrict fluids. They are given a card on which to record wet and dry nights and are warned to expect many disturbed nights during the first fortnight.

Further visits are at fortnightly intervals. When the patient has remained dry for not less than a fortnight (in practice it averages at over three weeks) the apparatus is returned and the family doctor notified of the result. The parent is assured that, should the child relapse, treatment will be immediately available without further charge.

FIG. 2.—Number of patients who became dry each week while using the electric alarm in relation to the number of weeks taken to effect a cure. Total number of patients, 90.

FIG. 3.—Relationship between the number of patients becoming dry and the number of bells which rang before they became dry. In addition one patient became dry after 71 bells and another after 95 bells. Total number of patients, 45.

C

Results

Ninety out of 100 patients recovered while on the pad and bell, 53 in 5 weeks or under, 76 within 10 weeks. The proportion becoming dry when treated by their own doctor did not differ significantly from that at the clinic. Fig. 2 shows that this pattern of recovery was not entirely haphazard, for of the 76 who became dry in 10 weeks there was a peak recovery rate of 16 in the fourth week, dropping on either side down to 1 in the first and tenth weeks respectively.

An even closer relationship might well exist between the number of patients becoming dry and the number of bells which rang before they did so. The available data for this are limited to 45 patients treated at the clinic. Results are shown in Fig. 3. It will be seen that 38 out of 45 (84%)

TABLE I.—Comparison of Results of Treatment of 100 Enuretics in Different Age Groups

	Under 5 Years	5 to Under 10	10 to Under 15	15 and Over
Dry within 5 weeks ..	12 (63%)	32 (58%)	7 (39%)	2 (22%)
" 10 ..	14 (74%)	45 (82%)	13 (72%)	5 (56%)
" 30 ..	14 (74%)	52 (95%)	17 (94%)	7 (78%)
Failed ..	5	2	1	2
Total ..	19	54	18	9

became dry after the ringing of from 1 to 30 bells. Here again a similar pattern appears, the number of recoveries rising from 3 after 1-5 bells, up to a peak of 11 after 11-15 bells, dropping down again to only 1 after 26-30 bells. This pattern is more in keeping with the response to some specific therapeutic process than to mere chance or even to the results of suggestion. It is worth noting that in no instance was there recovery without the ringing of a single bell.

Age.—Table I relates response to age. It will be seen that the majority of patients in each age group eventually became dry, the younger patients (though there were several failures) responding the quickest. It was gratifying to find that in spite of years of persistent bed-wetting many of the older patients also responded to this treatment.

Diurnal Symptoms

Where diurnal symptoms such as frequency, urgency, or diurnal enuresis coexist, it is usual for these symptoms to subside *pari passu* with improvement in the main complaint.

Case 1.—Girl aged 4. Wet every night since birth. Mother brought the child for treatment on account of excessive frequency of micturition, urgency, and frequent wetting by day. She had had to change the knickers 13 times in the two days prior to seeing the doctor. Five months of treatment by a prescribed regime, together with medicine and tablets, produced little improvement by day, and she had about one dry night a month. She was then put on the pad and bell and showed immediate response. In 22 nights she became completely dry and could go for as long as 12 hours without passing urine. Her daytime symptoms also vanished. She has remained dry for over two years.

Case 2.—Girl aged 6. Wet every night since birth. Wet also by day, requiring several changes of knickers; these were always soaking wet when she returned from school. The condition was so severe that the question arose whether she should first of all see a urologist. She was, however, given a trial of the pad and bell with the intention of referring her if there was little response. She became dry at night in six weeks, and her mother reported that she was also dry by day, though still with a mild urgency of micturition.

Severity

Of the 100 patients, 74 were reported as wetting the bed every night (sometimes two or three times a night), the remaining 26 less often. It might be thought that those who already had some dry nights and thereby showed some measure of control would become continent more readily than those who wet every night. This was not so (Table II). At the end of five weeks 59% of the "every nighters" had become dry, compared with 35% of the intermittent wetters,

TABLE II.—*Comparison of Results of Treatment of 74 Enuretic Children who were Reported as Wetting the Bed Every Night with 26 who Wetted Less Frequently*

		Wet 7 Nights a Week	Wet Less than 7 Nights a Week
Dry within 5 weeks		44 (59%)	9 (35%)
" 10 "		56 (76%)	19 (73%)
" 30 "		66 (89%)	24 (92%)
Failed		8	2

though ultimately both groups became dry to the same extent. Possibly the greater number of bells experienced by the "every nighters" at the outset produced their more rapid response.

Case 3.—Boy aged 6. Wet every night since birth. Bell rang 20 times the first week (a record for the clinic), six times the second week, and twice the third week; thereafter he remained dry.

Case 4.—Boy aged 9. Enuretic since birth. Reported to wet the bed about four times a week. However, for the 12 weeks he was on the electric alarm the number of bells a week was as follows: 1, 2, 2, 1, 1, 0, 0, 1, 0, 0, 0.

Thus Case 3 had 28 bells but became dry within three weeks, while Case 4 had only 10 bells, yet took nine weeks to achieve full continence.

Enuretics Previously Continent.—Eight patients were reported as having previously become continent and then relapsed. Six of these (75%) became dry in 10 weeks, a figure almost identical with the whole group (76%).

Deep Sleep

Braithwaite (1956), Ström-Olsen (1950), and others have stressed the importance of deep sleep in enuresis. Of the patients treated at the clinic, seven were found to be such deep sleepers that they were given amphetamine to enable them to rouse to the bell; another eight failed to rouse at first, but later responded without the use of sleep-lightening drugs; the remainder woke to the bell from the outset.

Of those at the clinic who became dry within 10 weeks, only 2 out of 36 (6%) required amphetamine, whereas of those who took more than 10 weeks, or who failed to become dry, 5 out of 12 (42%) were given the drug. The impression gained, therefore, was that abnormally deep sleep was not present in the majority of enuretics, but that when present it tended to retard recovery. Three patients among those treated by the doctors are continuing to take amphetamine to prevent relapse.

Nocturnal Polyuria

It has been maintained that an enuretic child secretes more urine at night than his bladder can reasonably hold—nocturnal polyuria—and that this is a major aetiological factor (Poulton and Hinden, 1953). This is not borne out in the present series. Although all children were allowed free fluids at bedtime, and though they were not lifted when the parents retired, the majority after becoming dry were able to sleep undisturbed throughout the night, thus proving that their bladders were by then capable of retaining a whole night's urine. Further, test measurements in about 20 cases, made at the time of actual wetting, showed that the bladder is generally less than half full when wetting occurs. Even where nocturnal polyuria exists it is not necessarily the main aetiological factor.

Case 5.—Boy aged 10. Enuretic since birth. Wet six nights out of seven. Became dry in two weeks on the pad and bell. His mother measured the night urine for four weeks. It averaged 15 oz (450 ml.) a night, occasionally reaching 20 oz. (600 ml.). He woke and rose in the night to pass water. Later he relapsed. Further measurements over 18 nights now showed an average of 5 oz. (150 ml.) a night, with a maximum of 8 oz. (240 ml.). Thus he became dry while secreting 15 oz. (450 ml.) a night, yet relapsed and was enuretic while passing only one-third of that amount.

This case also illustrates that nocturnal polyuria is not necessarily a permanent condition.

The pad-and-bell treatment also supplies information on the time and frequency of bed-wetting. Sometimes improvement can be recognized because wettings have dropped from twice to once nightly, sometimes because they have become progressively later in the night, though often, it must be admitted, the pattern appeared quite haphazard.

Failures and Relapses

There were 10 failures. This includes three who were much improved, being dry five to six nights a week, whereas formerly they were wet every night. Of the remainder, three failed to co-operate, one never woke when the bell rang, and one ceased treatment after four weeks on account of a buttock rash.

It is not surprising that in a recently acquired control of this sort there should be occasional relapses. Most relapses occurred within the first few weeks or early months of becoming dry. Eleven patients relapsed but became dry after a further course of treatment. Two relapsed three or four times but responded to further sessions with the pad and bell. Such relapses would suggest, however, some complicating factor such as abnormally deep sleep or emotional tension.

As there is no systematic follow-up scheme there may well be rather more relapses than are here recorded, particularly of the mild or partial variety; but, since all are invited to return if relapse ensues, and informal contact is often made between clinic workers and ex-patients, it is not thought that severe or complete relapses are much in excess of the figure given. An isolated "accident" in the early weeks of continence is not regarded as a relapse.

Response to a second or later course of treatment is variable; sometimes it is shorter than the original course, sometimes longer.

It so happens that all relapses occurred in patients enuretic since birth, none in the small group previously continent; this is probably purely coincidental. However, if psychological factors played a big part in the causation of this latter group and were still operative one might well have expected a greater tendency for those patients to relapse; in point of fact none of them did.

Psychological Effects

No adverse psychological effects, or substitution symptoms, have been observed either during or subsequent to treatment. Indeed, parents have spontaneously remarked how much brighter and happier the child has been since he became dry. This corresponds with the observations of the psychologists Mowrer and Mowrer (1938), who reported: "Personality changes when they have occurred have uniformly been in a favourable direction. In no case has there been any evidence of symptom substitution."

We know of no published evidence which refutes this view. Even in the occasional case where a psychological factor has triggered off the condition, the electric alarm may prove more effective than psychotherapy.

Case 6.—A boy aged 13 started to wet his bed at the age of 6 following the death of his mother. Six months' therapy at a London clinic for nervous disorders and two years at a London teaching hospital produced no results, yet after five weeks on the pad and bell he became dry and has remained dry ever since (six months). He was reported as being much brighter and happier and looking forward to going to camp for the very first time.

Psychologists have stressed the purely hypothetical and unproved dangers of curing this symptom; they sometimes seem to turn a blind eye to the very real danger of psychological harm that may arise as a result of not curing it.

Buttock Rash

Mention must be made of a complication which sometimes occurs—namely, a rash on the thigh or buttock. It appears to be due to electrolysis of sodium chloride in the urine with the production of sodium hydroxide at the

cathode. Normally the bell rings within a second or two of wetting the drawsheet and electrolysis is insignificant. If, however, for any reason the bell fails to ring, then a small but continuous current passes through the pad and electrolysis occurs. The rash produced may consist of a number of red papules, but many show definite punched-out superficial ulcers, presumably chemical burns, which, while often mild and generally painless, can at times be more severe and slow to heal.

Eleven out of 48 (23%) treated at the clinic developed a rash to some extent, but in none did it result in stopping treatment. A roughly similar proportion of rashes are considered to have occurred among those treated by their own doctor, and in one instance this led to abandonment of treatment.

Our present routine is to advise the use of a doubled drawsheet over the pad and the dusting of boric powder to neutralize any soda produced. This appears to have lessened the danger, for since adopting this procedure there have been only two further cases, both mild, out of a total of 37 patients treated or still receiving treatment.

Discussion

While no theory of enuresis has yet met with general acceptance, the fact that 9 out of 10 enuretics have continued to wet their beds since birth would seem to support the view that it is mainly a failure of development—a failure, that is, to substitute cerebral control for the spinal control of infancy. A likely explanation is that in enuretic children bladder sensations are not adequately perceived during sleep at cerebral level, consequently the appropriate efferent inhibitory impulses are not forthcoming.

Strong support for this view comes from a consideration of the electric-alarm treatment, for all that this does is to waken the patient in the act of passing urine. Micturition centres normally controlling the inhibitory reflexes are thus roused at the very moment when bladder sensations are at their height, the detrusor is in full contraction, vesical tension is maximal, and, for good measure, there is a distended urethra with a flowing current of urine. Response is almost instantaneous—inhibition occurs *before the patient is fully awake*. This is the key to an understanding of how the method works, for it is an *unconscious inhibitory reflex* that needs developing; the moment conscious voluntary control takes over, the inhibitory mechanism is suppressed. Fortunately there is apparently this small fraction of time in which the lower cerebral centres are alerted before the higher centres have become fully awake; and by repetition night after night this inhibitory reflex is strengthened until in most cases it becomes firmly established.

Proof that the response is reflex and unconscious takes several forms, for not only is the size of the patch only just sufficient to cause the bell to ring, thereby indicating that the response must have been almost instantaneous, but older patients, when questioned, admit that when they wake they do not consciously have to inhibit the act—this has already occurred. At the other end of the scale young children are known whose wet patches after the bell has rung have been minimal, yet they have become dry without ever fully rousing on any night until lifted by their mothers.

Once it is conceded that the defect in most enuretics is a weakness of this inhibitory reflex and that the electric alarm achieves its results by strengthening that reflex, then this at once becomes the most logical—indeed, the most physiological—method of treatment.

It is unfortunate that the usual explanation of how this method works is that it is the result of a “conditioned reflex” (Mowrer and Mowrer, 1938). This is untrue, and leads to such erroneous statements as that “the bell conditions the child to wake to a full bladder.” It does nothing of the sort. Neither is the bladder full at the time of wetting nor does the bell train the child to wake; if it trains him to do anything at all, in most cases it trains him to sleep continent and undisturbed throughout the night.

The term “conditioning apparatus” is therefore inaccurate and misleading, and should be abandoned; it be-fogs the issue by failing to make clear that we are here dealing with the establishment of a normal physiological inhibitory mechanism.

All published accounts of electric-alarm treatment report a high proportion of recoveries: Mowrer and Mowrer (1938) 30 out of 30; Davidson and Douglass (1950) 15 out of 20; Crosby (1950) 46 out of 52; Geppert (1953) 38 out of 42; Seiger (1952) 94 out of 106. A method, therefore, that produces such a high rate of recovery, that achieves its results in such a short space of time, and is so complete that in most cases no restrictions of any sort are required to prevent recurrence must surely be getting very near to the heart of the matter. If psychological factors were paramount one would not expect this striking rate of recovery from the mere ringing of a bell; it is also significant that, although warnings have from time to time been sounded regarding possible dire psychological harm that might result from this method, no single example of this sort, to the best of our knowledge, has yet been published.

The time may, therefore, well be ripe for others with wider experience and greater facilities to reassess the place of the electric alarm in the treatment of enuresis; those, for instance, familiar with cystometrograms might well demonstrate whether an enuretic who showed the low-volume high-tension bladder of infancy, with numerous uninhibited contractions (Ellison Nash, 1949), developed, after responding to the electric alarm, into the large-volume low-tension bladder of maturity.

Finally, a word about cost. While effectiveness of treatment rather than cost should be the main criterion, a word on this subject may not come amiss. A commercial firm is charging 25 guineas merely for the loan of the apparatus; this is quite unnecessary, as there are at least three firms in this country who will sell it outright at prices from 6 to 10 guineas. The cost can be reduced still further if treatment is run from a clinic where the alarm unit can be loaned, the cost then becoming little more than that of the pad, which varies according to make from 1 to 3½ guineas. Cost, however, is not the only argument in favour of running treatment mainly from a clinic. It must be freely admitted that there is a good deal of fuss and bother over the distribution, care, and maintenance of the apparatus and that it is better handled by those familiar with the method and with adequate spare equipment. Most doctors would co-operate freely by referring their patients to such a clinic; many might well hesitate to initiate it on their own account. Results, too, tend to be better where regular methodical supervision is maintained, and this is more likely to be achieved at such a clinic.

It would thus seem possible to reduce the problem of enuresis, which at present looms large in most children's out-patient departments, to one of much more modest proportions, and once the back-log of older enuretics had been dealt with—itsself a reflection of the failure of present methods—the numbers for future treatment would become greatly reduced, consisting largely of the annual influx of new patients of pre-school age.

Summary

A report is given on the treatment in their own homes of 100 nocturnal enuretics by means of the electric alarm. Their ages ranged from 3½ to 21 years. More than half of them became dry within 5 weeks, three-quarters within 10 weeks, and 90 within 30 weeks. A theory is submitted concerning the nature of the defect in nocturnal enuresis and of the way the electric-alarm treatment corrects this defect. It is suggested that treatment is best administered from a clinic.

We thank the Ilkeston (Derby 16th Detachment) branch of the British Red Cross and in particular Mesdames Riley, Meakin, and

Fisher, for their invaluable help in running the clinic; and Mr. E. S. McLeod, of the Department of clinical photography, Nottingham General Hospital, for providing the photograph of the apparatus. The bulk of our equipment was obtained from the Orphan Homes of Scotland, Bridge of Weir, Renfrewshire, but it may also be obtained from N. H. Eastwood, 5, Farmleigh, Southgate, London, N.14; and from Down Bros. May and Phelps, of New Cavendish Street, London, W.1. The pads and alarm units of these makers differ considerably.

REFERENCES

- Braithwaite, J. V. (1956). *Proc. roy. Soc. Med.*, 49, 33.
 Crosby, N. D. (1950). *Med. J. Aust.*, 2, 533.
 Davidson, J. R., and Douglass, E. (1950). *Brit. med. J.*, 1, 1345.
 Geppert, T. V. (1953). *J. Amer. med. Ass.*, 152, 381.
 Mowrer, O. H., and Mowrer, W. M. (1938). *Amer. J. Orthopsychiat.*, 8, 436.
 Nash, D. F. Ellison (1949). *Ann. roy. Coll. Surg. Engl.*, 5, 318.
 Poulton, E. M., and Hinde, E. (1953). *Arch. Dis. Childh.*, 28, 392.
 Seiger, H. W. (1952). *J. Pediatr.*, 40, 738.
 Ström-Olsen, R. (1950). *Lancet*, 2, 133.

VISUAL DISTURBANCES ASSOCIATED WITH TRIVALENT ANTIMONY SALTS

A REPORT OF TWO CASES

BY

D. M. FORSYTH, M.R.C.P.Ed., D.T.M.&H.

Physician, Kuwait Oil Company Hospital, Magwa, Kuwait

The causes of optic neuropathy are almost legion. Duke-Elder (1940) has classified them as follows.

1. Local inflammatory conditions.
2. General inflammatory conditions: (i) central nervous (? virus) infections; (ii) syphilis; (iii) tuberculosis.
3. Leber's disease.
4. Endogenous toxins: (i) acute infective disorders; (ii) septic foci (teeth); (iii) metabolic (deficiency diseases).
5. Intoxications by exogenous toxins: tobacco, methyl and ethyl alcohols, lead, arsenic, thallium, apiol, quinine, ergot, optochin, felix mas, aniline.

The condition is fortunately uncommon in Kuwait. If one excludes cases associated with proved intracranial neoplasm, hypertension, or nephritis, only two examples have been seen in the native population during the 10 years or so in which the company has been developing its medical services. During 1957 about 500 patients were seen daily at the out-patient clinics.

Case 1

This patient was a young man about 25 years old. He was well nourished and of fair physique. He had had repeated attacks of left-sided renal colic, and urinary schistosomiasis was first diagnosed at the beginning of September, 1956. His weight was 120 lb. (54.4 kg.). Routine physical examination revealed nothing abnormal, and he was given five intravenous injections of 12 mg. of sodium antimony tartrate at 12-hourly intervals, with lucanthone hydrochloride ("miracil D"), 0.55 g. b.d., for three days over the same period. An E.C.G. taken at the end of the course showed only mild toxic changes. Viable ova of *S. haematobium* were again present in the urine at the beginning of October, and he received a standard course of intramuscular lithium antimony-thiomalate ("anthiomaline") to a total of 40 ml.

He continued to void viable ova, and on October 29 received intramuscular stibophen in the usual dosage to a total of 50 ml. He was still voiding viable schistosoma ova on November 21, and it was decided to embark upon an extended course of treatment with sodium antimony tartrate. He was given three intravenous injections weekly— $\frac{1}{2}$ gr. (32 mg.), 1 gr. (65 mg.), $1\frac{1}{2}$ gr. (100 mg.)—and then 2 gr. (130 mg.) thrice weekly.

On December 22 he complained of dimness of vision of the right eye. By this time 21 gr. (1,365 mg.) of sodium antimony tartrate had been given, and from this date no schistosoma ovum has been found in the urine. Visual acuity for the right eye on December 31 was 5/60, the left eye 6/6. Nothing abnormal was seen in the anterior segments, but haemorrhages and exudates were present at the right macula. Both disks appeared normal, as did the left macula. The right fundus was unchanged when examined in the middle of January, 1957, at the beginning of February, and on February 14. A week later, however, some improvement was noted, and on February 25 visual acuity in the right eye was 6/24. The haemorrhages steadily cleared and none was present on March 20, when visual acuity was 6/12 in the right eye. The exudate was lessening in extent and in area, though vision was still 6/12 in the right eye on April 11. On April 29 he said that he was better. It was noted that there were very few retinal exudates and that visual acuity was 6/6 each eye. He continued to have no complaints as regards his eyes, and further examinations at the beginning of June and in September showed no abnormality of the fundi and both eyes to be 6/6.

The patient continues to suffer from attacks of renal colic, but has no other morbid symptoms. Repeated skiagrams of the chest and repeated stool examinations have showed no abnormality, but he has a persistent eosinophilia of 20-23%, with a white cell count of 5,800-8,000.

Case 2

A well-nourished young man of good physique, aged about 23, and weighing 145 lb. (65.8 kg.). He had several attacks of right-sided renal colic, and *S. haematobium* ova were first found in the urine at the beginning of October, 1956. He had no other complaint and routine physical examination revealed no abnormality. He was given lucanthone hydrochloride, 0.6 g. b.d. for three days, receiving five intravenous injections of 14 mg. of sodium antimony tartrate at 12-hourly intervals during the same period. An E.C.G. taken on October 8 at the end of this course showed toxic effects of antimony upon the myocardium.

Viable schistosoma ova were demonstrated in the urine on November 26. A standard course of 40 ml. of lithium antimony-thiomalate intramuscularly was completed by December 23, but again viable ova were seen in the urine.

On January 12, 1957, he complained of dimness of vision of the right eye for the past five days. It was noted that he had "white eyes," and that nothing abnormal could be seen in the anterior segment or in the fundi. He continued to complain of poor vision in the right eye. On February 2 he was found to have amoebiasis and was admitted for treatment of this, receiving emetine and bismuth iodide, $1\frac{1}{2}$ gr. (100 mg.) daily for 10 days.

When the eyes were examined on February 9, intra-ocular tension was normal. Again nothing pathological was seen in the anterior segments or in the fundi. Vision for the right eye was 6/12, for the left 6/6. He was given a course of lucanthone hydrochloride 1.3 g. daily for three days, since when no viable ovum of *S. haematobium* has been found in the urine. Visual acuity for the right eye was now reduced to 1/60, the left remaining at 6/6. The pupils were equal in size; the fundus on the right side appeared granular, but the macula was otherwise normal. He said that he was better on March 12, when the visual acuity of the right eye was 2/60. By March 20 it was 6/60, by the 28th 6/24, by April 7 6/18, and by May 29 it was once again 6/6. Frequent examinations subsequently have always resulted in 6/6 for each eye, both fundi being normal.

The patient was admitted to hospital on July 7, 1957, when he said that he had vomited blood. No abnormality was found even after a barium meal, fractional test meal, haemoglobin estimation, and repeated stool examinations, and it was thought that he had been mistaken. At various